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1. List of current and pending publications based on the project's findings

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2. Demographic information about individuals funded under the grant
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FINAL REPORT

The status of women and underrepresented minorities in postsecondary education has been an issue of concern since the 1960s, a time period when equity and access to higher education was not proportionate across race/ethnicity and gender. This also marked a time period when there was national concern about producing talented scientists in the United States (Meinholdt & Murray, 1999; Rossi, 1965). Over the past few decades, the numbers of women and underrepresented minorities in higher education has steadily increased. In fact, women have outnumbered men in undergraduate education for the past two decades (National Center for Educational Statistics, 2006). As such, the overall bachelor's degree attainment for women and underrepresented minorities has increased as well, even in scientific fields of study. However, increases in bachelor's degree enrollment and attainment for women and underrepresented minorities have not been equal across all science, mathematics, and engineering (SME) majors. Although gender and racial disparities in SME fields of study have improved over time, these groups have not reached parity with their counterparts in the sciences to date.

According to data collected by the Higher Education Research Institute at UCLA, about 1/3 of all freshmen intend to major in the sciences and that this trend has held over the past two decades (NSB, 2006). Moreover, the diversity of students who intend to enroll in SME programs has increased over time. For example, from 1983 to 2004 women who planned to enroll in SME majors increased from 38% to 45%. Asian/Pacific Islanders and Hispanics experienced the greatest SME growth rates in enrollment compared to other racial/ethnic groups. On the other hand, White students experienced a decline in SME enrollment from 85% in 1983 to 72% in 2004. African Americans stalled

at 10% in planned SME enrollment over the last 20 years. It is tempting to think that women and underrepresented minorities have reached parity with their counterparts given the increases in representation over the last few decades; however, more men in all racial/ethnic groups planned to major in the sciences compared to women, and a higher percentage of Asian Pacific Islanders intended to major in the sciences compared to all other racial/ethnic groups in 2004.

In regards to degree attainment, women have experienced increases in just about all scientific fields of study since the 1960s (Commission on Professionals in Science and Technology, 2006). For example, the bachelor's degree attainment for women in computer, physical, and biological sciences has steadily increased over the past two decades. However, the growth for women has declined and/or stalled at various points over the last two decades in fields such as engineering and mathematics. Despite the increases in bachelor's degree attainment for women in computer, physical, and biological sciences, the degree attainment percentages lag far behind that of their male counterparts.

The situation is considerably more daunting for underrepresented minorities in engineering fields. According to NCES data, there is a sizeable gap between the large numbers of minorities graduating from high school and the low percentage of minority graduates who are eligible for engineering majors based on high school grades and courses taken (NSB, 2006). Underrepresented minorities who are eligible for engineering are slightly more likely to select engineering compared to all other majors, but nevertheless make up a small percentage of the total number of engineering admits. Over the past 20 years, underrepresented minorities have steadily increased their enrollments

and degree attainment in engineering. However, the numbers of underrepresented minorities in engineering has stalled since the mid-1990s. African Americans, in particular, have experienced a decline in engineering enrollments since the mid-1980s. On the other hand, underrepresented minorities have experienced steady increases in biological sciences, nearly doubling their bachelor's degree attainment since 1985. Underrepresented minorities have also increased their degree attainment rates in the physical sciences, computer science, and mathematics, but the numbers have remained constant over the past decade. Again, despite the overall increases for underrepresented minorities in some scientific fields of study, the numbers lag far behind White and Asians and even women in the same fields of study.

Such disparities in the sciences, as illustrated above speak to the need for more research on the experiences of women and underrepresented minorities in the sciences at four-year colleges and universities. In particular, it would be useful to know what institutional factors influence degree completion for this population and if those effects are general or conditional across race and gender. In other words, do some experiences have a greater impact on degree attainment for certain groups than for others? Thus, the purpose of the proposed study is to examine changes in the status of women and minorities over the past decade and to assess the extent to which college impacts degree completion across gender and race/ethnicity in the sciences.

Review of Relevant Literature

As early as the 1980s, scholars began trying to understand empirically reasons for attrition and persistence of women and minorities in the sciences. These studies have focused largely on the pipeline into the sciences, as well as factors related to attrition and

persistence of women and underrepresented minorities in science fields. Collectively, these two lines of inquiry have identified a number of variables that influence the extent to which women and minorities enroll, leave, and persist in SME fields of study.

Level of parental education has been studied extensively and has been found to have an impact on selecting and persisting in science majors. Having highly educated parents has been linked to high levels of parental encouragement, which also has been found to influence entry and persistence in the sciences for women (Astin & Sax, 1996; Haung, Taddese, & Walter, 2000; Maple & Stage, 1991; Rayman & Brett, 1995). Further, the influence of parental education has been found to differ across race/ethnicity. Some studies have found father's level of education to be influential for women (Gruca, Ethington, & Pascarella, 1988; Ware, Steckler, & Leserman, 1985), whereas mother's level of education has been found to be influential for African Americans (Gruca, Ethington, & Pascarella, 1988; Maple & Stage, 1991). Yet, Grandy (1998) found that for high ability minority students, level of parental education was not significant in their success in science and engineering. Finally, in a study of persistence in science and engineering, Haung, Taddese, & Walter (2000) found that financial support from parents was a significant predictor of degree completion for both women and underrepresented minorities.

Studies have also examined the extent to which academic preparation at the high school level impacts selection of and persistence in science majors at the college level. According to 2002 NCES data, 20% of students planning to major in the sciences reported needing remedial math, and 10% reported needing remedial work in the sciences (NSB, 2006). These percentages are slightly higher than the 1983 figures and more

students who intended to major in social and behavioral sciences reported needing remedial work compared to freshmen in the hard sciences. Also, male freshmen reported needing less remediation in math and science compared to female freshmen. In general, factors such as the number of math and science courses taken (Rayman & Brett, 1995; Sax, 1994), math SAT score (Maple & Stage, 1991; Sax, 1994), and high school grade point average (Sax, 2001) have been found to predict persistence in the sciences, mostly for women.

Other research suggests that noncognitive or social-psychological factors impact selection of and persistence in science majors. This body of work focuses on internal aspects of individual students, such as personal self-concept about one's ability to succeed and general attitudes about math and science. Low self-confidence usually indicates that students will not select a science major and declining self-concept can lead to switching to a non-science major (Seymour & Hewitt, 1997; Ware & Lee, 1988). Moreover, research supports that women express lower self-concept related to math ability than men, despite the fact that they performed better than men in the classroom and on tests (DeBoer, 1986; Marsh, Smith, & Barnes, 1985; Sax, 1995; Sherman, 1983). Sax (1994) studied this phenomenon in depth by examining factors related to the development of mathematical self-concept. Overall, she found a general decline in mathematical self-concept over the four year period that was more pronounced at selective colleges. Although no gender differences in decline of math self-concept were found, women fell out of rating themselves in the highest 10% in greater proportion compared to men. In a longitudinal study of factors that predict degree attainment, Haung, Taddese, & Walter (2000) found that high self-confidence and high aspirations

for degree attainment were significant in predicting degree completion. Further, high self-confidence and high aspirations for degree attainment helped to mediate the effect of family financial support and parental level of education. In other words, high self-confidence and high aspirations decreased the effect of family financial support and level of parental education on degree completion. Ferreira (2003) examined factors related to attrition rates of graduate students in biology and chemistry and found that women had higher attrition rates in both majors and that men in chemistry had higher levels of self-confidence compared to women. Astin and Sax (1996) suggest that the "lifelong exposure to cultural messages that women are not cut out for science does much to explain this underestimation" (p. 97).

The lack of parity for women and underrepresented minorities in the sciences coupled with the general decline in self-confidence during the college years have led researchers to study institutional and environmental factors that might influence attrition and persistence in the sciences. Institutional factors such as size, control, and type have been included in most studies. The weight of the evidence suggests that students who major in the sciences at four year colleges and universities are more likely to persist (Commission on Professionals in Science and Technology, 2006; Sax, 2001). Also, single-sex institutions have been linked to the persistence of women in science and have been found to enhance women's academic and intellectual self-concept (Astin, 1977; 1993a). Historically black institutions have been instrumental in the persistence of African Americans in the sciences; however, their influential role has been declining over the past twenty years (Commission on Professionals in Science and Technology, 2006). Financial aid received has also been studied as an institutional factor related to

persistence and degree completion in the sciences. Haung, Taddese, & Walter (2000) found that financial aid received increased the likelihood of degree completion for a national sample of college students attending four-year institutions.

Environmental factors such as campus climate have been found to be influential on the success of women and underrepresented minorities in the sciences. Some studies suggest that women and underrepresented minorities experience a chilly climate in science majors and report experiencing a "null environment" in which they were ignored or excluded (Meinholdt & Murray, 1999, p.245). In a longitudinal study of high ability minority students in science and engineering, Grandy (1998) found that minority support had a strong effect on science commitment in the sophomore year of college. In turn, the sophomore year status was a strong predictor of persistence in the sciences two years later. The author viewed minority support as a mechanism to counter discrimination experienced by minority students in the study. Not having a critical mass of women and minorities in the sciences has also been cited as an issue for women and underrepresented minorities. The lack of a numerical presence of women and underrepresented minorities necessary to bring about positive changes in the climate can have a significant influence attrition rates for these populations (Ferreria, 2003; Rayman & Brett, 1995). However, other researchers suggest that the proportion of women at the institution has no effect on college grades, satisfaction with and persistence in the major, and intellectual and social self-concept (Astin & Sax, 1996).

According to Astin and Sax (1996), "research consistently finds that for both women and men, the likelihood of persisting in science depends on the experiences they have in college" (p. 109). Moreover, the authors suggest that the type of activity in which

sciences students engage is important. Chickering and Gamson (1987) have also identified educational activities, known as the Seven Principles of Good Practice, which contribute to student learning, satisfaction, and educational attainment. The seven principles are: 1) student-faculty contact; 2) cooperation among students; 3) active learning; 4) prompt feedback; 5) time on task; 6) high expectations; and 7) respect for diverse talents and ways of learning. A few studies have examined the impact of the undergraduate college experience on persistence in the sciences. In a study of gender differences in graduate enrollment in the sciences, Sax (1994) found that college grade point average and interaction with faculty were significant for both males and females. Further, hours per week spent socializing had a negative effect and hours per week spent doing homework had a positive effect for men in the study. It was not clear in the study if socializing less kept men focused on their major or if the commitment of pursuing a science major prevented men from socializing with other students. Using data from the National Survey of Student Engagement (NSSE), Zhao, Carini, and Kuh (2005) examined the extent to which science majors were engaged in educational activities, as well as gender differences in engagement. Generally, they found that women in the sciences were just as engaged in and satisfied with their college experience as males in the sciences. However, this study did not examine the extent to which engagement in educational activities and satisfaction with the college experience influenced degree completion.

Thus, the purpose of the proposed study is to examine the status of women and underrepresented minorities in the sciences and to assess the extent to which gender and racial/ethnic gaps have narrowed over the last decade. Additionally, the proposed study

will examine factors that influence degree attainment in the sciences across race/ethnicity and gender and whether or not the effects of the college experience are general or conditional. The following research questions will guide this study:

- Are there gaps in persistence in science majors by race/ethnicity and gender over the six year period between 1996 and 2001?
- What background characteristics, institutional characteristics, and college experiences influence degree attainment in science majors by race/ethnicity and gender?
- Are gender and racial/ethnic differences in science degree attainment general or conditional? In other words, are the factors that influence degree completion the same in magnitude and direction across gender and race/ethnicity or are some factors more important than others for certain groups?

Conceptual Framework

One of the most frequently used models in the research literature to explain the impact of college on educational outcomes is Astin's (1993a, 1993b) Input-Environment-Outcome (I-E-O) framework. In the I-E-O model, student outcomes are presumed to be a function of the interactions of individual inputs and various components of the environment (Pascarella, & Terenzini, 1991; 2005). The I-E-O model allows the researcher to examine the impact of individual experiences and the college environment on educational outcomes, after controlling for traits and characteristics students bring with them to college. A fundamental assumption of the model is that who the students are and what they do in college will affect college outcomes.

In the proposed study, this research based conceptual framework will be used to examine the impact of three categories of variables on degree attainment: a) precollege characteristics, b) institutional characteristics, c) college experiences. A diagram of the conceptual framework for the proposed study is illustrated in Figure 1. The specific way in which the framework will be used to inform the study is described below.

Methods

The primary data source for this study was the 1996/2001 cohort of Beginning Postsecondary Students (BPS) longitudinal study. The national survey collected data on the college experiences and persistence within postsecondary education from a representative sample of students who enrolled in college for the first time in the 1996/1997 academic year. The data were collected in three waves: 1996, 1998, and 2001. Institutional level data were obtained from the National Center for Educational Statistics (NCES)'s Integrated Postsecondary Education Data System (IPEDS) 1996 Fall Enrollment and Staff Survey. The analytical sample for this study was limited to students below the age of 30 who enrolled in four-year institutions and declared a major in the Science, Mathematics and Engineering fields. The NCES definition of majors belonging to these fields was used, which excludes the social sciences and psychology. American Indians/Alaska Natives and students who selected other race/ethnicity were also excluded from the sample due to their relatively small numbers. The selection criteria reduced the sample from 11,098 to 1,488 respondents.

Variables

The primary dependent variable in this study was six year degree completion at a four-year institution. The independent variables were separated into three categories: a)

background characteristics and precollege traits; b) institutional characteristics; and c) academic experiences and other college experiences. Background characteristics consisted of gender, age, parental educational attainment, parental income, financial need, aspiration for graduate education, and high school grades. Institutional characteristics consisted of institutional control, college selectivity, institutional size, and Carnegie classifications. Students' aspiration for further education was used as proxy for self efficacy. Variables related to the academic experience were grade point average, interactions with faculty and advisors, and involvement in study groups. The other college experience variables were social integration, attendance status, hours worked, and whether the student lived on campus. Due to poor factor structure and low reliability, academic experiences were included in the estimation as individual variables as opposed to a single factor.

Data Analysis

Logistic regression was used to address the major research questions in this study. Logistic regression is appropriate for binary dependent variables and allows the researcher to determine the best combination of variables that predict an outcome by estimating the odds probability of the dependent variable occurring as the values of the independent variables change. The outcome variable, degree completion, was regressed on the independent variables in steps. More specifically, a weighted logistic regression was conducted to control for the clustered sampling design. A primary focus of this study concerned the conditional effects of college experiences by race and gender. Therefore, cross products of significant college experiences across race and gender were included in the estimation to address the research question related to differential effects.

Results

Table 1 presents weighted descriptive statistics for all the categorical variables and Table 2 consists of the same information for continuous variables. For the full sample, about 51% of STEM students completed a bachelor's degree in six years. The degree completion rates for females and underrepresented minorities were much lower – 44% and 46%, respectively. Females and underrepresented minorities had similar backgrounds for the most part in comparison to the full sample; however, there were some apparent differences. Underrepresented minorities had parents with less education and income compared to the full sample. Additionally, underrepresented minorities reported high aspirations for graduate school; yet, their average high school math and science grades were less frequently reported as "B or above" when compared to the full sample.

Other differences in the descriptive statics involved academic and other college experiences. For example, females reported attending full-time and working more than 15 hours per week more often in comparison to the full sample. Underrepresented minority students reported lower frequencies of living on campus, being satisfied with the campus climate, attending full-time, and never having social contact with an advisor or faculty member in comparison to the full sample. Similar to females, underrepresented minorities reported higher frequencies of working more than 15 hours per week compared to the full sample.

Table 3 presents the results from the logistic regression analysis for the full sample. The omitted group for the categorical variables is in brackets and the predicted results are discussed in relation to the omitted group. The log-odds coefficients are

presented to show the predicted probabilities and the odd ratios were estimated to show the effect sizes of the variables on degree completion. Results from the background characteristics show expected probabilities. As mentioned earlier, minority students and females were less likely to complete their degree in six years. The results for the full sample show that receiving financial support from family (i.e., dependent status) has a large effect on degree completion in six years. Additionally, high levels of parental education and income beyond $75,000 per year had a large effect on degree completion for STEM majors. Related to institutional characteristics, attending doctoral and baccalaureate granting institutions compared to research institutions, and attending small institutions with enrollments under 1,000 students in comparison to enrollments of 20,000 or more had a large effect on six year degree completion. Further, students who attend institutions with low levels of selectivity had a much lower chance of graduating in six years compared to students who attended very selective institutions.

A primary focus of this study was the conditional effects of college experiences on degree completion in STEM majors for females and underrepresented minorities. Interaction effects were examined across race and gender and yielded a few interesting findings. Table 4 presents the logistic regression results with interaction terms for females.

Many of the academic experiences had more of a positive effect for females compared to males. For example, talking to faculty outside of class had positive and significant effects on degree completion for all students. However, the interaction terms indicated that for female students talking with faculty in their first year was important for degree completion. The second wave measure of the variable had a negative log odds

estimation showing that the female students do not benefit as much from relating to faculty outside class as male students. Students in general who attended their institutions fulltime in the first year were seven times more likely to complete their degree. For female students, however, attendance status played a greater role. The interaction between gender and attending full-time indicated that females were twenty times more likely to complete their degree than their male counterparts if they attended full-time. The negative effect of working more than 15 hours experienced by the full sample was tampered down for females, as the cross product of these variables was positive and significant. Other academic experiences like regular meetings with an advisor, social contact with faculty or an advisor, and involvement in study groups outside of class had negative effects on degree completion for all students, and were intensified for female students in comparison to males.

Table 5 presents the results from the logistic regression with interaction terms for underrepresented minorities. The results from the academic experience variables yielded mixed results. Some of the same academic experience effects on degree completion that were positive for nonminority students had little to no effect or a negative effect for minority students. More specifically, interacting with faculty outside of the classroom in the first wave of the study was only beneficial for nonminority students. Moreover, as minority students make progress toward degree completion, the effect of talking to faculty (as indicated by the second wave) outside of the classroom became significant, but not to the extent that it is for non minority students. Regular meetings with an advisor had a negative effect for the entire sample with no significant differences between minority and non-minority students. Interestingly, social integration and attending the

institution full-time had more of a positive effect on degree completion for minority students compared to non minority students. Working full-time had a negative effect on degree completion for STEM majors, but the effect of working more than 15 hours per week were exacerbated for minority students compared to non minority students. Finally, living on campus had a positive effect on degree completion for non minority students, but a negative effect on degree completion for minority students.

Discussion & Conclusions

Many of the results from this study support previous research on the experiences of women and underrepresented minorities in STEM majors. Women and underrepresented minorities continue to lag behind their peers in terms of bachelor's degree completion in the sciences. Consistent with previous research, minorities differed on a few key background characteristics that have been linked to persistence in STEM majors, such as lower levels of parental education and income. High school performance in math and science has been identified as a key factor related to degree attainment (Maple & Sage, 1991; Rayman & Brett, 1995; Sax, 1994). Although minorities reported higher aspirations for graduate education compared to the full sample, their performance in high school math and science was lower compared to the full sample. This is an interesting dynamic that needs to be explored further in future research. Also similar to past studies, being dependent on family financial support had a large positive effect on degree completion in the sciences.

The analysis of factors related to degree completion and the extent to which the effects were uniform across race/ethnicity and gender was one of the most interesting aspects of this study. The findings revealed that female students benefit extraordinarily

from attending their institution full time. The results also showed that female students in science majors differ significantly from their male counterparts in how their college experiences influence degree completion. Interacting with faculty in the first year was found to be more beneficial for female students. However, in the third year interaction with faculty outside of the classroom had less of a positive effect for women compared to men. In the third year students are most likely taking courses in the major; thus, faculty interaction is more critical during these later years of college. A possible explanation for the dampened effect of faculty interaction outside of the classroom for women could be the chilly climate experience that has been reported in the extant literature. Social contact with faculty and meeting with advisors also more of a negative impact for female students compared to men in the sciences, which also lends support for the conclusion that women may experience a chilly climate in which they less likely to interact with faculty and staff. Further research is needed to understand more specifically the climate for women in science majors and how it impacts academic achievement for this population.

Concerning underrepresented minority students, the findings from this study show that the effect of being an underrepresented minority had a significantly negative impact on completing a degree in the sciences within six years. Moreover, the results of this study underscore the importance of examining differential effects because the same factors that increase the likelihood of degree completion in the sciences for White and Asian Americans did not have the same level of positive influence for underrepresented minorities. More specifically, key educational experiences such as interacting with

faculty outside of the classroom and social interaction with faculty, were less beneficial for underrepresented minorities in science majors.

There were, however, a few factors that were more beneficial for underrepresented minorities. For example, minorities benefitted more from participating in study groups outside of class, being socially integrated in the campus community, and attending the institution full time. Working more than 15 hours per week had a negative effect for all students in the sciences; however this negative effect is exacerbated for minority students. It is interesting to note that when interaction effects were included as additional control variables in the model, minority students in STEM majors were 44% less likely to graduate in six years compared to 12% less likely to graduate in the model without the interaction terms. The large negative effects of the academic experiences for minority students could possibly explain some of the decrease in likelihood of degree completion for this sub-population. More research is needed to understand what educational experiences influence persistence and degree attainment for this population, as well as why key academic experiences have such a negative impact on degree attainment for minorities in comparison to Whites and Asians.

The results from this study have several policy implications for various higher education constituents. Given that the primary focus for this study concerned the academic experiences for women and minorities, most of the implications are directed toward institutions of higher education. Most notably, there were differences in the rate at which women and underrepresented minorities graduated with undergraduate degrees in the sciences. In order for the United States to remain globally competitive and meet the science and technology challenges of the 21st century, it is imperative to develop a

diverse talent pool of scientists. Knowing what factors impact degree completion in STEM areas at the college level has major policy and practice implications. Such valuable information can help support students interested in the sciences, particularly females and minorities who continue to be less visible these areas.

Several recommendations are offered based on the results of this study. First, institutions of higher education should find ways to improve faculty-student relationships for women and underrepresented minorities in the sciences. Upperclassmen often depend on faculty for career advice, letters of recommendation for graduate school, and mentorship. If female students in the sciences are less likely to interact with faculty then they are also less likely to have those positive experiences. The fact that women do not benefit from interaction with faculty could also be a pipeline issue. If women had more opportunities to interact with female professors in their majors then perhaps they might benefit more from this experience. The same is likely true for underrepresented minority students in the sciences. Thus, a major focus for colleges and universities should be to diversify the faculty in science fields of study.

Institutions of higher education should also provide more opportunities for meaningful peer interaction. Minority students in particular benefitted the most from participating in study groups with peers outside of the classroom. We know from the literature that students have a powerful influence on another that can enhance an individual's learning experience (Astin, 1993a).

Finally, institutions of higher education should work to reduce the dependence on work income for minority students who experienced the most negative effects from working more than 15 hours per week. Working takes time away from participating in

college experiences that could have a positive effect on degree attainment. However, minority students may find it necessary to work to pay for their education. Providing financial assistance in the form of scholarships, work study, and/or federal aid for minority students would assist in relieving at least some of the financial burden of attending college. Financial assistance might also allow minority students to attend full-time, a factor that also had more of a positive effect on degree completion for this population.

In conclusion, the findings from this study shed light on important factors related to degree completion for women and minorities in the sciences, as well as the importance of understanding differential effects of the college experience on degree completion. While women and minorities have experienced an increased presence in science related fields of study over the years, there is a growing need to make sure that these subpopulations of students persist through degree completion. Future research might examine characteristics of students who transition out of science majors versus students who persist, as well as within group differences for women and minorities across science majors.

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TABLE 1: Descriptive statistics (weighted) for categorical analyses variables

Variable	Full Sample		Minority Sample		Female Sample	
	Number	%	Number	%	Number	%
Student Background Characteristics						
Completed Degree						
Yes	119,476	51.5	25,674	46.3	50,778	44.2
No	112,374	48.5	29,832	53.7	40,274	55.8
Gender						
Female	91,052	39.3	24,604	55.7		
Male	140,798	60.7	30,902	44.3		
Race/Ethnicity						
Black	24,639	10.6			14,508	15.9
Hispanic	27,963	12.1			10,212	11.2
Asian	24,744	10.7			9,478	10.4
White	154,504	66.6			56,854	62.4
Parent's Educational Attainment						
Less than high school	5,283	2.8	2,856	5.6	1,561	2.0
High school degree	53,449	28.4	20,142	39.7	23,641	31.3
Some post secondary education	35,355	18.8	9,165	18.0	13,823	18.3
Bachelor's degree or higher	94,303	50.1	18,603	36.6	36,598	48.4
Parental Income						
Less than $25,000	44,100	19.9	18,255	34.4	18,568	21.0
Between $25,000 and $50,000	50,689	22.8	16,190	30.5	18,500	21.0
Between $50,000 and $75,000	58,334	26.3	11,834	22.3	23,871	27.1
Between $75,000 and $100,000	35,523	16.0	3,407	6.4	12,968	14.7
Greater than $100,000	33,365	15.0	3,441	6.5	14,277	16.2
Dependent on Family						
Yes	218,256	95.2	52,141	95.1	87,596	96.6
No	11,004	4.8	2,671	4.9	3,108	3.4
Aspiration for Graduate Education						
Yes	143,884	67.0	40,987	81.4	58,445	68.4
No	70,940	33.0	9,368	18.6	27,040	31.6
Average High School Math						
B or greater	175,598	91.7	36,575	84.1	74,612	91.9
C or lower	15,967	8.3	6,921	15.9	6,584	8.1
High School Science						
B or greater	176,956	92.2	37,606	85.8	74,508	91.8
C or lower	15,001	7.8	6,234	14.2	6,698	8.2
Math remediation needed						

Variable	Full Sample		Minority Sample		Female Sample	
	Number	%	Number	%	Number	%
Yes	9,667	5.2	4,908	9.8	5,025	6.9
No	174,902	94.8	44,970	90.2	67,325	93.1
Student College Experiences						
Satisfied with campus climate						
Yes	165,086	90.1	40,748	81.7	62,885	86.9
No	18,108	9.9	9,130	18.3	9,453	13.1
On-Campus Residency						
Yes	139,342	60.1	29,958	54.0	59,733	65.6
No	92,508	39.9	25,548	46.0	31,319	34.4
Attendance Status						
Full-time	212,383	91.6	48,115	86.7	85,889	94.3
Part-time	19,467	8.4	7,391	13.3	5,163	5.7
Worked 15 hours or more						
Yes	78,854	34.0	22,308	40.2	26,991	70.4
No	152,996	66.0	33,198	59.8	64,061	29.6
Talked with faculty outside class						
Never	25,099	13.6	6,057	12.1	8,983	12.4
Sometimes	115,210	62.4	25,133	50.4	43,891	60.6
Often	44,351	24.0	18,688	37.5	19,567	27.0
Talked with faculty outside class						
Never	34,284	15.3	7,231	14.3	9,400	12.7
Sometimes	145,791	65.1	32,303	63.8	47,661	64.3
Often	44,002	19.6	11,105	21.9	17,046	23.0
Met with advisor about plans						
Never	20,159	10.9	4,201	8.4	6,368	8.8
Sometimes	127,620	69.2	31,899	64.0	49,112	67.8
Often	36,742	19.9	13,778	27.6	16,961	23.4
Have social contact with advisor or faculty						
Never	79,326	43.0	17,926	35.9	29,275	40.4
Sometimes	86,482	46.9	22,605	45.3	34,002	46.9
Often	18,746	10.1	9,347	18.8	9,164	12.6
Attend study groups outside class						
Never	33,631	18.2	8,716	17.5	8,518	11.7
Sometimes	99,038	53.6	22,610	45.3	38,011	52.4
Often	52,103	28.2	18,552	37.2	26,024	35.9
Institutional Characteristics						

Variable	Full Sample		Minority Sample		Female Sample	
	Number	%	Number	%	Number	%
Public Institution						
Yes	156,794	67.6	36,712	66.1	60,477	66.4
No	75,056	32.4	18,794	33.9	30,575	33.6
Institutional Size						
20,000 or more students enrolled	82,062	35.5	16,788	30.3	30,689	33.7
10,000-19,999 students enrolled	59,621	25.7	14,270	25.8	23,419	25.7
5,000-9,999 students enrolled	44,523	19.2	9,141	16.5	16,923	18.6
2,500-4,999 students enrolled	15,895	6.9	5,655	10.2	6,585	7.2
1,000-2,499 students enrolled	20,770	9.0	5,721	10.3	10,059	11.1
under 1,000 students enrolled	8,633	3.7	3,835	6.9	3,377	3.7
Institutional Selectivity						
Very Selective	79,641	34.4	12,872	23.2	31,945	35.1
Selective	46,377	20.0	8,615	15.5	19,290	21.2
Least Selective	105,832	45.6	34,019	61.3	39,817	43.7
Carnegie classification						
Research Institutions	88,699	38.5	15,219	27.8	35,473	39.3
Doctoral Institutions	34,008	14.7	9,952	18.2	12,461	13.8
Comprehensive Institutions	70,896	30.8	18,359	33.6	25,507	28.2
Baccalaureate Institutions	36,973	16.0	11,131	20.4	16,920	18.7

TABLE 2: Descriptive statistics (weighted) for continuous analyses variables

Variable	Full Sample		Minority Sample		Female Sample	
	Mean	SD	Mean	SD	Mean	SD
Age	18.7	1.5	18.7	1.7	18.4	1.0
Financial need after grants and scholarships	3417.3	4667.5	4184	4378.9	3660.6	5122.2
Grade Point Average	2.68	0.9	2.56	0.9	2.74	0.9
Social Integration	181.7	41.3	178.1	38.1	180.2	42.2

TABLE 3: Predictors of degree completion among STEM students at 4-year institutions

Variables	Coefficients (log-odds)	SE	Odds Ratio
Student Background Characteristics			
Female	-0.188***	0.017	0.83
Race/Ethnicity (white students)			
Black	-0.122***	0.028	0.89
Hispanic	-0.131***	0.025	0.88
Asian	0.698***	0.029	2.01
Age	0.165***	0.012	1.18
Parent's Educational Attainment (Less than high school degree)			
High school degree	0.795***	0.052	2.21
Some post secondary education	0.980***	0.054	2.66
Bachelor's degree or higher	1.016***	0.053	2.76
Parental Income (Less than $25,000)			
Between $25,000 and $50,000	-0.078***	0.025	0.93
Between $50,000 and $75,000	0.117***	0.027	1.12
Between $75,000 and $100,000	0.894***	0.034	2.45
Greater than $100,000	0.439***	0.035	1.55
Dependent	3.013***	0.124	20.34
Graduate Education Goal	0.436***	0.018	1.55
Financial need after grants and scholarships	-0.0001***	0.000	0.99
B and above average in high school math	0.281***	0.027	1.32
B and above average in high school science	1.068***	0.032	2.91
Math remediation not needed	0.537***	0.036	1.71
Institutional characteristics			
Carnegie classification (Research Institution)			
Doctoral Institutions	1.009***	0.035	2.74
Comprehensive Institutions	0.390***	0.039	1.48
Baccalaureate Institutions	1.017***	0.046	2.77
Institutional Size (20,000 students or greater enrolled)			
10,000-19,999 students enrolled	0.339***	0.023	1.40
5,000-9,999 students enrolled	0.302***	0.029	1.35
2,500-4,999 students enrolled	-0.301***	0.042	0.74
1,000-2,499 students enrolled	-0.128***	0.045	0.88
under 1,000 students enrolled	0.772***	0.077	2.16
Institutional Selectivity (Very Selective)			
Selective	-0.323***	0.024	0.72
Least Selective	-1.386***	0.034	0.25
Public institution	-0.231***	0.026	0.79

Variables	Coefficients (log-odds)	SE	Odds Ratio
Academic Experiences			
Talked with faculty outside class (95/96)	0.504***	0.028	1.66
Talked with faculty outside class (98)	0.316***	0.026	1.37
Met with advisor	-0.286***	0.031	0.75
Social contact with faculty	-0.233***	0.021	0.79
Had study groups outside of class	-0.297***	0.025	1.02
Grade Point Average	0.017***	0.000	1.02
Other College experiences			
Social Integration	0.002***	0.000	1.00
Satisfied with campus climate	-0.110***	0.027	0.90
Attending full-time	2.354***	0.036	10.53
Worked 15 hours or more	-0.552***	0.017	0.58
Lived on campus	0.263***	0.019	1.30

TABLE 4: Predictors of degree completion among STEM students at 4-year institutions with interaction of the female variable

Variables	Coefficients (log-odds)	SE	Odds Ratio
Student Background Characteristics			
Female	-2.592***	0.177	0.07
Race/Ethnicity (white students)			
Black	-0.174***	0.029	0.84
Hispanic	-0.227***	0.026	0.80
Asian	0.621***	0.029	1.86
Age	0.180***	0.012	1.20
Parent's Educational Attainment (Less than hgh school degree)			
High school degree	0.742***	0.052	2.10
Some post secondary education	0.847***	0.054	2.33
Bachelor's degree or higher	0.861***	0.053	2.36
Parental Income (Less than $25,000)			
Between $25,000 and $50,000	0.032	0.025	1.032
Between $50,000 and $75,000	0.202***	0.027	1.22
Between $75,000 and $100,000	1.012***	0.033	2.75
Greater than $100,000	0.600***	0.035	1.82
Dependent	2.872***	0.124	17.68
Graduate Education Goal	0.577***	0.023	1.78
Financial need after grants and scholarships	-0.0001***	0.015	0.91
B and above average in high school math	0.240***	0.028	1.27
B and above average in high school science	1.132***	0.032	3.10
Math remediation not needed	0.532***	0.037	1.70
Institutional characteristics			
Carnegie classification (Research Institution)			
Doctoral Institutions	1.135***	0.035	3.11
Comprehensive Institutions	0.480***	0.040	1.62
Baccalaureate Institutions	1.065***	0.046	2.90
Institutional Size (20,000 students or greater enrolled)			
10,000-19,999 students enrolled	0.362***	0.024	1.44
5,000-9,999 students enrolled	0.261***	0.029	1.30
2,500-4,999 students enrolled	-0.358***	0.043	0.70
1,000-2,499 students enrolled	-0.101**	0.045	0.90
under 1,000 students enrolled	0.787***	0.080	2.20
Institutional Selectivity (Very Selective)			
Selective	-0.271***	0.025	0.76
Least Selective	-1.427***	0.034	0.24

Variables	Coefficients (log-odds)	SE	Odds Ratio
Public institution	-0.175***	0.027	0.84
Academic Experiences			
Talked with faculty outside class (95/96)	0.423***	0.019	1.53
Talked with faculty outside class (98)	0.345***	0.020	1.41
Met with advisor	-0.238***	0.020	0.79
Social contact with faculty	-0.112***	0.017	0.89
Had study groups outside of class	-0.251***	0.017	0.78
Grade Point Average	0.016***	0.000	1.02
Other College experiences			
Social Integration	-0.001***	0.000	0.10
Satisfied with campus climate	0.088**	0.035	1.09
Attending full-time	2.089***	0.039	8.08
Worked 15 hours or more	-0.682***	0.021	0.51
Lived on campus	0.376***	0.023	1.46
Interaction terms with female variable			
Graduate Education Goal	-0.241***	0.038	0.78
Talked with faculty outside class (first year)	0.298***	0.033	1.35
Talked with faculty outside class (third year)	-0.176***	0.032	0.84
Met with advisor	-0.151***	0.033	0.86
Social contact with faculty	-0.214***	0.027	0.81
Had study groups outside of class	-0.241***	0.030	0.78
Social Integration	0.007***	0.000	1.01
Attending full-time	3.056***	0.136	21.2
Worked 15 hours or more	0.378***	0.037	1.46
Lived on campus	-0.376***	0.041	0.69

TABLE 5: Predictors of degree completion among STEM students at 4-year institutions with interaction of the minority variable

Variables	Coefficients (log-odds)	SE	Odds Ratio
Student Background Characteristics			
Female	-0.211***	0.017	0.81
Minority Student	-0.579***	0.180	0.56
Age	0.087***	0.012	1.09
Parent's Educational Attainment (Less than high school degree)			
High school degree	0.855***	0.054	2.35
Some post secondary education	0.996***	0.055	2.71
Bachelor's degree or higher	1.065***	0.054	2.90
Parental Income (Less than $25,000)			
Between $25,000 and $50,000	-0.119***	0.025	0.89
Between $50,000 and $75,000	0.008	0.026	1.01
Between $75,000 and $100,000	0.923***	0.033	2.52
Greater than $100,000	0.389***	0.034	1.48
Dependent	2.611***	0.122	13.61
Graduate Education Goal	0.379***	0.020	1.46
Financial need after grants and scholarships	-0.0001***	0.000	0.99
B and above average in high school math	0.420***	0.028	1.52
B and above average in high school science	0.900***	0.033	2.46
Math remediation not needed	0.263***	0.035	1.30
Institutional characteristics			
Carnegie classification (Research Institutions)			
Doctoral Institutions	1.111***	0.035	3.03
Comprehensive Institutions	0.245***	0.039	1.28
Baccalaureate Institutions	0.594***	0.046	1.81
Institutional Size (20,000 students or more enrolled)			
10,000-19,999 students enrolled	0.311***	0.023	1.36
5,000-9,999 students enrolled	0.244***	0.028	1.28
2,500-4,999 students enrolled	-0.262***	0.043	0.77
1,000-2,499 students enrolled	0.082*	0.046	1.08
under 1,000 students enrolled	0.661***	0.078	1.94
Institutional Selectivity (Very Selective)			
Selective	-0.323***	0.025	0.72
Least Selective	-1.291***	0.034	0.27
Public institution	-0.162***	0.027	0.85
Academic Experiences			

Variables	Coefficients (log-odds)	SE	Odds Ratio
Talked with faculty outside class (first year)	0.834***	0.019	2.30
Talked with faculty outside class (third year)	0.367***	0.018	1.44
Met with advisor	-0.349***	0.019	.71
Social contact with faculty	0.071***	0.016	1.07
Had study groups outside of class	0.461***	0.016	0.63
Grade Point Average	0.017***	0.000	1.02
Other College experiences			
Social Integration	0.002***	0.001	1.00
Satisfied with campus climate	0.011	0.032	1.01
Attending full-time	2.126***	0.083	8.37
Worked 15 hours or more	-0.462***	0.039	0.63
Lived on campus	0.358***	0.021	1.43
Interaction terms with minority variable			
Graduate Education Goal	-0.104**	0.051	0.90
Talked with faculty outside class (first wave)	-0.801***	0.038	0.45
Talked with faculty outside class (second wave)	-0.298***	0.036	0.74
Met with advisor	0.028	0.039	1.03
Social contact with faculty	-1.121***	0.032	0.33
Had study groups outside of class	0.841***	0.037	2.32
Social Integration	0.015***	0.001	1.02
Attending full-time	0.471***	0.090	1.60
Worked 15 hours or more	-0.915***	0.044	0.40
Lived on campus	-0.628***	0.045	0.53

Figure 1

Conceptual Framework for Proposed Study