Beyond the Bachelor's: What Influences STEM Post-Baccalaureate Pathways

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Association for Institutional Research Annual Forum
May 2013
Long Beach, CA

This study was made possible by the support of the National Institute of General Medical Sciences, NIH Grant Numbers 1 R01 GMO71968-01 and R01 GMO71968-05, the National Science Foundation, NSF Grant Number 0757076, and the American Recovery and Reinvestment Act of 2009 through the National Institute of General Medical Sciences, NIH Grant 1RC1GM090776-01. This independent research and the views expressed here do not indicate endorsement by the sponsors.

Introduction

The United States faces a critical shortage in its domestic STEM (science, technology, engineering, and mathematics) workforce. Historically, the competitiveness and health of the US economy has relied on our leading global position in scientific and technological innovation, owing much in part to the strength of STEM education and research of the nation's colleges and universities (National Academy of Sciences, 2011). Yet compared to other nations, STEM degrees make up a much smaller proportion of overall bachelor's degrees in the United States. Job growth in STEM fields is also expected to outpace growth in other areas (PCAST, 2012). As national reports call for an increase in STEM professionals to fill this critical shortage, the President's Council of Advisors on Science and Technology has called for an additional one million STEM degrees over the next decade (PCAST, 2012).

However, STEM completion may not automatically translate into either advanced STEM study or a STEM career. The amount of individuals with a bachelor's degree (or higher) in STEM far outnumbers the amount of individuals employed in STEM (National Science Board, 2012). In other words, improving the effectiveness of degree productivity will only partially contribute to meeting the US need for STEM professionals.

Research has identified several experiences and interventions universities can utilize to improve STEM retention and persistence, foster STEM graduate school aspirations, and facilitate the development of a science identity in students (Espinosa, 2011; Hurtado et al., 2009; Johnson, 2007; Jones, Barlow, & Villarejo, 2010; Maltese & Tai, 2010; Palmer, Maramba, & Dancy, 2011; Strayhorn, 2010). Very little has connected these experiences to the actual decisions students make after graduation, however. Research on post-college pathways is limited, as most studies rely on the restricted national longitudinal databases which quickly become outdated (Xu, 2013), and many of these have not focused on STEM (Mullen, Goyette, & Soares, 2003; Perna, 2004; Smart, 1986; Zhang, 2005). In addition, many of the longitudinal studies on STEM pathways focus on experiences or characteristics outside the college environment that lead to employment in STEM careers, especially characteristics of students' home environments or quality of elementary and secondary education, and are often limited by the use of single-level analysis techniques (Kimmell, Miller, & Eccles, 2012; Miller & Kimmell, 2012). In other words, much remains to be uncovered about how the college environment turns STEM degrees into STEM careers, either through the decision to enroll in STEM graduate programs or employment in the STEM workforce after graduation.

The purpose of this study is to identify college experiences and institutional contexts that lead to advanced study and careers in STEM fields. Policy makers are primarily concerned that efforts to improve STEM education and STEM outcomes lead to an enhanced STEM workforce, but very few studies have been able to track post-college outcomes of students three years after graduation. This study uses multilevel techniques to analyze a longitudinal dataset that followed students from college entry in 2004 through post-baccalaureate outcomes seven years later in 2011 to capture the effect of student experiences and contextual influences on students' post-college STEM pathways.

Literature Review

Student Background Characteristics

STEM pathways are shaped by students' background characteristics long before they ever make the decision to declare a STEM major. Race and ethnicity continue to be salient characteristics in shaping college students' STEM trajectories (Bonous-Hammarth, 2000; Carlone & Johnson, 2007; Davis & Finelli, 2007; Espinosa, 2011; Fries-Britt, Younger, & Hall, 2010; Johnson, 2007; Museus, Palmer, Davis, & Maramba, 2011). Underrepresented racial minority (African American, American Indian, and Latino/a) students aspire to STEM careers at rates equivalent to or exceeding their White and Asian American counterparts (Hurtado et al., 2005), but constitute a disproportionately small amount of the United States STEM workforce (National Academy of Sciences, 2011). Cole and Espinoza (2011) found among women, racial/ethnic minority women are more likely to report STEM career goals than their White female counterparts. Perna (2004) also found that Black students are more likely than White students to enroll in graduate programs altogether. She did not test this for STEM programs in particular, however.

Women also continue to be severely underrepresented in the STEM workforce (Beede et al., 2011). Even though women are more likely to earn college degrees than men, men are still more likely to major in STEM fields and higher proportions of men earn STEM degrees and pursue STEM careers (Kimmell, Miller, & Eccles, 2012; Miller & Kimmell, 2012). This underrepresentation may also result from the types of majors and graduate programs that women choose to pursue; women are more likely to enroll in masters and sub-masters (i.e. certificate) post-baccalaureate programs while men are more likely to choose professional and doctoral programs which include many STEM programs (Mullen, Goyette, & Soares, 2003; Perna, 2004). In addition, fields that employ larger percentages of women tend to have lower occupational earnings (Roksa & Levey, 2010). Zhang (2005) even found women were less likely to enroll in graduate school in general than men.

In spite of this, Kimmell, Miller, and Eccles (2012) found that there are no significant differences between men and women in enrolling in STEM graduate programs, concluding that gender differences in STEM employment emerge as the result of educational decisions made at the baccalaureate level (Miller & Kimmell, 2012). Xu (2013) also found among STEM students that gender was not a significant factor in terms of choosing a career related to one's major until about ten years after college, with men more likely to be employed in a major-related field than women. Husbands Fealing and Meyers (2011) suggested that women also enter STEM careers via unique pathways; further research is needed to elaborate these trajectories.

Finally, socioeconomic indicators have been found to relate to students' post-college STEM pathways. Students from higher income families are more likely to report STEM career goals and to enroll in graduate school (Cole & Espinoza, 2011; Zhang, 2005). Parents' level of education has been found to relate to enrolling in college (Kimmell, Miller, & Eccles, 2012; Miller & Kimmell, 2012; Zhang, 2005), to succeeding in science and math courses (Miller & Kimmell, 2012), to enrolling in graduate school (Perna, 2004), and to pursuing a STEM career (Miller & Kimmell, 2012). Parents' level of education is not related to occupational status (Roksa & Levey, 2010), however, more likely influencing post-college outcomes indirectly. Mullen, Goyette, and Soares (2003) found that the effect of parents' educational level diminished after controlling for college-related variables, suggesting parents' education level influences students' choice of undergraduate institution, thereby indirectly influences post-college outcomes. Having a parent employed in a STEM occupation is also important for a student's pathway to a STEM career, though it may not necessarily lead to a student's declaration of a STEM major (Miller & Kimmell, 2012).

High School Academic Preparation

One of the most important factors in retaining students along STEM pathways is the academic preparation they receive in high school for the rigor of college-level STEM coursework (AAAS, 2001; Adelman, 2006; Bonous-Hammarth, 2000, 2006; Chang, Cerna, Han, & Saenz, 2008; Elliott, Strenta, Adair, Matier, & Scott, 1996; Museus et al., 2011; National Academy of Sciences, 2011). Completing calculus in high school leads to both enrolling in a STEM major and subsequent employment in a STEM field (Kimmell, Miller, & Eccles, 2012; Miller & Kimmell, 2012). Higher high school GPAs are associated in particular with women who report STEM career goals (Cole & Espinoza, 2011). Students with higher standardized test scores are also more likely to enroll in graduate programs in general (Mullen, Goyette, & Soares, 2003). One study found that students with high SAT scores began gravitating toward non-STEM fields in the 1990s (Lowell et al., 2009), indicative of ways STEM talent can become diverted after a student graduates high school.

Entering Goals and Aspirations

After accounting for demographic discrepancies and the academic preparation needed to succeed in postsecondary STEM coursework, the goals and aspirations with which students enter college also affect their propensity toward a STEM career. Higher self efficacy is related to STEM career goals among women (Cole & Espinoza, 2011). Students who expect to complete more years of school are more likely to enroll in graduate programs (Mullen, Goyette, & Soares, 2003).

Students' dispositions entering college also affect the decisions they make both during and following college in terms of the pathways they take into—or out of—STEM careers. Science identity is one construct developed by Carlone and Johnson (2007) to identify the various dimensions used to describe the extent to which students identify themselves as scientists. Chang et al. (2011) broadened the application of this construct to represent the extent to which students identified with STEM fields. McGee and Keller (2007) found that a major difference between students who chose to complete a combined MD/PhD and those who chose just an MD was the former's interest in discovery and desire to help people through research, key indicators of a science identity. Hernandez et al. (2012) found that students with a higher science identity were more likely to set goals to demonstrate science competence as opposed to aiming to avoid failure, and Chemers et al. (2011) found a stronger science identity is linked with a stronger commitment to a STEM career. Finally, Mullen, Goyette, and Soares (2003) determined that different types of commitments lead to different choices for graduate study: students who wish to influence the political structure are more likely to enroll in master's and professional programs, which include many STEM fields, while students more interested in a lucrative career tend to opt for MBA programs.

Institutional characteristics

While much research has been done on the effect of college characteristics on academic outcomes, such as retention, persistence, and degree completion (Cragg, 2009; Gansemer-Topf & Schuh, 2006; Hubbard & Stage, 2010; Melguizo, 2008, 2010; Museus, 2011; Oseguera, 2005; Titus, 2004, 2006), these effects on post-college outcomes have been studied in the literature to a lesser extent. Institutional type has been found to affect the paths students take after college. Xu (2013) found that STEM students who attend baccalaureate and doctoral universities are less likely to have a job related to their degree relative to students who attended associates-granting institutions; Mullen, Goyette, and Soares (2003) found that graduates of research and liberal arts institutions were more likely to enroll in graduate school than those who attended comprehensive institutions; and Perna (2004) found that students who attended Carnegie-classified liberal arts I colleges were more likely to enroll in graduate school relative to liberal arts II and specialized colleges.

Of special interest in the literature is the role selectivity plays in student success (Bowen & Bok, 1998; Bowen, Chingos, & McPherson, 2009; Gansemer-Topf & Schuh, 2006). More selective institutions enroll students with higher pre-college academic preparation (higher high school GPAs and standardized test scores) and tend to be elite institutions with higher levels of resources. More selective institutions tend to enjoy higher graduation rates relative to schools of lesser selectivity. Selectivity affects the pathways students take after college as well. Graduates of more selective institutions are more likely to enroll in graduate school, attend more prestigious universities for graduate school, and complete graduate degrees (Zhang, 2005). Attending more selective institutions appears to affect the type of graduate programs students pursue as Mullen, Goyette, and Soares (2003) found that graduates of more selective colleges were more likely to enroll in masters, professional, and MBA programs than graduates of less selective colleges. Again, in their study, many of the professional graduate programs included STEM programs such as health science or medicine programs.

College Experiences

After accounting for all of the pre-college decisions students make that affect their post-college pathways, several experiences students have while in college have been found to directly affect their trajectories after commencement. Students’ choice of major has one of the most direct effects on their decision to continue on to graduate school or enter the workforce because different fields of work require different levels of credentials for entry. For example, the first professional degree in engineering is the bachelor’s degree. Engineering students thus have the option to pursue a graduate engineering degree, a graduate degree in another field, or to forego graduate school all together. Fleming and Williams (2009) then found among Black engineering students that those who were unsure of the graduate degree they wanted to pursue deferred that decision until they had entered the workforce, often finding their employers provided assistance with covering the cost of graduate school. Mullen, Goyette, and Soares (2003) found that biology, math, and other science majors were more likely to enroll in doctoral programs, biology majors were also more likely to enroll in professional programs (like medicine and health sciences), and engineers were more likely to enroll in MBA programs. Fleming et al. (2007) also found among Black STEM students that science and math students were more likely to report plans to earn a graduate degree while engineering and computer science students were more likely to report plans to enter the workforce after graduation. Students in different STEM programs progress along different pathways.

Academic performance in college also affects students' post-college pathways. Students with higher college GPAs are more likely to enroll in graduate school (Zhang, 2005) and are more likely to enroll in all types of graduate programs (Mullen, Goyette, & Soares, 2003). In addition, students with higher college GPAs are more likely to choose careers related to their undergraduate field of study (Xu, 2013). Admission to graduate school can directly hinge on a student's undergraduate academic performance so it is no surprise to see an effect of college GPA on a student's post-college trajectory.

STEM Interventions

This study is specifically concerned with the effect of various programs and interventions that STEM faculty and administrators are implementing to improve the persistence of STEM students toward a baccalaureate degree and subsequent post-college STEM pathway. A significant body of literature has emerged that examines the impact of these interventions on academic success in STEM, and this research has also begun examining this impact on students' trajectories after college. One of the most influential experiences students have is the support and mentoring they receive from faculty. Faculty concern and perceived responsibility for student success motivates them to create a supportive environment, especially critical to the success of URMs in STEM (Fries-Britt, Younger, & Hall, 2010; Museus & Liverman, 2010; Perna et al., 2010). Faculty provide access to networks promoting educational and career development (Crisp & Cruz, 2009), and faculty are the primary institutional agents who socialize STEM students into the culture of their disciplines (Stanton-Salazar, 2010). The amount and quality of faculty mentoring predicts likelihood of plans to enroll in STEM graduate programs (Eagan, Chang, Hurtado, et al., 2010)–Black engineering students reported faculty mentoring was influential in their decision to enter graduate school (Fleming & Williams, 2009). Support, recognition, and encouragement from faculty help students develop stronger sense of science identity (Carlone & Johnson, 2007), and increased contact with faculty enhances graduate degree aspirations (Cole, 1999; Kim & Sax, 2007; Phelan, 1979).

One of the primary conduits by which faculty mentoring takes place is through engagement in undergraduate research (Seymour, Hunter, Laursen, & DeAntoni, 2004). The mentoring Black engineering students received in undergraduate research was key to choosing to attend graduate school (Fleming & Williams, 2009). Students report the quality of faculty mentoring receive during an undergraduate research experience positively impacts the overall effectiveness of that experience (Thiry & Laursen, 2011). Undergraduate research holds many other benefits for students besides faculty mentoring, however. Research experiences provide students with a sense of what a science research career entails (Kinkead, 2003; Lopatto, 2004) and enhances science identity (Hurtado et al., 2009). Participation in undergraduate research has been found to specifically strengthen URM students' confidence in science (Hernandez et al., 2012). Finally, undergraduate research enhances students' aspirations to graduate study

(Kardash, 2000; Sabatini, 1997; Strayhorn, 2010) and graduate school enrollment (Barlow & Villarejo, 2004; Bauer & Bennett, 2003; Eagan et al., 2010).

Targeted retention programs for URM students increase the likelihood of completing a STEM degree (Barlow & Villarejo, 2004; Jones, Barlow, & Villarejo, 2010; Slovacek et al., 2012). These programs provide a space for students to develop peer support networks (Palmer, Maramba, & Dancy, 2011). While the evidence is not clear that these programs improve academic performance due to differences in the type of support provided (Good, Halpin, & Halpin, 2002; Johnson, 2007), they do affect persistence, maintaining students' forward momentum on STEM pathways.

In addition to institution-facilitated formally structured opportunities, student organizations and chapters of professional associations also affect students' STEM pathways. Major-related clubs have been found to sustain URM STEM students' career interests (Herrera, Hurtado, & Chang, 2011). Participation in an engineering student organization helps engineering students clarify educational and career goals (Durham & Marshall, 2012). These student-facilitated major-related spaces can enhance career development (Bohlscheid & Clark, 2012), boost professional networks (Do et al., 2006), and help students secure jobs sooner (Sagen et al., 2000). It is also likely the connections students make with each other in these spaces will persist after they graduate and enter the workforce.

Finally, internships, cooperative education, and other STEM-related work experiences students have while in college will affect their trajectories after they graduate. STEM-related work experiences sustain STEM career interests and prepare students for a first job in STEM (Jaeger et al., 2008). Black engineering students who worked internships learned about the potential salary they could earn right out of college (Fleming & Williams, 2009). Internships can also be a gateway to employment after graduation (Do et al., 2006), especially for URM students (Inroads, 1993), and may result in students choosing STEM employment over a STEM graduate degree immediately after completing their undergraduate degree.

Conceptual Framework

Our conceptual framework borrows from psychological and sociological theories of career decision-making to account for both the individual factors and the contextual influences that affect students' career pathways through college (Harren, 1979; Hodkinson & Sparkes, 1997). Harren (1979) focuses on the psychological aspects of career decision-making. He identifies four parameters that either constitute decision-making or influence how it progresses—the process itself, characteristics of the decision-maker, characteristics of the developmental tasks driving career decisions, and the conditions under which decisions are made. Harren specifically outlines that career decision-making involves awareness of one's own options and self-confidence in choosing among career options, gathering information about different options available and comparing it to one's own internal criteria and self-concept, and then assessing the decision against the feedback of others. He pays special attention to the importance of identity and background in decision-making, arguing that past experiences and sense of self play an important role in assessing the meaning of information gathered in the decision-making process. Also, he reiterates the importance of Chickering and Reisser's (1993) vector of developing a sense of purpose in the career decision-making process—students should align their choice of major and career field with their personal values.

Harren's (1979) model is insufficient in accounting for contextual and structural factors that shape career decision-making, however, and so we turned to Hodkinson and Sparkes (1997) for a sociological explanation of the process. Hodkinson and Sparkes also stress that individuals make rational, pragmatic decisions when evaluating career options; however, they also describe the ways social and cultural factors shape a decision-maker's frame of reference. Their model builds onto the work of Roberts (1968) who articulated that career decision-making results from the ways opportunities are structured differently for individuals—that cultural and social capital, personal history, life experiences, and differing levels of resources accumulate to shape the career options available for individuals to choose among.

Hodkinson and Sparkes also describe the point of graduation from school as a structured turning point in that an individual's routines will change and that the point at which those routines will change can be anticipated and planned for. A person's routines prior to that turning point may be confirmatory, in that they reinforce the person's decision to follow along a specified career trajectory; contradictory, in that they undermine the person's decision; socializing, in the sense that a person passively assumes a particular career trajectory; dislocating, in that a person is neither socialized into a path yet also unable to transform their routine; or evolutionary, that the routine leads to personal growth. In addition to structuring opportunity, we conceptualize the contextual influences of a student's institution, such as institutional characteristics or normative environment, and specific college experiences, such as participation in STEM activities or faculty mentoring, as shaping a student's routines and confirming, contradicting, or exhibiting any of the other three influences on their trajectory along a STEM pathway. For instance, Lichtenstein et al. (2009) found that internship experiences confirmed some students' choice of an engineering major while contradicting others'. These models guided our selection of variables that influence STEM pathways to see how they affect the probability of choosing one over another.

Method

Data Source and Sample

Drawing from merged data from several national databases including longitudinal student data from the 2004 Cooperative Institutional Research Program's (CIRP) Freshman Survey (TFS) and the 2011 Post-Baccalaureate Survey (PBS), as well as institutional data from the Integrated Postsecondary Educational Data System (IPEDS), this study examines the individual- and institutional-level factors that predict STEM bachelor's degree recipients' likelihood of matriculating into a STEM graduate/professional degree program relative to entering the STEM workforce or entering a non-STEM pathway within seven years of college entry. Our baseline sample came from the Cooperative Institutional Research Program's (CIRP) 2004 Freshman Survey (TFS), which was administered by the Higher Education Research Institute (HERI). The TFS asked freshman students about their demographic characteristics and academic backgrounds, their high school activities, their educational and career ambitions, and expectations of college. The National Institutes of Health (NIH) provided funds to target minority-serving institutions and institutions with NIH-sponsored undergraduate research programs to expand the traditional sample of colleges and universities that participate in the TFS. These funds provided an opportunity to administer the TFS to campuses that typically do not collect such data on their students.

In 2011, we collected additional information from students seven years after college entry to learn more about their educational and career pathways using the Post-Baccalaureate Survey. The 2011 PBS gathered information about participants' undergraduate experiences, perceptions, and posttest data on many of the attitudinal and behavioral items collected on the 2004 TFS. For this survey, we began with the original intended sample for the 2008 CSS, which included 240 institutions. HERI researchers then added all 2004 TFS respondents who had indicated on the TFS that they intended to pursue a STEM major and had enrolled at an institution that had provided degree information. Our final targeted sample for this survey was 66,080 students across 533 institutions. Of the 57,790 reachable participants, a total of 13,671 participants located across 500 undergraduate institutions responded to the survey, which resulted in a response rate of 23.7%. Additionally, in order to examine the relationship between institutional characteristics and STEM bachelor's degree recipients' post-baccalaureate pathways, this study uses institutional data from IPEDS, which provides the most comprehensive data available on higher education institutions in the U.S.

From the longitudinal sample, we identified students who reported on the 2011 PBS that their undergraduate major was in a STEM discipline (see Appendix A for all majors defined as STEM), which included 7,649 students across 480 four-year colleges and universities. After removing cases that had yet to enter into a graduate program and were unemployed, our sample was further reduced to 7,331 students across 471 institutions.

Variables

Dependent variable. The dependent variable in this study was a three-part categorical variable that represents three distinct pathways for recipients of STEM bachelor's degrees: matriculation into STEM graduate/professional programs, entry into a STEM-related job, or departure from STEM pathways by matriculating into a non-STEM graduate program or beginning a non-STEM career. We derived this dependent variable from the PBS data. In the analyses, we used "matriculated into a STEM graduate/professional degree program" as the reference group so that we can compare STEM bachelor's degree recipients who have entered into a STEM graduate/professional degree program roughly 2-3 years after receiving their degree to STEM bachelor's degree recipients who had entered the STEM workforce (and had yet to enter a graduate program) or had departed from STEM pathways by matriculating into a non-STEM graduate program or beginning a non-STEM career.

Student-level variables. The analyses accounted for several student-level independent variables, including demographic characteristics, prior academic preparation, educational and career aspirations, and pre-college experiences (see Appendix B for a complete description of the variables and their coding schemes used in the analyses). For demographic characteristics we included dummy variables representing Latina/o, Black, American Indian, and Asian American/Pacific Islander students with White/Other as the reference group. We also accounted for gender (male as the reference group), socio-economic status, whether the student has a parent who is employed in a STEM field, and whether the student is a native English speaker. We measured prior academic preparation with several variables: high school GPA; standardized test scores (SAT composite with ACT equivalent conversions); the years of study students completed in high school in biological science, physical science, and mathematics; and whether a student participated in a summer research program or health science research program sponsored by a university.

We also examined a set of self-perceptions, aspirations and goals students had upon enrolling in college. The model accounted for two constructs representing students' academic self-concept and social self-concept at college entry, which were created using Item Response Theory techniques (Sharkness, DeAngelo, & Pryor, 2010). The model included dummy variables representing students' aspirations for a masters degree, health professional degree (M.D., D.O.O., DVM, etc.), and Ph.D. or Ed.D, with other degree serving as the reference group. Additionally, the model included dummy variables representing whether a student aspires to become an engineer, scientific researcher, computer programmer, or health professional. Given Carlone and Johnson's (2007) science identity framework, we included a factor representing students' STEM identity at college entry. We created this construct using principal axis factoring with promax rotation, and the items comprising this factor included the following four items: goal of wanting to make a theoretical contribution to science, wanting to be recognized as an authority in the field, wanting to be recognized for contributions to their specific field, and wanting to find a cure to a health problem (for more information about this factor see Chang et al., 2011). Furthermore, students' freshman-year goals of being very well off financially and becoming successful in a business of their own are controlled for.

The study also examined various undergraduate experiences. We examined students' undergraduate STEM major by including whether a student's undergraduate major was engineering, physical science, health professional field, math/statistics, or computer/technological sciences with biological sciences serving as the reference group. The model also examined experiences such as receiving mentorship from a faculty member, working on a professor's research project, participating in a structured undergraduate research program. Students' participation in an academic club/professional association and participation in an ethnic/cultural club or organization are also explored in the study. Finally, whether a student worked on campus during the academic year in college, worked off campus during the academic year in college, and students' debt related to their undergraduate studies are also accounted for.

Institutional-level variables. The analyses also accounted for a number of institutional characteristics. We controlled for institutional selectivity, Minority-Serving-status, size, and control. We measured selectivity as the average SAT scores (or ACT-equivalent scores) of entering students in 2004 and re-scaled this variable so that a one-unit change corresponds to a

100-point change in average SAT scores. To account for MSI-status, we used three types of minority-serving institutions to compare them to predominantly White institutions (PWI): whether an institution is an HBCU, Hispanic-Serving Institution (Hispanic students comprising 25% or more of undergraduate enrollment), or Emerging Hispanic-Serving Institution (Hispanic students comprising 15-24% of undergraduate students). We used a dichotomous variable to represent an institution's status as private (compared to public) and examined the predictive power of Carnegie classification (research and liberal arts institutions compared with masters comprehensive, other baccalaureate colleges, and other specialized health or engineering schools). An institution's size is examined through undergraduate FTE enrollment.

Analyses

To account for any potential non-response bias present in the data, non-response weights were calculated and applied to adjust the 2011 PBS sample of respondents upward to look more like the original target sample of 2004 TFS respondents. The non-response weighting process occurred in multiple steps. First, the EM algorithm was used to account for missing data on key variables from the 2004 Freshman Survey as these variables were used in the creation of the weights. Then, a logistic regression was conducted to predict the probability of responding to the 2011 Post-Baccalaureate Survey (PBS) using predictors from the 2004 Freshman Survey. The products of variables' values and their predicted log odds were included in the regression equation to calculate the probability of responding to both the 2004 Freshman Survey and 2011 Post-Baccalaureate survey. The general formula for developing a non-response weight is: weight= 1/(probability of response)

Once these weights were calculated, the weighted 2011 PBS respondent sample was compared with the un-weighted target sample from 2004 to determine whether the weight inappropriately skewed any of the 2004 Freshman Survey variables. This comparison confirmed that that the weight had not inappropriately skewed distributions of variables from the 2004 Freshman Survey. Finally, a normalized weight, which accounted for sample sizes, was created to prevent the inflation of any *t*-statistics calculated in regressions or other analyses on the weighted sample.

After weighting the data, we addressed cases with missing values by using multiple imputation. Providing a single imputation for missing values does not account for the possible variance of missing data (Sinharay, Stern, & Russell, 2001). Multiple imputation of missing data may provide a more precise estimate of standard errors of parameter estimates (Little & Rubin, 2002). We used the Markov chain Monte Carlo method in SPSS to execute the multiple imputation procedure.

After addressing issues with missing data we examined our data with univariate descriptive statistics. We then analyzed the data using multinomial hierarchical generalized linear modeling (HGLM). Multinomial HGLM represented the most appropriate analytic technique given our categorical, unranked outcome and the clustered nature of the data. This technique partitions the variance between individuals (students) and groups (institutions) in analyses with multi-level data and a categorical dependent variable (Raudenbush & Bryk, 2002). Employing a single-level statistical technique, such as logistic regression, on multi-level data does not account for the unique clustering effect of the complex sample design, which increases the risk of making a Type I statistical error by erroneously concluding the significance of a parameter estimate (Raudenbush & Bryk, 2002).

Limitations

While the longitudinal assessment of STEM bachelor's degree recipients' post-baccalaureate pathways is very useful, this study is limited in several ways. First, this study is limited by its use of secondary data analysis, as we are limited by the variables and their definitions on the 2004 CIRP Freshman Survey and 2011 PBS instrument. Specifically, the 2011 PBS instrument lacked important measures of college experiences including interactions with peers within their respective major and whether students received mentorship from STEM faculty or not. Additionally, the 2011 PBS instrument did not collect information on specific post-college experiences that may have influenced students' pathways, such as whether students' participated in post-baccalaureate programs in STEM. A second limitation relates to the relatively low longitudinal response rate from the student surveys. Although methods were used to try to account for non-response bias by using analytic weights, the low response rate for the 2011 PBS may still inappropriately bias the data and results. Thus, generalization of the study's results beyond this study's sample must be done with caution.

Results

Descriptive Statistics

Descriptive statistics on our sample are displayed in Table 1. In our sample, 34.6% had enrolled in a STEM graduate program, 28.6% were employed in a STEM occupation, and 36.8% had chosen a non-STEM pathway after completing college. Although 56% of the sample is female, the sample is not terribly racially diverse: 14% are Asian American, 9.6% are Latino/a, 7.7% are African American, and 2.8% are American Indian or Alaska Native. 35% of the sample had at least one parent employed in a STEM career at college entry. The sample was fairly well-prepared academically leaving high school; on average their high school grade average fell around A- to A, SAT scores were slightly less than 1250, and they took 4 years of math, 1-2 years of biology, and 2 years of physics before enrolling in college.

Matriculation into STEM Grad/Professional Program versus STEM workforce

Table 2 provides the results from the multinomial HGLM analyses. The multinomial HGLM analyses produces two models: (1) one focused on students who are in a STEM post-college pathway and examining the predictors of whether they have enrolled in a STEM graduate degree program or entered the STEM workforce, and (2) the second focused on the predictors of departure from a STEM post-college pathway compared to enrolling in a STEM graduate program. We will present the results from each model separately.

Several independent variables were significant in the first model predicting the probability of STEM graduate school enrollment relative to entering the STEM workforce following college graduation. Having higher socioeconomic status is related to a higher probability of enrolling in STEM graduate school, while being a native English speaker increases the probability of STEM employment. A one-point increase in average high school GPA increases a STEM aspirant's likelihood of being enrolled in a STEM graduate program by 2.14% and a 100-point increase in SAT score increases a STEM aspirant's likelihood of enrollment in a STEM graduate program by 0.02%. Students with higher degree aspirations—master's, doctoral, and health professional—are more likely to enroll in STEM graduate programs while students who aspire to an engineering career are more likely to enter the STEM workforce after college.

A number of college experiences also significantly affect students' likelihood of enrolling in STEM graduate programs within 2-3 years of college graduation relative to seeking employment in a STEM occupation. Students who work with faculty on research are 14.23%

more likely to enroll in STEM graduate programs and students who receive mentorship from faculty are 5.41% more likely to enroll in STEM graduate programs. Students who participate in an academic club or professional association are 5.34% more likely to enroll in STEM graduate programs, but students who work off campus during the academic year are 7.59% more likely to be employed in a STEM occupation relative to enrolling in a STEM graduate program. We also observed differences by major, relative to biological science majors. Engineering majors (26.68%), health professional science majors (24.67%), and computer and technological sciences (35.84%) are more likely to enter the STEM workforce while math and statistics majors (14.61%) are more likely to enroll in STEM graduate programs.

Matriculation into STEM Graduate/Professional Program versus Departure from STEM

In the model predicting the probability of entering into a non-STEM pathway relative to enrolling in a STEM graduate program, one of the institution-level variables in the model was significant. Students who attend private institutions are 7.19% more likely to enroll in a STEM graduate program relative to choosing a non-STEM pathway. Among the student level controls, women are 4.84% more likely than men to choose a non-STEM pathway after college, and students with higher high school GPAs and SAT scores are more likely to enroll in STEM graduate programs relative to choosing non-STEM pathways.

Several pre-college aspirations and expectations predict the likelihood of STEM aspirants enrolling in STEM graduate programs relative to entering non-STEM pathways following college. Students with a higher social self-concept are more likely to choose a non-STEM pathway, as are students who have a goal of becoming successful in a business of their own. Students who aspire to health professional degrees are 11.16% more likely to enroll in

STEM graduate programs, as are students who aspire to engineering (6.08%), science research (8.46%), computer programming (16.40%), and health professional (5.76%) careers.

Among college experiences, working with a faculty member on research (10.96%) and receiving mentoring from a faculty member (6.77%) increase the likelihood of enrolling in a STEM graduate program, as does participating in an academic club or professional association (6.85%). Working off campus during the academic year increases the likelihood of choosing a non-STEM pathway by 5.80%, however. Differences were also observed by final college major in this model as well. Health profession science majors are more likely (19.17%) to enroll in STEM graduate programs while math and statistics majors (17.74%) and computer and technological science majors (14.99%) are more likely to choose non-STEM pathways after college.

Discussion and Implications

This study provides an important, expanded view of the STEM pipeline as well as a look into the various post-college pathways of STEM bachelor's degree recipients. Past research has illuminated the stark disparities in STEM bachelor's degree retention and completion between underrepresented students of color and women compared to their majority and male counterparts, respectively. This study reveals that even among students who are successful in STEM at the undergraduate level, additional disparities exist in their post-undergraduate trajectories.

The findings show that equity issues remain in the post-college years as several background characteristics are related to STEM bachelor's degree recipients' post-college pathways. With respect to gender, females are more likely to depart from a STEM pathway after college than matriculate into a STEM graduate program. This finding runs contrary to the assertions of Kimmell, Miller, and Eccles (2012) and Xu (2013) that the underrepresentation of women in the STEM workforce is primarily due to decisions made at college entry. Rather, it supports Mullen, Goyette, and Soares (2003) and Perna (2004) who indicated women are more likely to enroll in certain types of graduate programs, i.e. master's and submaster's programs, which tend not to include STEM programs. Perhaps these women are resilient enough to persevere through degree completion but decide due to marginalizing experiences within their undergraduate programs to choose non-STEM pathways after college. Future research should examine these women's trajectories to better understand if their undergraduate experiencdes are diverting them to other fields, or if they simply made a different decision about their future late in their undergraduate careers.

Additionally, socioeconomic differences related to students' decisions whether to enroll in a STEM graduate program or move directly into STEM employment after college. Our framework indicates that students' background and history shape how they make meaning of the information they receive about their career alternatives (Harren, 1979) and how people's individual frames of reference—habitus—influence their perception of which alternatives are available to them (Hodkinson & Sparkes, 1997). Students from higher socioeconomic backgrounds were more likely to enter STEM graduate programs than enter the STEM workforce. Given that students from higher income backgrounds and whose parents hold higher levels of education are more likely to enroll in graduate school (Perna, 2004; Zhang, 2005) and pursue STEM careers (Kimmell, Miller, & Eccles, 2012; Miller & Kimmell, 2012), our results suggest a post-baccalaureate sorting process in STEM may continue to be taking place. For one, graduate admissions and entrance structures likely advantage students from higher socioeconomic backgrounds as admissions requirements into STEM fields continue to place heavy emphasis on standardized test scores, which may reflect students' financial backgrounds more than academic performance. Furthermore, the additional, heavy financial cost and sacrifice of graduate school may be too difficult to take on, particularly within 2-3 years after college, for many students who are low income and/or who need to provide for their families and themselves. These findings suggest that efforts are necessary to restructure graduate requirements in STEM in order to create more equitable and accessible post-college pathways that could reduce this inequity at higher levels of the STEM pipeline. As financial difficulties may impede the ability of many students to pursue their STEM ambitions, robust financial aid packages and research stipends will be necessary to meet this essential need.

Several experiences during college also have a significant relationship with students' post-college pathways. Students who were mentored by a faculty member and students who worked on a professor's research project were more likely to enter into a STEM graduate program relative to the other two pathways. Faculty members play a unique role in the socialization of students into their respective disciplines (Becher, 1989; Stanton-Salazar, 2010) and developing faculty support networks are an essential component in the undergraduate experience that open doors to the structure of opportunity within institutions—including engaging in research and learning about what a research career entails (Thiry & Laursen, 2011). In addition to faculty support networks, developing peer networks through participation in student organizations also influences student outcomes (Herrera, Hurtado, & Chang, 2011; Palmer, Maramba, & Dancy, 2011). In this study, students who participated in an academic or professional organization were more likely to enter into a STEM graduate program. These student organizations may provide important contexts for students to not only further develop their emerging STEM identities, but also provide access to social networks, information, and opportunities that facilitate their entry into STEM graduate programs (Bohlscheid & Clark, 2012; Do et al., 2006; Durham & Marshall, 2012; Sagen et al., 2000).

Students who work off campus are more likely to enter the STEM workforce or depart from a STEM pathway relative to matriculation into a STEM graduate program. Students who work off campus during college may develop professional networks that may facilitate their employment options, yet spending large amounts of time off-campus hinders their chances of making critical connections on campus (Astin, 1984), such as with faculty and peers, that facilitate access to higher levels of the STEM pipeline. However, for students from lower socioeconomic backgrounds, off-campus employment may be unavoidable to make ends meet during college. Further research is needed to better understand the types of jobs different groups of students are accessing, their specific occupations, and the role of the recent U.S. economic recession in understanding students' post-college pathways.

Variation among STEM career aspirants and STEM majors was also related to students' post-baccalaureate pathways. Much of this difference can be attributed to the distinct requirements for entry into each of these fields. Engineering, health professional, and computer/technological science students were more likely than biological science students to enter the STEM workforce compared to entering a STEM graduate program, as many jobs in these fields only require a bachelor's as the minimum credential needed for entry. Health professional students, however, were more likely than biological science students to enter into a STEM graduate program than depart from a STEM pathway, which likely includes students in health profession fields requiring graduate work, such as medicine. Conversely, computer/technological science students were more likely than biological science students to depart from a STEM pathway than enter into a STEM graduate program. Many occupations that are classified as non-STEM still require STEM skills (PCAST, 2012), and so perhaps some of these students are choosing to put their STEM abilities to work in other ways. Further analysis by specific STEM field may provide a better understanding of the diversity of pathways into each field.

Finally, the only institutional characteristic that was significant in this study was institutional control. Specifically, students who attended to private institutions are more likely to enter into a STEM graduate program rather than depart from a STEM pathway after college. While many institutional contexts did not play as significant a role as expected in predicting students' post-college pathways, institutional structures may play an indirect role through providing contexts that harbor the development of faculty and peer support structures (Eagan, Herrera, Garibay, Hurtado, & Chang, 2011) which play an influential role in students' pathways after college. Institutional control shapes the mission of individual colleges and universities and relates to the level of resources available to support students in seeing through their STEM aspirations. Additionally, further research is necessary to better assess conditional effects at the institutional level to better understand how institutional contexts may differentially predict the post-college pathways of students from diverse backgrounds.

Conclusion

While the President's Council of Advisors on Science and Technology has called for an additional one million STEM degrees over the next decade to fill a critical shortage facing the nation's STEM workforce, increasing the number of STEM bachelor's degree holders may not be enough to fill this need. While many undergraduate STEM majors continue on to pursue graduate study in STEM or employment in a STEM field, our analysis demonstrated that a significant amount of STEM majors choose other pathways after they complete college. These pathways may still utilize the skills and abilities honed within their undergraduate STEM programs, but to further boost the domestic STEM workforce additional efforts are also necessary beyond the bachelor’s degree in order to retain STEM talent along STEM pathways in the post-undergraduate years. Attention to the experiences students have within their STEM programs, especially their interactions with faculty, augments efforts to increase the pool of STEM degree holders to encourage students to reach their goals and become the scientists, engineers, technology experts, and medical professionals that our nation demands.

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Appendix A

List of Majors Defined as STEM

1. General Biology
2. Biochemistry/Biophysics
3. Botany
4. Environmental Science
5. Marine (Life) Science
6. Microbiology/Bacterial Biology
7. Zoology
8. Other Biological Science
9. Aeronautical/Astronautical Engineering
10. Civil Engineering
11. Chemical Engineering
12. Computer Engineering
13. Electrical Engineering
14. Industrial Engineering
15. Mechanical Engineering
16. Other Engineering
17. Astronomy
18. Atmospheric Science
19. Chemistry
20. Earth Science
21. Marine Science
22. Mathematics
23. Physics
24. Statistics
25. Other Physical Science
26. Health Technology
27. Medicine/Dentistry/Veterinary Medicine
28. Nursing
29. Pharmacy
30. Agriculture
31. Computer Scienc

Appendix B

Variables and Their Coding Schemes

Variables	Coding Description
Dependent Variables	
Post-Baccalaureate Pathway	1= Non-STEM workforce or graduate/professional program, 2= STEM workforce, 3= STEM graduate/professional program
Background/Pre-college Characteristics & Experiences	
Race: Latina/o	0=no, 1=yes
Race: Black/African American	0=no, 1=yes
Race: American Indian/Alaska Native	0=no, 1=yes
Race: Asian American/Pacific Islander	0=no, 1=yes
Gender: Female	1=male, 2=female
Socioeconomic status	Scale of three items: Mother's education (1=grammar school or less to 8=graduate degree); father's education (1=grammar school or less to 8=graduate degree); and parental income (1=less than $10,000 to 14=$250,000 or more)
Either parent's career in STEM	0=no, 1=yes
Native English Speaker	0=no, 1=yes
Average High School GPA	1=D to 8=A or A+
SAT score	Range: 400-1600
Years of HS study: Math	1=None to 7= Five or more
Years of HS study: Biological Sciences	1=None to 7= Five or more
Years of HS study: Physical Sciences	1=None to 7= Five or more
Participated in a summer research program or health science research program sponsored by university	0=no, 1=yes
Academic Self-Concept	Continuous
Social Self-Concept	Continuous
Degree Aspirations: Masters	0=no, 1=yes

Degree Aspirations: Health Professional Degree	0=no, 1=yes
Degree Aspirations: Ph.D./Ed.D.	0=no, 1=yes
Career Aspirations: Engineering	0=no, 1=yes
Career Aspirations: Scientific Researcher	0=no, 1=yes
Career Aspirations: Computer Programmer	0=no, 1=yes
Career Aspirations: Health Professional	0=no, 1=yes
STEM Identity	Continuous
Goal: Being very well of financially	1=Not important to 4=Essential
Goal: Becoming successful in a business of my own	1=Not important to 4=Essential
Undergraduate Experiences	
Undergrad Major: Engineer (ref. Biological Sciences)	1= yes, 0=no
Undergrad Major: Physical Science (ref. Biological Sciences)	1= yes, 0=no
Undergrad Major: Health Professional Sciences (ref. Biological Sciences)	1= yes, 0=no
Undergrad Major: Math/Statistics (ref. Biological Sciences)	1= yes, 0=no
Undergrad Major: Computer/Technological Sciences (ref. Biological Sciences)	1= yes, 0=no
Work with a faculty member on his/her research	1= yes, 0=no
Receive mentoring from a faculty member	1= yes, 0=no
Participate in a structured undergrad research program	1= yes, 0=no
Participate in an ethnic or cultural club or organization	1= yes, 0=no
Participate in an academic club or professional association	1= yes, 0=no
Work on campus during the academic year	1= yes, 0=no
Work off campus during the academic year	1= yes, 0=no
Student undergraduate debt	1= less than 10,000 to 20= 190,000+
Institutional Level Variables	
Control	1=public, 2=private
Size: Undergraduate FTE enrollment (natural log)	Continuous
Selectivity (100)	Continuous
Institutional Type: Research (ref: masters comp)	1= yes, 0=no
Institutional Type: Liberal Arts (ref: masters comp)	1= yes, 0=no
HBCU	1= yes, 0=no
HSI (25% or more of undergraduates are Latino)	1= yes, 0=no
Emerging HSI (15-24% of undergraduates are Latino)	1= yes, 0=no

Table 1.

Descriptive Statistics

	Mean	S.D.	Min.	Max.
Background/Pre-college Characteristics & Experiences				
Race: Latina/o	1.096	0.294	1	2
Race: Black/African American	1.077	0.266	1	2
Race: American Indian/Alaska Native	1.028	0.166	1	2
Race: Asian American/Pacific Islander	1.14	0.347	1	2
Gender: Female	1.56	0.497	1	2
Socioeconomic status	20.665	5.486	3	39.7
Either parent's career in STEM	0.35	0.477	0	1
Native English Speaker	1.894	0.308	1	2
Average High School GPA	7.15	1.117	2	11
SAT score	1247.618	169.993	460	1886.58
Years of HS study: Math	6.04	0.511	0	7
Years of HS study: Biological Sciences	3.76	0.997	0	7
Years of HS study: Physical Sciences	4.1	1.251	0	7
Participated in a summer research program or health science research program sponsored by university	0.128	0.334	0	1
Academic Self-Concept	0.001	0.868	-4.604	3.35
Social Self-Concept	0	0.856	-2.665	2.834
Degree Aspirations: Masters	0.2866	0.452	0	1
Degree Aspirations: Health Professional Degree	0.251	0.433	0	1
Degree Aspirations: Ph.D./Ed.D.	0.237	0.425	0	1
Career Aspirations: Engineering	0.229	0.42	0	1
Career Aspirations: Scientific Researcher	0.084	0.277	0	1
Career Aspirations: Computer Programmer	0.034	0.18	0	1
Career Aspirations: Health Professional	0.4046	0.491	0	1
STEM Identity	0	0.861	-2.58	2.834
Goal: Being very well of financially	2.99	0.86	1	4
Goal: Becoming successful in a business of my own	2.01	1.007	1	4
Undergraduate Experiences				
Undergrad Major: Engineer	0.271	0.445	0	1
Undergrad Major: Physical Science	0.095	0.293	0	1
Undergrad Major: Health Professional Sciences	0.127	0.333	0	1
Undergrad Major: Math/Statistics	0.046	0.209	0	1
Undergrad Major: Computer/Technological Sciences	0.057	0.231	0	1
Work with a faculty member on his/her research	1.448	0.497	1	2
Receive mentoring from a faculty member	1.655	0.475	1	2

Participate in a structured undergrad research program	1.195	0.396	1	2
Participate in an ethnic or cultural club or organization	1.314	0.464	1	2
Participate in an academic club or professional association	1.648	0.478	1	2
Work on campus during the academic year	1.591	0.492	1	2
Work off campus during the academic year	1.475	0.499	1	2
Student undergraduate debt	3.004	3.217	1	20
Institutional Level Variables				
Control	1.51	0.5	1	2
Size: Undergraduate FTE enrollment (natural log)	9.082	1.004	5.81	10.75
Selectivity (100)	11.84	1.196	7.8	15.1
Institutional Type: Research	0.571	0.495	0	1
Institutional Type: Liberal Arts	0.125	0.331	0	1
HBCU	1.022	0.148	1	2
HSI (25% or more of undergraduates are Latino)	0.029	0.169	0	1
Emerging HSI (15-24% of undergraduates are Latino)	0.042	0.201	0	1

Table 2.

Results from Multinomial HGLM Analysis (Reference: Matriculation into a STEM Graduate/Professional Program)

	STEM Workforce				Non-STEM Post-Bacc Pathway			
	Coef.	S.E.	Sig.	Delta-p	Coef.	S.E.	Sig.	Delta-p
Institutional Level Variables								
Intercept	-0.355	0.664			1.343	0.514	**	
Control	-0.128	0.101			-0.298	0.091	**	-7.19%
Size: Undergraduate FTE enrollment (natural log)	-0.027	0.069			-0.127	0.065		
Selectivity (100)	-0.05	0.047			0.061	0.048		
Institutional Type: Research (ref: masters comp)	-0.218	0.116			-0.03	0.117		
Institutional Type: Liberal Arts (ref: masters comp)	-0.17	0.149			-0.207	0.132		
HBCU	-0.049	0.247			-0.058	0.23		
HSI (25% or more of undergraduates are Latino)	-0.211	0.176			-0.348	0.218		
Emerging HSI (15-24% of undergraduates are Latino)	0.053	0.224			-0.152	0.124		
Background/Pre-college Characteristics & Experiences								
Race: Latina/o	0.057	0.147			-0.006	0.111		
Race: Black/African American	0.091	0.171			0.172	0.155		
Race: American Indian/Alaska Native	0.254	0.235			0.1	0.201		
Race: Asian American/Pacific Islander	0.136	0.131			0.039	0.105		
Gender: Female	0.025	0.082			0.195	0.068	**	4.84%
Socioeconomic status	-0.032	0.008	***	-0.78%	-0.005	0.007		
Either parent's career in STEM	0.074	0.08			0.039	0.065		
Native English Speaker	0.386	0.144	**	8.46%	0.181	0.116		
Average High School GPA	-0.087	0.041	*	-2.14%	-0.101	0.039	**	-2.53%
SAT score	-0.001	0.0004	*	-0.02%	-0.001	0.0003	***	-0.03%
Years of HS study: Math	-0.016	0.08			-0.082	0.066		
Years of HS study: Physical Sciences	-0.013	0.032			-0.051	0.028		

Years of HS study: Biological Sciences	-0.038	0.037			0.012	0.037		
Participated in a summer research program or health science research program sponsored by university	0.12	0.097			0.022	0.089		
Academic Self-Concept	-0.058	0.058			-0.064	0.051		
Social Self-Concept	0.049	0.053			0.176	0.045	***	4.37%
Degree Aspirations: Masters	-0.275	0.099	**	-6.77%	-0.103	0.099		
Degree Aspirations: Health Professional Degree	-0.763	0.123	***	-18.18%	-0.448	0.11	***	-11.16%
Degree Aspirations: Ph.D./Ed.D.	-0.561	0.109	***	-13.54%	-0.197	0.107		
Career Aspirations: Engineering	0.266	0.123	*	6.61%	-0.244	0.114	*	-6.08%
Career Aspirations: Scientific Researcher	0.224	0.174			-0.34	0.14	*	-8.46%
Career Aspirations: Computer Programmer	0.172	0.245			-0.673	0.261	**	-16.40%
Career Aspirations: Health Professional	-0.123	0.116			-0.231	0.096	*	-5.76%
STEM Identity	-0.005	0.053			-0.039	0.045		
Goal: Being very well of financially	0.022	0.048			-0.02	0.042		
Goal: Becoming successful in a business of my own	0.045	0.043			0.086	0.037	*	2.13%
Undergraduate Experiences								
Undergrad Major: Engineer (ref. Biological Sciences)	1.094	0.139	***	26.68%	-0.08	0.123		
Undergrad Major: Physical Science (ref. Biological Sciences)	0.131	0.161			-0.05	0.122		
Undergrad Major: Health Professional Sciences (ref. Biological Sciences)	1.014	0.146	***	24.67%	-0.791	0.139	***	-19.17%
Undergrad Major: Math/Statistics (ref. Biological Sciences)	-0.624	0.256	*	-14.61%	0.744	0.158	***	17.74%
Undergrad Major: Computer/Techonological Sciences (ref. Biological Sciences)	1.594	0.212	***	35.84%	0.622	0.198	**	14.99%
Work with a faculty member on his/her research	-0.594	0.081	***	-14.23%	-0.472	0.068	***	-10.96%
Receive mentoring from a faculty member	-0.217	0.084	*	-5.41%	-0.282	0.07	***	-6.77%
Participate in a structured undergrad research program	-0.17	0.105			-0.022	0.089		
Participate in an ethnic or cultural club or organization	0.104	0.077			0.115	0.068		
Participate in an academic club or professional association	-0.214	0.081	**	-5.34%	-0.285	0.072	***	-6.85%

Work on campus during the academic year	0.072	0.078			0.029	0.065		
Work off campus during the academic year	0.324	0.072	***	7.59%	0.234	0.07	***	5.80%
Student undergraduate debt	0.008	0.012			0.009	0.011		

**p<0.05, **p<0.01, ***p<0.001*