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Intersectionality, Institutions, & Inequality: STEM Majors and Status Competition Processes in the U.S. Higher Education System.

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An abstract of
A dissertation submitted to the Faculty of the
James T. Laney School of Graduate Studies of Emory University
in partial fulfillment of the requirements for the degree of
Doctor of Philosophy
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ABSTRACT

Intersectionality, Institutions, & Inequality:
STEM Majors and Status Competition Processes in the U.S. Higher Education System

By Christina R. Steidl

This dissertation studies the effects of the intersectionality of gender, race and class on majoring in science, technology, engineering and math (STEM) fields within a status competition framework. It expands research on inequality in STEM in three ways. First, I focus representation of intersectional status groups, allowing for comparisons among men and among women, as well as between men and women. Second, I analyze disparities among STEM majors – comparing life science and mathematical science (physics, math, engineering, computer science) majors. Third, I explore interactions between institutional context and status effects. I conduct weighted logistic regression analyses on recent data from the Beginning Postsecondary Students Longitudinal Survey (BPS:04/09) and the Integrated Postsecondary Educational Data System (IPEDS). STEM majors are students who have completed a bachelor's degree in or are working toward a bachelor's degree in a STEM field in what would be their sixth year. Results confirm previous findings that Asians and men are overrepresented in STEM, but also show significant intersectional effects. Parental income operates differently by race; income is negatively associated with STEM rates for whites, blacks and Asians, but positively associated with STEM rates for Hispanics. Among women, parental education levels are positively associated with STEM rates (no effect for me). I also find variation *among* STEM majors. Men are more likely to major in math sciences than life sciences, as are black students (especially from lower income families), lower income Asian men, and women of color (vs. white women). Asian men are more likely to major in the life sciences than the math sciences. Finally, I explore five institutional contexts (public, Carnegie Doctorates, land-grants, HBCUs and Hispanic-serving institutions) and find that the salience of intersectionality varies by context. I argue that the activation of particular intersectional statuses in certain institutional contexts (and not in others) results from variation in status competition processes for STEM majors. Thus, my results demonstrate the importance of considering intersectional status in the creation of policies that seek to broaden participation in STEM and reinforce the existence of multiple pathways into STEM instead of a single "leaky" pipeline.

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On December 15, 2011, in his convocation address to graduates of the Open Campus in Clayton County, Dr. William Greene told the following story:

> Charles Plumb was a US Navy jet pilot in Vietnam. After 75 combat missions, his plane was destroyed by a surface-to-air missile. Plumb ejected and parachuted into enemy hands. He was captured and spent 6 years in a communist Vietnamese prison. He survived the ordeal and now lectures on lessons learned from that experience.
>
> One day, when Plumb and his wife were sitting in a restaurant, a man at another table came up and said, "You're Plumb! You flew jet fighters in Vietnam from the aircraft carrier Kitty Hawk. You were shot down!"
>
> "How in the world did you know that?" asked Plumb. "I packed your parachute," the man replied. Plumb gasped in surprise and gratitude. The man pumped his hand and said, "I guess it worked!"
>
> Plumb couldn't sleep that night, thinking about that man. Plumb says, "I kept wondering what he might have looked like in a Navy uniform. I wonder how many times I might have seen him and not even said 'Good morning' or 'How are you?' or anything because, you see, I was a fighter pilot and he was just a sailor."
>
> Plumb thought of the hours the sailor had spent on a long wooden table in the bowels of the ship, carefully weaving the shrouds and folding the silks of each chute, holding in his hands each time the fate of someone he didn't know.

Here, I would like to thank and name those who packed my parachute, those who have been critical in providing the love and lessons, structure and support necessary for me to complete this journey.

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Inequality, Intersections, and Institutions

From the common schools of the 1800s to the No Child Left Behind Act of 2001, Americans have consistently looked to schools to provide a means of social mobility. Levels of education certainly matter in the economic sphere, where individuals who have earned a bachelor's degree earn, on average, one and a half times as much as those who have only a high school degree (NCES 2011a). Such benefits have created a high demand for post-secondary education, and enrollments increased rapidly over the course of the 20th century (Hurst 1998). This pattern has continued into the 21st century with undergraduate enrollment rising 39% between 1999 and 2009 (NCES 2011b).

With increasing college aspirations and enrollments, America's higher education system has become a target of inquiry concerning the reproduction of inequality. Participation in the U.S. postsecondary system by historically marginalized groups has increased throughout the past century. For example, women constituted 36% of postsecondary enrollments in 1890, a number that remained relatively steady (and even increased slightly) through the 1940s. Following the passage of the G.I. Bill in 1944, women's percentage of enrollments dropped to 30% in the 1950s, and then climbed steadily, with female enrollments surpassing male enrollments in the 1980s (Solomon 1983; Mettler 2005; NCES 2011a). Students of color also gained an increased share of postsecondary enrollments during the 20th century, although not as dramatically, increasingly steadily from 13.1% in 1976 to 30.7% in 2009 (NCES 2011a).

Likewise, the range of institutions within the higher educational marketplace has expanded to include a wide range of private and public universities: liberal arts schools, land-grant universities, community colleges, technical and vocational schools, and now for-profit and online institutions. Schools also vary widely in their missions; some are religiously affiliated while others have historic roots in particular cultural communities or target specific student populations (e.g., women's colleges or historically black colleges and universities). Common sense would have us believe that such a wide array of institutions increases the opportunities for college education and thus for social mobility. Yet, despite increases in points of access and rates of college enrollment, the question remains whether expansion of the U.S. higher education system has helped reduce, reproduce, or exacerbate patterns of social stratification (Bradley and Charles 2004; Brint and Karabel 1989).

My dissertation explores how the structure of higher education in the U.S. shapes academic trajectories for students from different intersectional status groups (i.e., race, class, and gender). Status competition theory argues that, as the negotiation of status hierarchies takes place between and within postsecondary institutions, individual opportunity may be limited by the disproportionate channeling of certain students into particular schools or into less prestigious courses of study (Brint and Karabel 1989; Charles and Bradley 2002). This dissertation examines factors influencing which undergraduates major in the fields of science, technology, engineering and math (STEM fields). More specifically, I expand existing research that documents continuing gender segregation in STEM majors by looking at intersections of gender with race and class. I then ask: how does post-secondary institutional type mitigate, maintain, or exacerbate these social background effects? Analyzing these questions using nationally-representative survey data allows me to examine student success in these status competition process at the aggregate (how are students from different intersectional status groups faring?) as well as how institutional context influences the outcomes of these status competition processes.

Different or Unequal?

While gendered differences in field of study may be explained as merely a matter of personal preference or socialization, these "preferences" have long-term penalties and rewards associated with them. Variation in field of study along gendered, racial or class lines constitutes inequality, more than a "difference" because research has shown that disciplines are highly correlated with earnings and later life outcomes (Clark 1983; Rumberger and Thomas 1993) and are, "unequal with respect to power, prestige, and economic payoffs" (Davies and Guppy 1997: 1419). STEM fields, in particular, serve as a perfect example of the elite fields in such a horizontal hierarchy. Math skills translate into higher earnings for all types of workers (Mitra 2002), and salaries are most influenced by math and/or science skills (Murnane, Willett, and Levy 1995). Studies suggest that college field of study accounts for between one-quarter and one-half of the gender gap in wages for college graduates (Brown and Corcoran 1997; Daymont and Andrisani 1984), putting women at an increasing disadvantage as income disparities tend to grow over time (Marini 1989). In these respects, STEM fields provide optimal career opportunities for women in that workers in science and engineering occupations have lower than average unemployment rates (among college graduates) (Kannankutty 2010) and women engineers experience no gender gap in wages (Morgan 1998).

Bobbitt-Zeher (2007) stresses that when explaining gender disparities in earnings, gendered differences in field of study and work-related factors are more significant than differences in educational attainment and achievement. In other words, it is not just about individual women choosing majors from which they will enter poorly paid fields; *disciplines* that are female-dominated have become socially and economically devalued (see also England 1992). The percentage female of the college major actually explains 14% of the gender gap in income, even when workers enter comparable occupations with comparable skills (Bobbitt-Zeher 2007). As such, exploring gendered difference in field of study contributes to a wider understanding of gender inequality.

Two Axes of Inequality

My research questions are rooted in the argument that stratification in higher education is split along two axes: a vertical axis based on educational access and attainment (degrees earned, etc.) and a horizontal axis based on the prestige of institutions/departments and differentiation between fields of study (Charles and Bradley 2002; Davies and Guppy 1997). Although women have now surpassed men in postsecondary enrollment and in the earning of bachelor's, master's, and doctoral degrees (NCES 2011a), women remain underrepresented both at top-tier universities (Jacobs 1999) and in the fields of science and engineering (Fox 2001; Long 2001; Xie and Shauman 2003).

Existing research on vertical equity demonstrates the necessity of exploring the intersections of race and gender when considering educational outcomes. For example, although men have historically attended college at higher rates than women, black women have historically held higher completion rates than black males, constituting 58% of the students enrolled in historically black colleges and universities (HBCUs) as early as 1954 (Cross 1999). Describing aggregate completion rates by gender alone would obscure such racial differences in gendered completion rates. By 2004, women completed more bachelor's degrees than men across many racial/ethnic groups in the U.S., yet female rates of completion continue to vary by race: 67% for blacks; 61% for Hispanics; 61% for Native Americans; 57% for whites; and 54% for Asians (Buchmann and DiPrete 2006).

Despite evidence that intersectional statuses play a significant role in vertical equity, very little research on horizontal equity has adopted an intersectional frame and no research has examined how the intersectional framework applies to status competition theory. I seek to provide a richer analysis of inequality in undergraduate field of study by examining STEM majoring from an intersectional perspective (asking how various intersectional status groups are faring in the competition for STEM education), by exploring the institutional conditions under which these intersectional statuses become more or less salient, and by detailing variation within the fields of science, technology, engineering and math.

Structure of the Dissertation

The rest of this chapter provides a brief summary of the historical roots and applications of the concept of intersectionality and outlines the levels at which status competition theory can be used to explain changes in both the structure and use of the U.S. higher education system. I do not seek to test or evaluate *whether* status competition theory explains these changes since much other research has already done so. Instead I explore *how* various status competition processes work within the system. In particular, I stress how the application of intersectionality to status competition theory can simultaneously elucidate processes of stratification between men and women, among men, and among women, as well as how stratification processes within and between institutions of higher education create inequalities. I conclude this chapter by explaining the theoretical contributions of the dissertation.

The following chapter reviews the existing empirical literature pertaining to inequality in higher education by field of study. I begin by outlining what we currently know about the effects of race, class and gender on STEM majoring and then briefly relate how intersectional statuses (specifically, intersections of race, class, and/or gender) have been found to influence a number of other educational outcomes. I also summarize previous research regarding the effects of institutional type on educational outcomes, focusing especially on how particular types of institutional contexts have been found to influence racial, gendered, or class-based effects.

Chapter 3 outlines my data, variables and methods. First, I describe the *Beginning Postsecondary Students* (BPS) and *Institutional Postsecondary Educational Data Survey* (IPEDS) datasets compiled by the National Center for Educational Statistics (NCES) and how I have combined the two. I then discuss the measurement of particular variables pertaining to educational outcomes, students' background statuses, and institutional types (as well as controls). Last, I describe the various statistical models and procedures that I have utilized in my analyses.

Chapters 4-6 detail the results of my analyses for each of the three sections (intersectional status effects, differences in these effects between STEM majors, and the effects of institutional context). In these chapters, I stress the implications of my findings related to intersectional status effects for a refinement of status competition theory.

Chapter 7 contains my conclusions, suggestions for future research, and recommendations for educational policy based on the findings of this dissertation.

Intersectionality

Coined by Kimberlé Crenshaw (1989) and rooted in the literature on multicultural or multiracial feminism (Baca Zinn and Thornton Dill 1996; Lorber 1998), intersectionality refers to "the interaction between gender, race, and other categories of difference in individual lives, social practices, institutional arrangements, and cultural ideologies" (Davis 2008: 68) and seeks to, "make visible the multiple positioning that constitutes everyday life and the power relations that are central to it" (Phoenix 2006: 187). In other words, intersectionality attempts to address differences within gender designations, arguing that categories of race and gender are socially constructed and influence both individual identities as well as organizational principles in social systems (Collins 1999a).

Intersectionality's prominence and positioning within multicultural feminist theory poses a problem with regard to empirical methodology. Feminist critiques to positivist social science argue that subjective experience plays a crucial role in the creation of empirical knowledge because only by giving voice to the meanings and social interpretations of oppressed groups can we fully understand inequality (Collins 1999b; King 1988). Yet, such meaning can rarely be elicited through quantitative studies that seek to gauge the scope and impact of intersectional status effects. Thus, empirical research on intersectionality necessitates a compromise in which one can *either* use smaller-scale qualitative studies that richly describe the lived experiences and meanings of individuals *or* employ larger quantitative data that reveal patterns related to inequality and intersectionality, but which lack the nuance and depth of the smaller-scale qualitative patterns. Although both are valid and integral research strategies for clarifying the interlocking nature of race, class, and gender within social systems, this dissertation follows the second path – elucidating the scope of intersectional status effects with regard to college major. Although my research does not seek to determine the specific experiences, beliefs, and/or norms that shape STEM majoring within particular intersectional status groups, the use of national survey data and quantitative methods of analysis enables me to identify *which* women (and which men) may need the most recruitment, intervention and/or support if they are to successfully major in a STEM field.

The discourse on intersectionality unites two strands of feminist theory: the marginalization of women of color and 'multiple jeopardy' (King 1988) and how power relations are produced and transformed through women's lived experiences of race, class, and gender (Yuval-Davis 1997; Collins 2000; Weber 2001). This discourse has sparked debate around whether intersectional statuses always shape experience or whether activation of intersectionality, above and beyond the separate effects of race or gender, varies. Thus, some theorists stress changes in meaning associated with race and gender depending on historical and/or spacial context (Lorber 1994; Omi and Winant 1994). My work in Chapter 6 investigates this theoretical perspective, analyzing how enrollment in a particular type of institution may influence particular status effects and/or intersectional status effects.

Finally, in arguing that systems of race, class, gender and other social categories (like sexuality, ability/disability, age, etc.) form a 'matrix of domination' (Collins 1999a), intersectionality highlights the fact that a single individual can experience both privilege and disadvantage simultaneously (Baca Zinn and Thornton Dill 1996; Higginbotham 1997). This counters traditional research on stratification, which tends to assume the disadvantage of various groups in comparison to upper class white men (who were the primary beneficiaries of early schooling) and test for movements toward equity. While empirical studies have identified a variety of advantages held by upper class white males, such a dichotomous perspective oversimplifies the complex race, class, and gender dynamics in higher education. My findings fit the status competition perspective in that they suggest competition exists not only between dominant and subordinate groups, but also between status groups at each level of the social hierarchy (e.g., between men and women for access to STEM fields and simultaneously between women from different racial groups for access to STEM fields, etc.). As such, intersectionality provides a crucial perspective for understanding status competition processes given that, "specificity is critical to complete, effective, and useful analysis of inequality" (Browne and Misra 2003: 506).

Status Competition Processes in Higher Education

The idea of status groups comes from Weber, who argues that social stratification rests not solely upon class, defined in terms of economic power (as Marx would argue), but also upon status groups and party affiliations. Status groups are defined in terms of their social or cultural power and members of a status group share a "life fate…that is determined by a specific, positive or negative, social estimation of *honor*" (Weber 1946: 187). Unlike theories of status attainment, status competition theories acknowledge that individuals do not begin on an even playing field and that starting positions (in the status hierarchy) can play a significant role in determining outcomes. Status competition theorists argue that negotiation of status hierarchies takes place within social organizations, and particularly within educational institutions, through two processes: social closure and system expansion (Brint and Karabel 1989; Collins 1979; Fuller and Rubinson 1992; Ralph and Rubinson 1980; Rubinson 1986; Rubinson and Hurst 1997).

As formal education endows individuals with credentials that provide increased access to higher status occupations, higher status groups have traditionally maintained their status by controlling access to higher educational institutions and/or prestigious degree programs (i.e., social closure). In situations such as the U.S., however, where mass public schooling provides opportunities for status mobility to individuals from lower status groups, high status individuals must either remain in school longer (to achieve ever higher levels of degrees) or provide alternative post-secondary options for lower status individuals in order to maintain their advantage (i.e., system expansion).

Historical social closure processes have been detailed by Collins (1979), who notes that when high status groups in the U.S. (i.e. middle/upper-class white Anglo Protestants) felt threatened during the late nineteenth and early twentieth centuries, often by growing immigrant or ethnic minority populations, these groups used education as a barrier to the prevent the entry of immigrants and ethnic minorities into the occupations which they sought to monopolize. Specifically, members of high status groups and high status professions created organizations to create standards that could be used to regulate access to jobs and maintain the status of the professions (e.g., the American Medical Association, the bar exam) based on educational qualifications. Thus, the professionalization of high status fields was a conscious mechanism of social closure created by elite groups to regulate the entry of lower status persons into high status fields. The creation of these types of barriers effectively solidified the status of existing elites while legitimizing new mechanisms to guarantee the continuity of existing social hierarchies.

Thus, by restricting educational access through the creation and enforcement of entrance standards in colleges and professional schools (e.g., standardized tests, legacy enrollments, etc.), elites limited the mobility of low status competitors, effectively safeguarding their own status (Collins 1979). Karabel (2005) chronicles changes in admissions policies at elite schools that reflect the desire of elites to maintain their advantage even as postsecondary institutions became 'open' to new populations – a carefully balanced ideology of equality of educational opportunity and merit without acknowledgement of the structural disadvantages faced by applicants from non-dominant social groups. "Only a redefinition of 'merit' that acknowledges the profound differences in educational opportunity holds a real possibility of breaking more than token diversity" (Karabel 2005: 554). Similarly, the implementation of a variety of policies designed to exclude, and then to limit, enrollment of Jewish students at the nation's top universities after WWII reveals how status competition processes are influenced by changes in group membership (Steinberg 1981; see Sachs 1994 for a corresponding analysis of the historical factors leading to the re-labeling of Jews as white in American racial consciousness). Solomon (1985) too, notes that older colleges (catering mostly to white Protestants) created “selectivity” procedures in order to protect their traditions (by effectively limiting the access of blacks, Catholics, and Jews). It is worth noting that, at least within the United States, most of these attempts to create social closure have eventually failed and previously marginalized populations have gained increased access to higher education.

The proportion of the U.S. population attending college immediately after high school jumped from 49% in 1975 to 70% in 2009 (NCES 2011a). With such increases in college attendance, *where* one attends college has become an increasingly important indicator of future academic and career opportunities (Rivera 2011). In other words, social closure processes have increasingly shifted from vertical exclusion to horizontal exclusion. Karen (2002) concludes that the continued effect of social background statuses on matriculation at selective colleges stems from some combination of status competition (maximally-maintained inequality) and counter-mobilization by elites (similar to the strategies discussed above). Changes in educational policy can also effectively escalate status competition between groups for access to higher education. For example, after the passage of the G.I. Bill in 1944, some women’s colleges began to accept male veterans, effectively reducing the space left for women and bringing about a surge in female enrollments at 2-year colleges (Solomon 1985; Mettler 2005). Hurst (1998) records the impact of federal and state policies related to discrimination (for a discussion of affirmative action, see Bowen & Bok 1998) and financial aid in lowering barriers to access, resulting in system expansion based on the incorporation of previously excluded groups into the higher educational marketplace.

Linking system expansion (and differentiation of institutions within this expanding system) to persisting inequalities, status competition theorists argue that competition between status groups for control of and access to the best schools has led to the creation of a diverse and highly stratified institutional field, offering students a range of credentials. Many researchers who take the status competition perspective attribute secondary and post-secondary expansion to competition between social groups for control of wealth, power, and prestige (Werum and Rauscher 2006; Werum 2002; Werum 2001; Bradley and Charles 2002; Charles and Bradley 2004; Collins 1979; Rubinson and Ralph 1984; Rubinson and Hurst 1997; Blossfeld and Shavit 1993). For example, Brint and Karabel (1991) assert that, in addition to environmental and organizational factors, status group conflicts played a role in the development of the community college system and its subsequent transition from a 2-year liberal arts curriculum to a more vocational-oriented program of study, with some of the earliest leaders in the vocational movement consisting of 4-year university presidents who wanted to increase their own institution's status through specialization within the field of higher education (Hurst 1998). "The elite universities saw the junior college as an essential safety valve that would satisfy the demands for access while protecting their own institutions" (Brint and Karabel 1989: 208). Thus, the expansion of the community college sector in the 1950s and 1960s can be attributed to attempts by elites to create alternate post-secondary tracks. Community colleges resolved the tension between democratic pressures to provide access to new levels of education for previously excluded groups and the reality of labor market opportunities. “Most of the schools in a state have competed with one another for academic programs and resources, with many schools actively trying to move up the status hierarchy” (Hurst 1998: 101). Negotiation of status hierarchies then takes place both between and within schools.

Looking at this phenomenon from a comparative perspective, Rubinson (1986) employs a status competition perspective in explaining the structure of schooling in the U.S. and Europe. He notes that, compared to Europe, the U.S. has incredibly high rates of education across the entire population. He attributes this to the lack of formal stratification within the U.S. educational system (no groups are ‘diverted’ into the labor force) and the development of the U.S. political party system based on ethnocultural, religious, and regional lines instead of class lines (in the Marxist sense). Thus, while widely applicable, status competition theory is particularly salient in the U.S. higher education system due to the lack of centralization within the system. Not only does the government not control or regulate higher educational institutions, but anyone can establish a post-secondary institution.

To summarize, status competition theory stresses the importance of conflict between social groups in creating and maintaining stratification systems. They also argue that diversification of institutional forms within the higher education system may actually limit individual opportunity by disproportionately channeling certain students into less prestigious institutions and/or into vocational programs and other less prestigious tracks (Bradley and Charles 2004; Brint and Karabel 1989; Charles and Bradley 2002). Thus, status competition theory predicts that, as postsecondary education becomes increasingly available, stratification within the system (either between types of institutions or within institutions by field of study or level of study) becomes *increasingly* prevalent. "As the number of places in higher education expands, there can be large increases in the *amount* of education any given group attains without any change in its relative position in the educational hierarchy" (Karen 2002: 193). At the same time, competition exists not only between dominant and subordinate groups, but also between status groups at each level of the social hierarchy who seek to maintain their position. At the individual level, this means that, although individuals from previously excluded social groups can now obtain college educations, their social mobility has not necessarily increased because stratification hierarchies between social groups remain unchanged (Karen 2002).

My study extends this line of research by detailing status competition processes between men and women and among men and among women from different racial and class backgrounds to major in STEM fields. I also ask: to what extent has the differentiation of institutions within the U.S. higher education system assisted historically disadvantaged groups in attaining educational equity with regard to STEM majoring? The existing research indicates that equity has not yet been reached across the board and that some groups have made more progress toward equity than others. By including measures for race, class, and gender in my analysis (and specifically by looking at the intersections of these statuses), my research will help to demonstrate how and to what extent these factors continue to influence horizontal inequality within the U.S. postsecondary system.

Institutional Contexts: Status Competition Within and Between Institutions

If, as status competition theorists argue, the negotiation of status hierarchies takes place within social institutions, then any analysis of social inequality should consider the effects of institutional context. Postsecondary institutional context may shape status competition processes related to STEM fields in two ways. First, status competition occurs within an institution for access to the limited number of spaces in a major. Looking at the effects of institutional context within particular institutional types allows for comparison of successful STEM majoring between intersectional status groups. Here, institutional context defines the sample population (see Figure 1.1). Such an analysis demonstrates, for example, whether white women and black women who attend public schools are entering STEM fields at roughly the same rates. In other words, it assesses equity between groups within an institutional context and identifies which status competition processes (i.e., racial, gendered) are employed therein.

In contrast, between institution effects (which could also be called moderating effects or interaction effects) indicate how the type of institution attended changes the relationship between a student's intersectional status and their field of study. In other words, moderating effects allow us to determine which institutional contexts provide the best outcomes for whom, given that stratification processes within particular types of institutions may/may not benefit particular groups of students. The analysis of between institutional effects demonstrates, for example, whether being a black student at a private institution differs from being a black student at a public institution (in terms of its impact on STEM majoring). Here, institutional context itself is considered a variable factor in the model (see Figure 1.2). Chapter 6 addresses how institutional context influences status competition processes both within and between institutions.

Figure 1.1. Intersectional Status Effects Within Institutional Contexts

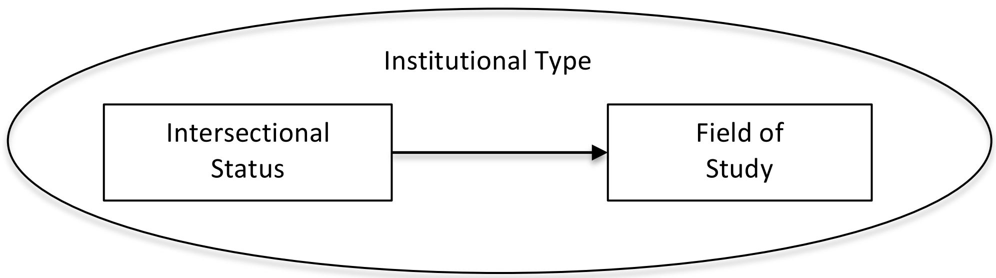
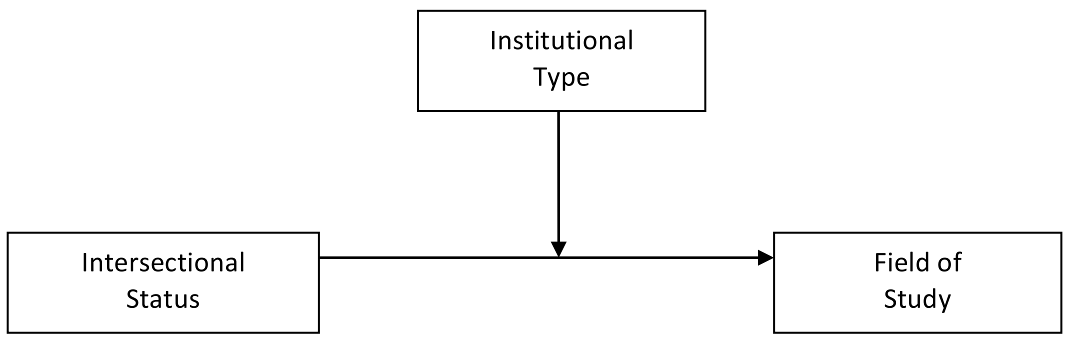


Figure 1.2. Intersectional Status Effects Between Institutional Contexts



Theoretical Contributions

This study contributes to our understanding of status competition processes in the American higher educational landscape in several significant ways. First, it contributes to our understanding of status competition theory by providing insights about *how* status competition process works for gender and race. Although a small number of studies have applied a status competition framework to analyses of immigration, gender, race, and religion (Karabel 2005; Steinberg 1981), most have merely assumed that status competition processes for theses types of status groups follow a model firmly rooted in class dynamics (status competition theory originally stems from Marxist conflict theories as well as Weberian theories of status) wherein higher class groups protect their advantage. Thus, my research will effectively test whether status competition processes for race and gender do, in fact, mimic class processes (i.e., whether whites and men, as the more privileged groups in U.S. society, similarly work to secure and maintain an advantage in STEM majors) and if not, potentially provide insights as to alternative processes. Second, by combining intersectionality and status competition theory, I seek to provide a more specific understanding of how status competition processes might occur between population groups – assessing the success of various intersectional status groups within the postsecondary educational field. While studies have determined almost unanimously that women are not yet drawing equal to men in STEM, my analysis seeks to determine racial and class differences in STEM majoring *among* women and *among* men.

Finally, I examine the extent to which intersectional status effects are contextually activated by analyzing how institutional context (both within and between institutions) changes these patterns of stratification. Furthermore, my results clarifying stratification processes *between* and *within* higher educational institutions will have direct implications for future educational policy. Strong effects of institutional context *within* institutions can provide direction for school-level policies and assessments while strong effects of institutional context *between* institutions can help policy-makers identify and address issues of equity both during the sorting process whereby students select (or are selected into) educational institutions (which might best be addressed by governmental policies related to admissions, recruiting, and financial aid) and after students arrive (identifying student populations who may require additional encouragement and support if they are to enter and succeed in STEM majors).

Chapter 2:
Studying Students who Study STEM

Analyses of vertical equity in post-secondary education have consistently demonstrated the necessity of exploring the intersections of race, class and gender when considering educational outcomes. For example, an examination of college completion rates shows that women have historically earned fewer bachelor's degrees than men, but that black women have historically held higher completion rates than black men. In fact, black women constituted 58% of the students enrolled in historically black colleges and universities (HBCUs) as early as 1954 (Cross 1999). As noted above, by 2004, women completed more bachelor's degrees than men across many racial/ethnic groups in the U.S.: 67% for blacks; 61% for Hispanics; 61% for Native Americans; 57% for whites; and 54% for Asians. Buchmann and DiPrete's (2006) analysis reveals differing causes for these advantages by racial group. Individual-level factors tend to matter more for white women's odds of graduating whereas institutional level factors matter more for black women's odds of graduating. Bennett and Xie (2003) show that although black students are overall less likely than white students to attend college, once we control for academic performance and SES, black students are actually more likely to attend a 4-year college than their white peers. This effect is driven by black students from lower-income families as there is an interaction between race*class. Finally, while blacks are more likely to attend college, net of socioeconomic background and academic characteristics (Alexander, Holupka and Pallas 1987; Bauman 1998; Hauser 1993; Kane and Spizman 1994; Rivkin 1995), whites actually attend college at higher rates, indicating that what appears to be a racial effect is actually an intersectional effect on college attendance.

Despite such definitive intersectional status effects on vertical equity, very little research on horizontal equity has adopted an intersectional frame. The majority of the research on inequality in the fields of science, technology, engineering and math (STEM) has focused on gender inequality. In most of these studies, racial/ethnic differences by gender are often ignored (Blickenstaff 2005) or race/ethnicity is considered a background variable (Xie and Shauman 2003). Other literature has focused solely on racial differences in STEM fields (Anderson and Kim 2006), including gender only as a background variable. Only recently has any work begun to address the intersections of gender, race, and class as they relate to undergraduate choice of major. In this chapter, I review two bodies of existing research: one on the effects of individuals' race, class, and gender on undergraduate STEM majoring and the other on how post-secondary institutional types influence rates of STEM majoring among various population groups.

As noted above, since much of the existing research addresses only gender or race (or class), I begin by reviewing what we know about each of these effects and then describe new research that begins to explore intersections of gender and race with regards to STEM majoring. Of course, student development theory has identified a variety of factors beyond these intersections that influence undergraduate majors so I briefly outline these factors as well. I then move to a discussion of how institutional types influence STEM majoring, focusing on institutional control, founding principles and institutional missions.

Gender Inequality in STEM

Most of the research related to unequal representation in STEM fields pertains to gender inequality and the masculinization or feminization of particular fields of study. As mentioned in Chapter 1, women had earned the majority of bachelor's and master's degrees by 1990 and have now surpassed men in earning doctoral degrees (Buchmann and DiPrete 2006; AAUW 2010). Yet, the fields in which men and women earn these degrees remain segregated with women more likely to major in social sciences, humanities, and education while men major in business, math, natural science and engineering (Bobbitt-Zeher 2007). Female students disproportionately major in fields that result in lower paying jobs (Bobbitt-Zeher 2007; Bradley 2000; Davis and Guppy 1997) and, as a result, women earn 15% less than men early in their careers (Blau and Khan 2007; Blau 1998), creating a wage gap that increases over time. Moreover, Davies & Guppy (1997) report that women are doubly disadvantaged in that they wind up in less prestigious institutions *and* less lucrative fields of study.

Cross-cultural and historical comparative research demonstrating changes in women's representation in science and math fields suggest that gender gaps result from social constructions of labor and gender, rather than biologically-based aptitudes or interests (Andreescu et al. 2008) and culturally prescribed gender roles influence occupational interest (Low et al. 2005). A review of child vocational development by Hartung, Porfeli and Vondracek (2005) found that children—and girls especially—develop beliefs that they cannot pursue particular occupations because they perceive them as inappropriate for their gender. Thus, almost twice as many male freshmen as female freshmen (29% to 15%) intend to major in a STEM field (NSF 2009).

A closer examination reveals great variation between STEM fields. For example, the gender disparity in plans to major is even more significant when the biological sciences are not included. Just over one-fifth of male freshmen planned to major in engineering, computer science, or the physical sciences, compared with only about 5 percent of female freshmen (NSF 2009). The biological and life sciences thus seem to be drawing increasing numbers of women, while women are actually losing ground in the physical sciences, math and computer science, and engineering. This pattern holds for degree completion as well. In 2006, women earned the majority of bachelor's degrees in biology, one-half of bachelor's degrees in chemistry, and nearly one-half in math (AAUW 2010). Yet, while women complete 72% of degrees in biological or life sciences, men complete 58% in physical sciences, 74% in math and computer sciences, and 82% in engineering (NSF 2010). In fact, the number of women earning a bachelor's degree in computer science has decreased since the 1980s (Spertus 2004).

Such variation between STEM fields has led to conflicting results on whether women are actually less likely to graduate in STEM fields (Chimka, Reed-Rhoads, and Barker 2008; Zhang et al. 2004). My own research seeks to clarify these patterns in two ways. First, I explore how these gendered patterns vary by race and class. Second, in Chapter 5, I expand my analysis of STEM fields to explore separately the current patterns of representation in the life sciences and the more math-oriented STEM fields (including physical sciences, math, computer science, and engineering).

Racial Inequality in STEM

Like the research on gender, the existing research on racial disparities in STEM majoring is somewhat contradictory. Most research shows that Asians major in STEM fields at higher rates than non-Asian students. Forty-seven percent of Asian/Pacific Islander students entered STEM fields compared to 19-23% of students from other racial groups (NCES 2009). The odds of declaring a STEM major were 1.93 times as large for Asians as for whites and Asians were 2.48 times as likely (as whites) to complete a STEM degree (Crisp, Nora and Taggart 2009). Representation of Hispanic and black students in STEM fields is less clear. Some research suggests that African Americans, Hispanic/Latinos, Native Americans and individuals of mixed ethnicity are significantly underrepresented in STEM majors (Murphy et al. 2010) and that, in contrast, whites and Asians are more likely to major in STEM fields (NCES 2009). Hispanic students seem particularly underrepresented both in STEM occupations and in attainment of degrees in STEM fields (Oakes 1990; Young 2005). Other research, however, suggests that blacks, Hispanics, and whites earn bachelor's degrees in STEM majors at roughly equal rates (Tyson et al. 2007), but that students from underrepresented groups are more likely to leave STEM majors (Bonous-Harnmarth 2000).

Some of these inconsistencies most likely stem from the measurement of race/ethnicity, with many studies simply comparing white students to racial minority students (as a unified group). This approach should lead to unreliable results as studies have shown that some students in the racial minority group, like Asians, tend to major in STEM fields at higher rates than whites while other students in the racial minority group, like Hispanics, most likely major in STEM at significantly lower rates. Other studies have compared *underrepresented* minorities (typically blacks, Hispanics, and sometimes Native Americans – as a unified group) to white and/or Asian students. Again, such an approach assumes empirical similarities between blacks and Hispanics that may or may not exist. Complicating the matter, students identifying as Asian or Hispanic come from three very different populations: some have traveled to the U.S. to attend college on a student visa, some are immigrants or children of recent immigrants, and others come from families who have lived in the U.S. for generations. Evidence suggests that time spent in the U.S. can reduce STEM majoring among Asians (Tang, Fouad and Smith 1999), but other research has found no effect of immigrant status on college major (Song and Glick 2004).

Of course, any mutually-exclusive designation of race/ethnicity greatly simplifies the complex realities of identity, but I attempt to improve upon these techniques by including four separate racial/ethnic groups in my analysis: whites, blacks, Asians, and Hispanics. Moreover, I include U.S. citizenship as a proxy measure to control for effects of foreign students and recent immigrants. Finally, I do not take for granted that racial/ethnic effects have the same effect on STEM majoring for men and women or on students from different class backgrounds.

Class Inequality in STEM

While research has shown that class background plays a significant role in determining educational outcomes, particular findings vary greatly depending on how class is conceptualized and measured. The literature tying class background to STEM majoring tends to conceptualize class in two ways: in terms of economic capital (i.e., SES, family income, etc.) or in terms of cultural capital (i.e., parents' education levels, parent's occupation, etc.). While research has consistently found significant associations between these two measures of class and rates of STEM majoring, the influences of economic versus cultural measures of class appear to work in opposite directions – highlighting the multidimensionality of class.

Various models exist for how SES impacts educational attainment. The two most common include the parental resources model which argues that students from higher SES families have more resources to devote to education and are able to attend school longer and/or attend more higher quality schools (Bowles and Gintis 1976; Steelman and Powell 1991) and the parental socialization model, which argues that students from higher SES families tend to have higher educational aspirations which translate into increased persistence (Alexander, Eckland, and Griffin 1976). While there is evidence to suggest both of these mechanisms may influence post-secondary outcomes at the undergraduate level, their effects weaken and disappear beyond the bachelor's degree (Stolzenberg 1994). While both of these models suggest that students from higher SES backgrounds would reap benefits, the research particular to STEM fields actually shows that students from lower income families are more likely to major in STEM fields, perhaps because students from lower-income families are more likely to approach post-secondary education from an instrumental perspective. Thus, students from lower SES backgrounds are more likely to major in technical but lucrative fields such as engineering and less likely to major in fields where economic returns are seen as risky, such as the humanities (Davies and Guppy 1997; Griffith 2008; Yingyi 2009).

Although students from lower income families may be more likely to major in

STEM fields, STEM majoring is also positively associated with higher levels of parental education. For example, students from families where at least one parent had a college degree were more likely to complete a degree in a STEM field (NCES 2009). Several mechanisms may account for this relationship. Higher levels of parental education may influence parental expectations with regard to academic achievement during high school, thus resulting in an advantageous student placement in the STEM pipeline. Higher levels of parental education may lift barriers to and create norms around graduate education perceived as necessary in some STEM fields.

My analysis seeks to elucidate whether these seemingly conflicting patterns of class impact might be better understood in relation to gendered or racial patterns. For example, women from families with a single female head of household may simultaneously experience lower income levels, but hold less traditional gender-role beliefs (see also Barber and Eccles 1992). Likewise, higher levels of parental education may reduce gendered (or other) stereotypes around careers in science, thus increasing rates of female entrance into STEM majors. If such contradictions cannot be explained by intersectional status effects, they may lend credence to recent claims that the effect of family background characteristics are significant only upon college entrance, but that, after matriculation, they no longer influence students' trajectories, including choice of major.

Intersections of Race, Class, and Gender

Clearly then, the evidence suggests that gender, race and class all play a role in influencing who majors in a STEM field. Yet, intersectionality, as defined by feminist and critical race scholars, would suggest that these status effects differ across categories (i.e., that the effect of gender may differ by race or the effect of class by gender, etc.). Although little research exists related to intersectional status effects on horizontal inequalities, research on vertical inequality in higher education indicates significant intersectional effects. Buchmann, DiPrete and McDaniel (2008: 319) identify intersectionality as a primary direction for future research on gender inequality in higher education, suggesting that we must seek to understand, “how gender differences might amplify other kinds of inequalities, such as racial, ethnic, class, or nativity inequalities.” If such intersectional effects do exist with regard to STEM majoring, they may help to explain apparent contradictions in the findings reviewed above. Below, I highlight research pertaining to intersectional status effects on educational outcomes with particular attention to STEM majoring.

Looking specifically at research on STEM majoring, results reveal significant racial and class differences among women. For example, black women report more interest in STEM fields than white women (Hanson 2004; Fouad and Walker 2005), possibly because young black women are encouraged to have high self-esteem and to be independent and assertive, characteristics associated with success in STEM fields (Hanson 2004). Likewise, the potential for race*gender effects are underscored by Song and Glick (2004), who find differences between Asian and white women in choice of major, but little difference between Asian and white men.

Among women, the father’s education level has also been shown to be positively associated with selecting a STEM major, whereas father’s education has a negative relationship for men (Ware, Steckler and Leserman 1985). Likewise, evidence suggests that the effects of SES may differ by gender (Leppel, Williams and Waldauer 2001; Yingyi 2009) with SES significantly influencing trends of STEM majoring among women, but less so among men.

Data collection techniques typically lead to majority white samples and thus conclusions about gender disparities drawn primarily from white populations. A recent report by the American Association of University Women calls into question the tendency to generalize the gender gap across racial groups:

> "Trends in [STEM] bachelor's degrees earned by women from underrepresented racial-ethnic groups (African American, Hispanic, and Native American/Alaskan Native) generally mirror the overall pattern; however, in some cases the gender gap in degrees earned by African American and Hispanic women and men is much smaller or even reversed. For example, African American women earned 57 percent of physical science degrees awarded to African Americans in 2007; still, the overall number of African American women earning physical science bachelor's degrees was less than 600" (AAUW 2010).

Intersectional research has also begun to shed light on status competition processes between race/gender groups. For example, controlling for academic preparedness, black men are twice as likely as white men to declare a major in physical sciences or engineering while black women are closer to closing the gap with white men than are white women (Riegle-Crumb & King 2010). Yet, while women of color (blacks, Asians, Latinas, Native Americans and Pacific Islanders) constitute roughly 20 percent of the U.S. population between the ages of 15-24 years, they earn only 12 percent of bachelor's of science degrees in STEM fields (Epsinosa 2011; NSF 2009). Finally, class background (in terms of income and parental education) appears to impact STEM majoring among white women, but not women of color (Espinosa 2011) and race*SES interactions have been found to significantly influence STEM majoring among men, but not among women (Trusty 2002). Such findings suggest the complicated nature of the relationship between intersectional status groups and undergraduate STEM education. My own research further expands our understanding of intersectional status effects by exploring not only how individuals from various intersectional statuses are faring (in comparison to white males), but also which racial and class groups among women or among men are succeeding in the competition for STEM degrees.

Astin's I-E-O Model

Of course, background status variables like race, class and gender are not the only factors influencing whether students declare a STEM major and then whether or not they remain in that major to complete a STEM degree. Astin's I-E-O model suggests that we must take into consideration inputs, environment, and outputs (Astin 1993). Inputs include not only background statuses, but also measures of academic expectations and motivation and academic preparedness. Environmental measures include experience and integration at college and family and job obligations, as well as institutional type. Leaving aside the question of institutional type (which I will address shortly), I present here a brief overview of existing research related to these major categories of input and environmental factors.

First, students' academic expectations play a significant role in determining undergraduate majors. The majority of students who major in science make that decision before or during their senior year of high school (Maltese & Tai 2011). Aspirations, in general, have a stronger effect for men than for women (Smart and Pascarella 1986) and African American women report higher levels of interest in science than white women

(Hanson 2004). Gender and racial differences in educational expectations may result from stereotypes about scientists. Even young children have been shown to express strong opinions about which science classes are for boys versus girls (Farenga & Joyce 1999; Ambady et al. 2001). Adults too, hold these stereotypes (Nosek, Banaji and Greenwald 2002) and studies show that, regardless of age, female aspirations and performance in math and science are negatively influenced by stereotype threat (Buck et al. 2008; Nguyen & Ryan 2008; Spencer, Steele and Quinn 1999). Even if aspirations, attitudes and performance are influenced by such stereotypes, the impact of attitudes toward math and science on STEM majoring may be overstated in the literature. Riegle-Crumb and King (2010) find no evidence that math attitudes contributed toward gender disparities in STEM majoring.

Second, STEM majors can be demanding and research shows that students who enter and complete STEM majors tend to have higher levels of academic preparation than their peers. Yet, recent studies have produced contradictory results with regard to academic preparation. High school achievement (by percentile), math SAT score and first semester college GPA have all been shown to predict STEM majoring (Crisp, Nora and Taggart 2009) as have total science courses taken in high school (Maltese and Tai 2011). Chang et al. (2010) confirmed the significance of SAT scores on all students' likelihood of persisting in a STEM major, but did not find a significant effect of high school GPA or number of years spent taking mathematics or science in high school. Ware and Lee (1988) found high school grades to be a significant predictor overall. Boys have historically taken more math and science courses than girls and have scored higher on standardized tests, but today, girls are taking roughly the same number of math and science courses as boys and are doing equally well, if not better, in them (AAUW 2010; Hyde et al. 2008; NCES 2007). Although boys continue to score slightly better on the math sections of the SAT and ACT (Halpern et al. 2007; AAUW 2008), recent studies find very minimal gender disparities in high school academic performance and reveal that these differences do not significantly contribute to gendered differences in STEM majoring (Simon and Farkas 2008; Xie and Shauman 2003).

Moreover, measures of academic preparation and prior achievement are not uncorrelated with students' intersectional status effects and may actually serve to mediate gender, racial and class effects on STEM majoring. For example, both male and female students from historically marginalized groups are more likely to attend high schools that offer fewer advanced courses in math and science, a situation which may lower their ability to successfully major in a STEM field (May & Chubin 2003; Frizell & Nave 2008; Tyson et al. 2007; Perna et al. 2009). Racial differences in completion of math and science courses at the high school level are telling. In 2005, the rates at which black and Hispanic high school graduates completed calculus were less than half the rate for white students and less than a quarter the rate for Asian students (National Science Board 2008).

The number of factors influencing a student's college experience is obviously so large that every student's trajectory is almost unique. Still, college experiences play a significant role in STEM persistence, particularly among women (Espinosa 2011). Specifically, positive interaction with faculty outside of class appears to increase STEM completion for all students (Alfred et al. 2005; NRC 2006) and working more than fifteen hours per week appears to decrease STEM completion for all students. Social integration on campus was positively associated with higher levels of STEM majoring for minority (black and Hispanic) students and living on campus significantly increased STEM completion rates for women and minorities. Changing major was negatively associated with completion of a STEM degree (Maltese and Tai 2011) as students in STEM majors are more likely to change their major to a non-STEM major (NCES 2009). Specifically, 64.1% of students enrolled in a STEM major in 1995-96 had either finished a STEM degree or were still enrolled in a STEM major in 2001, whereas 92.9% of non-STEM majors remained in non-STEM majors. Only 7.1% of non-STEM majors moved into STEM fields, but 35.9% of STEM majors moved to a non-STEM field (ibid).

Including these input and environmental variables (which I call student development controls) in my models, allows me to distinguish intersectional status effects that result from differences in students' academic preparation, expectations and experiences from intersectional status effects unmediated by these earlier educational effects. In several places, I specifically address the effects of these variables. In Chapter 4, I discuss how these input and environmental variables affect male and female students differently and, in Chapter 6, my analysis focuses on environmental effects – specifically how institutional contexts moderate intersectional status effect.

Institutional Effects

Most of the existing research on the effect of institutional type focuses on the selection process into schools and/or the experiences of students within particular types of institutions. For example, studies indicate that campus climate (experiences of prejudice and discrimination) is a leading cause of postsecondary withdrawal among minorities (e.g., Hurtado 1992, 1994; Hurtado, Carter, & Spuler 1996). Most studies, however, focus only on a single minority group and results are mixed when multiple groups are studied simultaneously (Arbona and Novy 1990). Moreover, perceptions of prejudice and discrimination had only indirect effects on minority students' decisions about whether to persist (Cabrera & Nora 1994). Cabrera et al. (1999) found that, among African Americans, perceptions of prejudice had a large indirect effect on persistence through institutional commitment. For underrepresented racial minority students majoring in the sciences, perceptions of a hostile racial climate and/or of a highly competitive environment are negatively correlated with their ability to adjust academically to campus in their first year (Hurtado et al. 2007). Departmental culture, including, "the expectations, assumptions, and values that guide the actions of professors, staff, and students" (AAUW 2010: 59), plays a particularly important role in retention of female students (Whitten et al. 2010). For example, physics departments that strove to reach out to younger students, sponsored social spaces and/or events for majors, and afforded higher levels of faculty-student interaction outside of the classroom (or lab) were most successful at retaining underrepresented populations (ibid). Beyond opportunities for interaction with faculty, the fact that women and minorities are underrepresented among faculty in the sciences and engineering, can prevent women and students of color from finding mentors to whom they can relate. The deficit of diverse role models increases with rank as women are concentrated in early tenure track positions, non-tenure track positions and lower-status institutions (NSF 2007; Nelson 2004). Women constitute 31.7% of all faculty members in the U.S., but women of color constitute less than 8% of all faculty and only 2% of full professors (NSF 2007).

Much of the existing research on institutional effects focuses on the particular mechanisms by which certain institutional types may directly or indirectly influence student retention in STEM fields. I expand this body of research, described below, to explore the significance of interactions between particular institutional contexts (as framed by institutional control, founding principles and institutional missions) and students' intersectional statuses. In other words, I seek to understand how institutional types provide contexts that are more or less beneficial for students from particular intersectional statuses.

Carnegie Classifications

The Carnegie Classification of Institutions of Higher Education, developed by the Carnegie Foundation for the Advancement of Teaching, is a system for categorizing postsecondary institutions in the U.S. for means of comparability. The classification system includes all accredited, degree-granting colleges and universities in the U.S. The basic classifications (revised in 2000) include: Doctorate-Granting Universities, Master's Colleges and Universities, Baccalaureate Colleges, Associates Colleges, Special Focus Institutions, and Tribal Colleges. For the purposes of my analysis, I distinguish the first of these from the rest. In other words, I look at differences between doctorate-granting universities (a category which includes three subgroups: Research Universities with very high research activity (RU/VH), Research Universities with high research activity (RU/H) and Doctoral/Research Universities (DRU)) and other types of institutions.

Current research suggests multiple possible effects with regard to the impact of Carnegie Classification on STEM majoring. On the one hand, many studies have found that STEM faculty at research institutions perceive teaching and research as competing priorities, with research the more valued institutional priority (Fairweather 1996; Massy, Wilger, & Colbeck 1994). Carnegie Doctorate institutions might have a negative impact on equity in STEM fields as quality of pedagogy is often cited as a reason for leaving STEM majors, with students complaining both about the availability of faculty members and the use of competitive grading systems that discourages student collaboration (Seymour 1995; Espinosa 2011). Thus, it would not be surprising that attending a more selective institution results in first-year underrepresented minority students majoring in science reporting lower levels of academic adjustment and less of a sense of belonging (Hurtado et al. 2007). On the other hand, the opportunity for undergraduates to participate in faculty research at doctorate-granting universities through part-time jobs as lab assistants, etc., should create a culture of wider interest in STEM fields. This is consistent with the finding that students are more likely to major in a STEM field if they attended a selective institution (Astin 1993). As such, STEM fields may be seen as more immediately lucrative fields of study and thus positively impact the majoring decisions of students from underrepresented populations (particularly those from lower class backgrounds who might be depending upon work-study funding or other part-time employment to support themselves financially).

Institutional Control: Public vs. Private

Beyond an institution's Carnegie classification, there are multiple common practices for categorizing institutions. Much research on the effects of institutional type on a wide range of postsecondary educational outcomes, but particularly on STEM majoring, has focused on institutional control and selectivity. Institutional control refers to whether a college or university is public or privately funded. Astin (1993) found that students attending a private college are more likely to major in the physical and social sciences, but those attending a public university are more likely to enter the biological sciences, health-related fields and engineering. Astin does not disaggregate this institutional effect by gender, race or class so we do not know if these findings hold true across population groups.

Land-Grant Institutions

Land-grant institutions are a particular type of public institution (with the exceptions of Cornell and MIT, both of which are private land-grant institutions) that derive their name from their founding and/or funding through the Morrill Land-Grant Acts of 1862 and 1890, which provided federal funds to states for the establishment and/or maintenance of one or more colleges devoted to higher-education focused on agriculture and the mechanic arts (Danforth 1957). Ideally, these schools established a uniquely American system of higher education: "open to all qualified young people from all walks of life…to serve less the perpetuation of an elite class and more the creation of a relatively classless society, with the doors of opportunity open to all through education" (Kerr 1963: 47). Yet, researchers have documented the amplification of gender inequalities through federal designation of funding to particular types of schools—including land-grant institutions—and historically sex-segregated programs of study, including scientific and technological fields (Wrigley 1992; Werum 2002). Like all public universities, land-grant institutions experienced large increases in enrollment in the mid-twentieth century (as a result of the GI Bill in 1944 and changes in Civil Rights and the women's movement during the 1960s and 1970s), but many land-grants, which had evolved into major research institutions, pushed to divert these new students into two-year and community colleges (Vandenberg-Daves 2003). So, on the one hand, land-grant institutions might yield more equitable rates of STEM majors given their educational mission related to postsecondary training in technological fields (many named "A&M" or "Tech") and the inclusion of previously excluded populations, but on the other hand, land-grant institutions might produce less equitable rates of STEM majors as formal structures of segregation (by race, gender, and class) have transformed into cultural forms of segregation. Interestingly, I am aware of no empirical research exploring the role of land-grant institutions in producing STEM majors; thus, my analysis provides critical insight as to the extent to which land-grant institutions have broadened their original mission both by incorporating women and by incorporating science, engineering and technology fields into their traditional training of farmers, miners and mechanics.

Historically Black Colleges and Universities

Finally, institutions whose missions specify target populations appear successful at increasing STEM majors among those populations, as we will see. Numerous studies have documented the success of women's colleges in producing a disproportionate number of female medical students and scientists (Tidball 1985, 1986). Unfortunately the BPS data does not contain enough enrollees at women's colleges to permit such an analysis. As such, I focus on the roles of historically black colleges and universities (HBCUs) and Hispanic-serving institutions (HSIs) in undergraduate STEM education.

HBCUs have played a dramatic role in the education of blacks in the United States. While the earliest HBCUs date to before the Civil War, the decade after the passage of the second Morrill Act in 1890 saw the creation of numerous public HBCUs.

In the South, these primarily focused on vocational and technical training (Werum 2002; Werum 2001) as well as the preparation of black teachers to teach in segregated public schools in the south (Fryer and Greenstone 2010). As late as 1960, more than half of African American students obtaining postsecondary education did so at HBCUs (Carter 2002). HBCUs have seen a drastic transformation in their enrollment during the past fifty years, however; today, only 20% of African American enrollment in 4-year colleges and universities is at HBCUs (Fryer and Greenstone 2010).

Empirical findings are inconclusive about the benefit to black students of attending an HBCU. Numerous studies have found that exposure to cultural intolerance and discrimination in the classroom and on campus decrease student persistence rates regardless of race (Fleming 1984; Cabrera et al. 1999). One potential advantage to attending an HBCU then is avoiding the higher levels of sociocultural alienation faced by students of color at predominantly white institutions (Loo and Rolison 1986). Academic outcomes may also be positively influenced by HBCU attendance. For example, graduation rates for black students are higher at HBCUs than for black students at predominantly white institutions (Bennett and Xie 2003). On the other hand, recent research has questioned the continued advantage of attending an HBCU for black students. Lee (2010) theorizes that whereas attendance at an HBCU historically provided blacks with social capital that they could not attain at predominantly white institutions, changing race relations have transformed the relative opportunities available at HBCUs. With increasing levels of interaction between minority and white students at predominantly white institutions, black students may actually limit their opportunities for developing social capital by attending HBCUs, which in turn limits the resources upon which they can draw for educational attainment. Likewise, Fryer and Greenstone (2010) demonstrate a significant decrease in returns (economic and academic) to HBCU students between the 1970s and the 1990s.

The research on STEM majoring at HBCUs suggests that HBCUs produce a disproportionate number of African American STEM majors. For example, more than one-half of all African American physics degree holders, female and male at all levels, graduate from HBCUs (Whitten et al. 2004). In particular, HBCUs seem to provide an advantage to black women majoring in physical sciences (Whitten et al. 2004; Fryer and Greenstone 2010). HBCUs also seem to do better at inspiring students to attend graduate school and have higher rates of African American graduates—both male and female—who choose a graduate major in science than among African Americans attending traditionally white institutions (Wenglinsky 1999). Moreover, Chang et al. (2008) report that HBCUs have a unique retention pattern in STEM majors for underrepresented minority students. Specifically, at HBCUs persistence of underrepresented minority students in STEM majors increases with institutional selectivity whereas at Hispanic-serving institutions and predominantly white institutions, persistence of underrepresented minority students in STEM majors decreases as institutional selectivity increases. While strongly suggesting that HBCUs may play an important role in the creation of black scientists, most of the existing research relies on student data that is more than a decade old (and in some cases over three decades old). I attempt to ascertain whether these patterns persist among students who began their post-secondary education in 2004 or whether the above-described changes in advantages accruing to students at HBCUs have also shifted with regard to STEM majors.

Hispanic Serving Institutions

Defined by the 1998 reauthorization of the Higher Education Act (HEA), Hispanic-serving institutions (HSIs) are accredited, degree-granting institutions that have at least 25% full-time equivalent (FTE) enrollment of undergraduate Latina/o students (Laden 2004). HSIs differ significantly from HBCUs. First, the 25% cut-off mandates that HSIs are generally more racially integrated than either HBCUs or predominantly white institutions (PWIs). Second, unlike HBCUs, which have typically had historical roots in and ties to the target community, HSIs are defined according to current student enrollments and may or may not have any formal allegiance to the Latino community. Currently, HSIs represent a small percentage of all colleges and universities—six percent of all higher education institutions in 2003-2004—but they enroll nearly 50% of all Latina/o undergraduate students (and this rate has not seen a decline comparable to the rates of African American enrollments at HBCUs), making it critical to assess the impact of these types of institutions (Santiago 2006).

HSIs appear to be an important point of access for Hispanic students in STEM fields (NCES 2002). In 2005-2006, HSIs awarded nearly 40% of all bachelor's degrees to Latina/o students, and granted 30% of all STEM degrees to Latina/o undergraduates (Dowd, Malcolm, & Bensimon, 2009). Crisp, Nora and Taggart (2009) find that the odds of declaring a STEM major at an HSI were 1.37 times as large for Hispanics as for whites. I attempt to determine whether and how intersectional statuses influence this HSI advantage in STEM. For example, I ask whether this STEM advantage accrues equally to both Latinos and Latinas and whether class plays a role in this effect.

Institutional Interactions

A limited number of studies have sought to understand how institutional types may affect student populations differently. For the most part, these studies focus on educational outcomes other than STEM majoring. Thus, we know that attending a private college increases prompt and subsequent graduation rates for males, but not females, and appears to have a stronger effect for black males than white males (Thomas 1981) and that black graduates from selective colleges attend graduate and/or professional schools at higher rates than their white peers (Bowen and Bok 1998). Similarly, Smart and Pascarella (1986) successfully analyzed differences in the effect of institutional type for white men, white women, minority men, and minority women, but their outcome of interest was salary level a decade after completion of a bachelor's degree. They found that attending a private institution had significant positive effects on salary, but for white males only. Thus institutional context can differentially impact students depending on their race and gender.

Only a few studies have sought to document the effects of institutional type on STEM majoring among particular racial/ethnic, gender, or class groups. Many of these have focused on women, black and Hispanic students attending women's colleges, HBCUs and HSIs. More recent research suggests that women who attend a private institution (versus a public institution) are more likely to persist in STEM majors and that attending a highly selective institution particularly decreases rates of STEM majoring among women of color (Espinosa 2011). I seek to broaden the scope of such analyses by asking: how might institutional contexts also play a role in STEM majoring for whites and Asians, among men and women, and for students from various class backgrounds?

Chapter 3:
Data and Methods

This dissertation attempts to unravel two complex puzzles related to persisting inequality in U.S. higher education. First, empirical research suggests that, although women have closed the gap with regard to vertical inequality in higher education, horizontal measures like field of study and institutional prestige reveal ongoing gender inequality. Race and class have also been shown to influence inequality in STEM majoring. Feminist theory would suggest that these effects are not separate, but that individuals' experiences of gender, race and class are intersectional. Thus, my research analyzes intersectional status effects on students' majoring in STEM fields. My analysis reveals patterns of status competition not simply between women and men, but also *among* men and *among* women. Second, I explore how postsecondary institutional context might mitigate, maintain or exacerbate these intersectional status effects. I focus on differences in effects *within* particular institutional types and variations in effects *between* institutional contexts. Analyzing these questions using national survey data allows me to examine how students from different intersectional status groups are faring as well as how institutional context influences the outcomes of these status competition processes.

Data

Construction of the Dataset

I employ the Beginning Postsecondary Students Longitudinal Study (BPS:09) conducted by the National Center for Educational Statistics (NCES). The dataset is a nationally representative dataset following students from the National Postsecondary

Student Aid Survey (NPSAS), who were first-time post-secondary enrollees in 2003-04. BPS surveys these students again in 2006 and 2009. The dataset contains a wide range of information from student interviews, institutional surveys, financial aid records and enrollment data focusing on student demographics, persistence and completion, post-graduate employment, attitudes and goals, income and debt, and a variety of other factors. All of my student-level variables come from BPS:09.

Although the BPS contains information on all of the institutions that students attended over the six-year period, indicators of institutional type (e.g., a variable indicating whether an institution is under public or private control) are associated primarily with a student's institution of enrollment at the time of the NPSAS survey (i.e., during their freshman year – 2003-04). Using students' NPSAS institution to address the effects of institutional context on STEM majoring is not ideal because it assumes that this institution had the most impact on a student's educational outcome. Alternatively, selecting among multiple institutions attended by a student in order to analyze the effects of institutional context poses several problems. On one hand, merely selecting the first institution attended (the NPSAS institution) would be problematic because it would assign a number of students to institutions from which they dropped out or transferred early in their postsecondary careers (while ignoring the rest of their educational trajectory). On the other hand, selecting the last institution attended would be no more reliable because, it would assign students who completed a bachelor's degree prior to 2009 and then attended graduate school to their graduate institution, not their undergraduate institution. This strategy results in similar problems for students who enrolled in a summer class at a community college, etc. To avoid these issues, I decided to use the institution that students indicated as their "primary institution" during their 2009 interview.

Primary institutions were identified in the BPS data as follows:

- If a respondent attended only one institution between 2006-2009, that school is their primary institution;
- If a respondent received a bachelor's degree from one school, then that school is their primary institution;
- If a respondent received multiple bachelor's degrees, then the school at which they earned their earliest bachelor's degree is their primary institution;
- If a respondent only enrolled for bachelor's degree at one institution, then that institution is their primary institution;
- If a respondent enrolled for bachelor's degrees at multiple institutions, then the most recent institution of enrollment is their primary institution.

For cases where the above criteria did not clearly identify a primary institution, students were asked which institution was their primary institution (see BPS variable PRIMSCH). Use of this primary institution designation in my analysis of institutional context will reduce noise in the data and allow me to focus more specifically on the institutions most relevant to students' bachelor's degree experience (whether they have completed it by 2009 or are continuing to work toward it).

Because BPS provides the IPEDS ID for each school that a student attended (including his/her primary institution), I was able to merge the student-level records from BPS with IPEDS data (containing institutional type indicators) in order to gain a more complete set of institutional type indicators for students' primary institution.[1] I use this merged data in Chapter 6.

Subsampling

I have limited my sample to those students who, in 2009, either had earned or were still working toward a 4-year degree and who indicated a major field of study[2]. I further excluded students who self-identified as multi-racial or of an "other" race (N=330). While future studies should focus on the academic trajectories of these students, my focus on patterns of inequality by intersectional status requires a substantial number of students in each of the status groups that I analyze. Not only were these groups of students too small, but the diversity of their status identities would forestall the identification of status group patterns. As such, my unweighted sample size is N=7,200 (rounded). As discussed shortly, my analysis employs weights and subsampling procedures to reduce bias in standard error estimates.

Variables

Dependent Variables

In Chapters 4, I analyze at how students' intersectional statuses influence their chances of majoring in a STEM field, and in Chapter 6, I explore how institutional contexts moderate these intersectional status effects. My dependent variable for these

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[1] Lack of availability of an indicator for Hispanic Serving Institutions (HSIs) in the 2009 IPEDS data forced me to use the BPS:09 indicator for HSIs. As a result, there was slightly more missing data in the HSI records than in the records for the other four institutional types.
[2] Among students who had earned or were still working toward a 4-year degree in 2009, very few had not indicated a major field of study (N=110 or 1.4%). Descriptive statistics suggest that the cases are missing at random and can thus be dropped.

chapters consists of a dichotomous measure of whether a student majored in a STEM field. The National Science Foundation (NSF) and the National Center for Educational Statistics (NCES) disagree about which disciplines should be considered STEM. While the NSF includes social science fields like sociology, economics, and political science, which tend to be statistics-oriented, the NCES defines STEM more narrowly as including only physical and biological sciences. For the purposes of this analysis, I have chosen to utilize NCES' criteria, defining STEM fields as not including the social sciences for two reasons. First, I am interested in who majors in STEM fields because of the various career opportunities and benefits associated with STEM occupations (e.g., lower rates of unemployment, reduced gender gaps in pay, etc.). These benefits accrue disproportionately to students who enter occupations associated with NCES' narrower definition of STEM majors (i.e., *not* social sciences). Second, because my data comes from the Beginning Post-secondary Students Longitudinal Study (BPS) compiled by NCES, using NCES' definition will maintain consistency between my results and NCES reports.

BPS asks students to identify their first and second (if applicable) majors out of a list of thirty-three possible majors. NCES then collapses these thirty-three categories into a twelve-category designation for student major (MAJ09B and MAJS09B). I use these twelve-category indicators to code for whether or not a student is majoring in a STEM field. STEM fields include those majors collapsed into the following categories: life sciences, physical sciences, mathematics, computer/information sciences, and engineering. Non-STEM fields include: humanities, social/behavioral sciences, education, business/management, health, vocational/technical, other technical/professional and undeclared. If either a student's first or second major was in a STEM field, they are considered a STEM major for the purposes of this analysis, as their degree will provide them with the opportunities for advancement described above. My analysis uses the majors provided by students in 2009 (i.e., in their sixth year) by which time less than three percent of students still indicated that their major was "undeclared" and were thus included as non-STEM majors. Students who had completed a bachelor's degree prior to 2009 reported the major(s) in which they had earned the bachelor's degree.

In Chapter 5, I explore differences between STEM majors – again looking at differences in intersectional status effects. In this chapter, I employ two separate dependent variables. The first is a dichotomous measure of whether a student majored in a life science field (coded from MAJ09B and MAJS09B, as described above). The second is a dichotomous measure of whether a student majored in a STEM field that was math-intensive. These majors, which I collectively call "math sciences," include physical sciences, mathematics, engineering and computer sciences. I explain the theoretical justification for this distinction more thoroughly in Chapter 5.

Independent Variables: Student Status Characteristics

My analysis focuses on two groups of independent variables: individual-level social background characteristics and institutional types. See Table 3.1 for summary statistics of the variables included in my analysis. Social background characteristic variables of interest include: gender, race, income and parents' education level. Gender is a simple categorical variable (from the BPS variable GENDER) coded as either male or female. Similarly, I have constructed four mutually exclusive dummy variables for race (black, white, Asian, and Hispanic) from the BPS variable RACE. Although Hispanic is technically an ethnicity, I include it in my analysis as a racial category because the experiences of Hispanic students within the U.S. higher education system often vary significantly from those of their "racial" peers – be they white or black. The Asian category necessarily includes both Pacific Islanders and Native Hawaiians (for purposes of sample size) although substantial variation in STEM patterns *among* Asians have been recorded (Song and Glick 2008).

I also include two measures of students' class status: family income and parental education level. I use income to assess the impact of economic capital on STEM majoring while I use parental education to capture effects of social and cultural capital associated with both college and the college-educated labor market. Income is the natural log of the student's reported family income, CINCOME, by dependency status.[3] For dependent students, this is essentially their parents' income. For independent students, it is the student's own income and the income of his/her spouse (if applicable). I measure parental education in two ways, depending on the model and sample size; both of my measures come from the BPS variable PAREDUC. Some of the time, I use three categories for parents' education: neither parent has attended college (parentNoColl), at least one parent has attended at least some college (parentColl), and at least one parent has earned a graduate degree (parentGradDeg) – with neither parent has attended college

[3] Dependency status was recorded for academic year 2003-04 from students' Federal Application for Student Financial Aid (FASFA). Students who had not filed a FASFA were asked to indicate whether they were financially dependent upon their parents or financially independent in their NPSAS:04 interview.

as the excluded category. At other times, I use a simple dichotomous variable indicating whether or not a student has a parent who has earned a bachelor's degree (parentBach). In Chapters 5 and 6, where most of the models include 3-way interactions or focus on a smaller subsample, this measure helps to ensure sufficient cell size for analysis. Tables 3.2 and 3.3 show the distribution of family income by parental education.

Table 3.1. Summary Statistics: Weighted Averages, Standard Errors and Descriptions

	mean	se	min	max	missInfo	Description
STEM Major	0.210	(.008)	0	1	0%	Dummy. 1=STEM Major.
Math Science Major	0.122	(.007)	0	1	0%	Dummy. 1=Math Sciences Major.
Life Science Major	0.089	(.005)	0	1	0%	Dummy. 1=Life Sciences Major.
Female	0.567	(.009)	0	1	0%	Dummy. 1=Female.
White	0.715	(.014)	0	1	0%	Dummies. Reference category is White.
Black	0.101	(.009)	0	1		
Hispanic	0.112	(.009)	0	1		
Asian	0.073	(.006)	0	1		
parentNoCollege	0.249	(.009)	0	1	1%	Dummies. Reference category is parentNoCollege.
parentCollege	0.473	(.008)	0	1		
parentGradDeg	0.278	(.008)	0	1		
parentBach	0.560	(.010)	0	1	1%	Dummy. 1=Parent has a Bachelor's Degree.
Income	72,213	(1119)	0	509,000	0%	Continuous. Reported family income (logged in analysis).
Degree Expectations	0.731	(.009)	0	1	0%	Dummy. 1=Expects to later earn a grad/prof degree (reported in 2003-04).
Math SAT	517	(3.026)	200	800	9%	Continuous. Reported by College Boards or converted from ACT score.
Employed - 1st year	0.124	(.008)	0	1	0%	Dummy. 1=Worked fulltime (including work study) during freshman year.
Transferred Schools	0.369	(.016)	0	1	0%	Dummy. 1=Transferred between institutions by 2009.
Changed Majors	0.344	(.009)	0	1	2%	Dummy. 1=Changed majors by 2009.
Academic Integration	83	(.952)	0	200	1%	Continuous. Derived from average of how often a student: participated in study groups, had social contact with faculty, met with an academic advisor, or talked with faculty about academic matters outside of class. Values averaged and multiplied by 100.
Not a U.S. Citizen	0.061	(.006)	0	1	0%	Dummy. 1=Not a U.S. Citizen
Carnegie Doctorate	0.420	(.016)	0	1	2%	Dummy. 1=Primary Institution is a Carnegie Doctorate institution.
Public	0.669	(.016)	0	1	1%	Dummy. 1=Primary Institution is a public college or university.
Land Grant	0.135	(.011)	0	1	1%	Dummy. 1=Primary Institution is a Land Grant institution.
HBCU	0.021	(.006)	0	1	1%	Dummy. 1=Primary Institution is a Historically Black College or University.
HBCU (Blacks only)	0.177	(.047)				
HSI	0.077	(.009)	0	1	14%	Dummy. 1=Primary Institution is a Hispanic-Serving institution.
HSI (Hispanics only)	0.379	(.042)				

TABLE 3.2: Crosstabulation: Income and Parental Education.
Based on Weighted BPS:04/09 Subsample.

	parentNoColl	parentColl	parentGradDeg	Total
Less than $25,000	8.4%	6.9%	1.9%	17.3%
$25,000-$100,000	14.8%	29.9%	14.6%	59.4%
More than $100,000	1.6%	10.3%	11.4%	23.3%
Total	24.8%	47.2%	27.9%	100.0%

TABLE 3.3: Crosstabulation: Income and Parental Education.
Based on Weighted BPS:04/09 Subsample.

	parentNoDeg	parentBach	Total
Less than $25,000	12.3%	5.0%	17.3%
$25,000-$100,000	27.5%	31.9%	59.4%
More than $100,000	4.1%	19.2%	23.3%
Total	43.9%	56.1%	100.0%

Independent Variables: Institutional Context

In addition to my focus on individual-level social background characteristics as independent variables in Chapters 4 and 5, Chapter 6 includes independent variables addressing institutional context. To address effects of institutional context on the patterns of intersectional status inequality prevalent in STEM fields, I focus on the five types of institutions discussed in Chapter 2: Carnegie Doctorate institutions, public colleges and universities, land-grant institutions, historically black colleges and universities (HBCUs) and Hispanic-serving institutions (HSIs). My analysis occurs at the individual level of analysis, focusing on each student's primary institution. As such, institutional measures are all dichotomous variables, but are not mutually exclusive (i.e., a student's primary institution may be *both* a public institution and an HBCU). I created my institutional type indicators from the following IPEDS variables: carnegie (for Carnegie Doctorate), control (for public), landgrnt (for land-grant) and HBCU (for HBCUs). As noted above, the HSI dummy comes from the BPS data (OCRHSI).

Control Variables

Numerous other factors have been identified through the literature on student development theory as influencing educational outcomes including: educational aspirations (Dumais 2002; Anderson 1981; MacLeod 2009), academic ability and/or preparation (Velez 1985; Anderson 1981), employment (Leppel 2001; Anderson 1981) and integration (Tierney 1999). I include a number of these factors in my analysis as controls. They fall primarily into two categories: those controlling for students' educational experiences and expectations prior to post-secondary matriculation and those controlling for students' experiences at the time of matriculation and during college. As noted in Chapter 2, this closely follows Astin's (1993) I-E-O Model in that it attempts to explain outputs (i.e., STEM majors) in terms of students' inputs (pre-college) and experiences (at college).

Degree Expectations measures whether, during his/her first year in college, a student expected to go on to earn a graduate or professional degree at some point. This dichotomous variable was constructed from the BPS variable HIGHLVEX, recorded in 2003-04. This variable measures students' educational aspirations and expectations.

Math SAT measures each student's score on the math portion of the Scholastic Aptitude Test (SAT) as reported by the College Board (TESATMDE). For students who did not take the SAT, but took the ACT, BPS includes a conversion score. Scores are reported as continuous variables ranging from 200-800. This variable measures students' academic aptitude or preparation for entering a STEM field.

Employed - 1st Year measures whether or not a student was employed full-time during his/her first year of college (calculated from the BPS variable JOBENR2). Here, employment includes work-study programs, and full-time is indicated by thirty-five or more hours per week. This dichotomous variable assesses the impact of balancing work and school (in terms of time commitments, resource availability, outside responsibilities and/or potential stigma).

Transfer indicates whether or not a student transferred his/her enrollment between institutions between 2003-2009. Transferring can impact choice of major because the school into which a student transfers may or may not accept course credit from the prior institution, potentially leaving students without certain prerequisites. STEM majors, in particular, tend to have more prerequisites and follow a more structured course sequence than non-STEM majors. Transfer is a dichotomous indicator calculated from the BPS variable TFNUM6Y.

Changed Majors is a dichotomous variable (calculated from the BPS variable MAJ09CHG) indicating whether or not a student changed majors between 2003-2009. Changing majors can set students back with regard to required courses. Moreover, the stricter course sequences prevalent in STEM majors often make changing into STEM majors more difficult than changing out of them (which has traditionally been a common pattern encouraged through the use of "weeding out" courses early in the major sequence). This variable also reveals whether students are primarily moving into, between, or out of STEM majors (whether the effect of changing majors is positive, not significant, or negative, respectively).

Academic Integration (BPS variable ACAINX04) is an index variable constructed from the average of how often a student participated in study groups, had social contact with faculty members, met with an academic advisor, or talked with faculty about academic matters outside of class. Student response values for their first year (2003-04) were averaged and multiplied by 100. The index ranges from 0 to 200.

Not a U.S. Citizen (from the BPS variable CITIZEN2) is a dichotomous variable indicating a student's citizenship status. I include this variable to avoid the identification of misleading racial effects on STEM majoring, particularly among Asians and Hispanics, that are actually attributable to a student's status as a resident alien or as a foreign/international student.

Earlier models included a variety of other student development measures, including high school GPA, whether college credit was earned in high school, type of high school attended, age at the time of matriculation, whether students have children or other dependents, attending an *in-state* vs. out-of-state institution, living on- vs. off-campus, first year college GPA and several measures of social integration at college. These controls were not included in my final models either because they were too highly correlated with the variables I included (e.g., high school GPA and Math SAT) or because they remained insignificant predictors of STEM across models.

While the included student development variables are not the focus of my analysis, they have been found to play a role in STEM majoring (as described in Chapter 2) and so are included as important predictors in regression analyses. I discuss gendered patterns of significance among these control variables in Chapter 4 and highlight changes in these patterns, when relevant, in the other chapters.

Missing Values

Although few of the variables in my final dataset contained missing values (see Table 3.1), I used multiple imputation with chained equations (MICE) to preserve cases that otherwise would have been eliminated because of missing values (Acock 2005; Royston 2004). I employed the MICE package in R (van Buuren and Groothuis-Oudshoorn 2011) to create five imputed datasets; model estimates are aggregated from these datasets using the 'MIcombine' command in the 'survey' package (Lumley 2011).

Methods of Analysis

Weighted Logistic Regression Models

Because all of my dependent variables (STEM, Math Sciences and Life Sciences) are dichotomous, I conduct multivariate analyses using weighted logistic regression. In the sections below, I describe my regression models for each of the three chapters of analyses and then describe in more detail the particulars of the weights and subsampling procedures that I employed.

In Chapter 4, I assess the effects of intersectional statuses (race, class, and gender) on majoring in a STEM field. The baseline models in this analysis include only the variables for gender, race and class as described above. This baseline model reveals essential levels of inequality between various status groups – regardless of other mediating factors. In other words, the baseline model demonstrates the actual representativeness of students in STEM fields by gender, race and class. In the second model, I add seven variables identified in the literature on student development theory as influencing educational outcomes across gender, racial and class lines: degree expectations, Math SAT, employment, transfers, changes in major, academic integration and citizenship. The inclusion of these controls effectively allows us to distinguish effects attributable to intersectional statuses from those attributable to academic preparation and experiences (that may or may not be related to status group membership). For example, models with controls assess the effect of race between students who have similar academic expectations and preparation and who have shared similar college experiences. As such, my results provide a conservative estimate of the true effects of gender, race and class as they hold constant student development effects that may previously have been influenced by a student's gender, race or class. Thus, the full model (including background statuses and controls, but not intersectional effects) is:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \ldots + \beta_{11} X_{11} + \varepsilon$$

Where:

Y = STEM Major

Student Status Characteristics:
X_1= Female
X_{2a}= Black; X_{2b}= Hispanic; X_{2c}= Asian (White as reference category)
X_{3a}= parentGradDeg; X_{3b}= parentCollege (parentNoCollege as reference category)
X_4= lnIncome

Student Development Controls:
X_5= Degree Expectations
X_6= Math SAT
X_7= Employed – 1st Year
X_8= Transferred Schools
X_9= Changed Majors
X_{10}= Academic Integration
X_{11}= Not a U.S. Citizen

The rest of the models in Chapter 4 assess the effects of a variety of intersectional statuses, tested through the inclusion of interaction terms. Although I test for all possible intersectional status effects (two-way interactions between race and income, gender and income, race and parental education, gender and parental education, race and gender;

three-way interactions between race, gender and income, and race, gender and parental education) I present regression results only for those models with significant intersectional status effects. Lastly, to compare most effectively intersectional differences between male and female students, I perform separate regression analyses for these two groups. Between-group significance tests for social background factors are based on pooled analyses with interaction terms (following Cheng, Martin and Werum 2007). This technique provides an advantage over running t-tests between models as it allows me to estimate significant differences *among* men and *among* women, as well as between men and women. Thus, I have multiple reference groups – comparing women to white, middle-class women and comparing men to white, middle-class men (as the dominant groups).

In Chapter 5, I replicate the analyses of Chapter 4 looking first at math science majors, then at life science majors (for both sets of analyses, the reference group is non-STEM majors). The third set of analyses in Chapter 5 compares math science majors to life science majors. In other words, filtering my sample to include only STEM majors, I explore the factors that make students more likely to major in one or the other of these categories. In this chapter, due to the precision of the dependent variable, I only examine two-way interactions; all other variables remain the same. In each of the three sections, I also include a table with split-gender models to estimate effects *among* men and *among* women, as well as where these effects differ.

In Chapter 6, I return to the more general measure of majoring in any STEM field as my dependent variable. Here, I focus on five institutional contexts: Carnegie Doctorate institutions, public colleges and universities, land-grant institutions, historically black colleges and universities (HBCUs) and Hispanic-serving institutions (HSIs).

For each of the five sections, I conduct two sets of analyses. I first analyze effects of intersectional statuses on STEM majoring *within* the institutional type. Specifically, I run the same models described above (the baseline, the full control model and the interaction effects models) filtering my sample to only students enrolled one type of institution (e.g., Carnegie Doctorate institutions). Thus, the first regression table in each of the five sections describes which groups of students are most successful in the competition for STEM majors at that particular type of postsecondary institution (i.e., how are Hispanic women doing in comparison to white women?).

After describing inequalities *within* each institutional type, I turn to status competition processes *between* types of institutions (examining institutions as moderators of social inequality around STEM majoring). Here, I have selected my sample filters to include only relevant comparison groups. In the first two analyses, I use my full sample from Chapter 4 (unweighted N=7200). Thus, I compare students attending Carnegie Doctorate institutions to students *not* attending Carnegie Doctorate institutions and students attending public colleges and universities to students attending private colleges and universities. In the third analysis, which focuses on land-grant institutions, I include only students at public schools (as land-grant schools are public, with two exceptions) comparing those attending public land-grant institutions[4] to public institutions that are not land-grant institutions. The fourth and fifth sections of Chapter 6 focus on HBCUs and

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[4] In my between institution models for land-grant institutions, I exclude the two private land-grant universities, Cornell University and the Massachusetts Institute of Technology, from my analysis.

HSIs. For these sections, I focus on the target population of the institution. So, for HBCUs, my analysis is limited to black students – comparing black students who attend HBCUs to black students who attend traditionally white institutions. Likewise, for HSIs, I limit my analyses to Hispanic students – comparing Hispanic students who attend HSIs to Hispanic students who attend other institutions.

My second set of analyses for each of these five institutional contexts begins with a full control model with the addition of the institutional type dummy – revealing direct effects of attending this type of institution. The rest of the models incorporate interaction terms to identify significant intersectional status effects. Here, the interaction terms are not simply between race, class and gender, but include the institutional type itself. In sum, these terms show how being in a particular institutional context moderates the effect of race, class, gender or some combination thereof. Again, I present only models in which I found significant effects, and when significant, I present tables with split-gender models to highlight variation in status competition processes *among* men and *among* women, as well as between.

In each of the Chapters (4-6), I further detail the specifics of the data and methods used. For all of my analyses, I have chosen to present significant results at the $p<.10$ level as well as the $p<.05$, $p<.01$, and $p<.001$ levels. While statisticians and academic writers may consider $p<.10$ only marginally significant, failure to report an effect that occurs in 90% of samples seems a disservice to administrators and policy-makers, who are frequently asked to solve complicated issues of inequity without substantial empirical information about subgroup patterns. I trust that my readers will decide for themselves what constitutes a significant finding.

Survey Weights, Sampling Weights and Subsampling Procedures

The very design of complex surveys often leads to statistical pitfalls in analysis and thus faulty conclusions (Hahs-Vaughn 2006; West 2008). When survey design is not incorporated into the analysis, conclusions are not reliable because: (1) individuals have unequal probability of being selected into the sample (due to over-sampling of certain populations) unlike random sampling, and (2) individuals are not completely independent due to selection within clusters (multi-stage sampling wherein individuals are sampled *within* institutions). Both of these are true for the BPS data (NCES 2011c). Use of sampling and survey weights correct for unequal probability of being sampled (due to both over-sampling and multi-stage design) and non-response rates.[5]

My analysis employs both sampling weights (WTA000) and design weights (BPS09PSU) to estimate standard errors. In order to accommodate the complex survey design of the BPS:09, I create sub-population analysis procedures to ensure the accuracy of estimated standard errors using the 'survey' package in R (Lumley 2011).[6]

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[5] Although debate persists about the use of weights in OLS regression analyses (c.f. Winship and Radbill 1994; Korn and Graubard 1995), unweighted logistic regression analyses of the models presented here yielded substantially different coefficients and standard errors. I follow the procedures for analysis suggested in the methodological documentation for the BPS:04/09 dataset (NCES 2011c).

[6] In multi-stage sample designs, variance in sample statistics between primary sampling units (PSUs) in any cluster is very important because the estimated variance (and thus standard error) of a survey statistic is based on such within-group variance. Thus, clusters must contain multiple cases in order to calculate non-zero variance estimates. Unfortunately, the BPS:09 data contain a relatively large number of schools in which a single student was sampled (called singleton PSUs), which results in errors when I employ Taylor series linearization to estimate standard errors with the design weight (BPS09STR). I thus employ only the BPS09PSU weight. Dropping the strata weight (while employing the PSU weight) is a common, if not ideal, method of dealing with this problem, which does not affect the estimation of regression coefficients and only slightly increases standard error estimates (UCLA 2012). As such, my results provide a conservative estimate of effects.

Unfortunately, the use of multiple-imputation procedures with the various weights and subsampling procedures necessary to ensure accurate standard error estimates leads to complications in traditional methods of assessing model fit. I return to this issue as it arises in future sections.

Finally, although my analyses include students and institutions, I do not employ hierarchical linear modeling for several reasons. First, I am not using institutional-level factors in the analysis. In fact, I do not address institutions at all in Chapters 4 or 5, and in Chapter 6, I am just indicating the type of institution that a student attended to compare between groups (using interaction terms). My focus is on how intersectional status effects differ within and between types of postsecondary institutions. Second, as mentioned above, the BPS:09 contains a high number of schools in which only a single student was surveyed. Most scholars agree that HLM requires at a very minimum two students per school (and ideally more), so if I used HLM, I would have to either combine groups or drop these students from my analysis. Thus, a single-level *weighted* logistic regression best enables me to answer my particular research questions and to estimate reliable effects and standard errors for my population of interest.

Chapter 4:
Intersectional Status Effects on STEM Majoring

In this chapter, I assess the impact of intersectional statuses on horizontal inequality, specifically looking at who majors in STEM fields. In doing so, I provide valuable insights about the application of status competition theory to postsecondary education. First, I expand the traditional class-based model of status competition theory to include status competition processes between genders and racial groups, as well as class groups. This analysis also clarifies confusion in the literature about how class background influences STEM majoring by separately modeling the effects of cultural and human capital assets (like parents' education) and of economic assets (family income). Second, I provide a broad overview of the scope of intersectional status effects on STEM majoring, which will encourage future researchers both to apply an intersectional framework to studies of horizontal equity and will serve as a baseline for the more in-depth analyses that follow in Chapters 5 and 6. Third, I paint a clearer picture of the complexities of status competition processes. Too often, educational inequality is portrayed as a one-dimensional problem wherein a particular population group is "behind" without articulating the complex relationships between the diverse social groups within the educational environment. Here, although my results immediately confirm the persistence and preeminence of gender inequality with regard to STEM majoring, they also highlight the fact that *among* men and *among* women, race and class have different effects that should be considered in the creation and implementation of policy.

A basic cross-tabulation of the Beginning Postsecondary Students data (BPS:04/09) suggests significant variation between students based on intersectional status (see Table 4.1). Here, I provide percentages for men's and women's STEM majoring by race and class (by parental education and by various income levels). This table illustrates the variance among men and women, as well as among races and social classes, and highlights the potential importance of the intersectional perspective.

TABLE 4.1: Percentage of Students Majoring in STEM by Intersectional Status.
Based on Weighted BPS:04/09 Subsample.

			% STEM				% STEM
MEN	WHITE	< $25K	28.9%	WOMEN	WHITE	< $25K	10.2%
		$25-100K	28.4%			$25-100K	14.2%
		> $100K	28.5%			> $100K	15.5%
	BLACK	< $25K	23.5%		BLACK	< $25K	10.9%
		$25-100K	30.3%			$25-100K	13.2%
		> $100K	9.9%			> $100K	11.9%
	HISPANIC	< $25K	32.7%		HISPANIC	< $25K	7.5%
		$25-100K	24.8%			$25-100K	13.9%
		> $100K	29.7%			> $100K	22.6%
	ASIAN	< $25K	71.2%		ASIAN	< $25K	20.0%
		$25-100K	35.8%			$25-100K	26.6%
		> $100K	41.0%			> $100K	28.1%
MEN	WHITE	parentNoColl	27.0%	WOMEN	WHITE	parentNoColl	10.4%
		parentColl	27.0%			parentColl	12.7%
		parentGradDeg	31.4%			parentGradDeg	18.8%
	BLACK	parentNoColl	26.6%		BLACK	parentNoColl	9.5%
		parentColl	25.9%			parentColl	12.9%
		parentGradDeg	21.6%			parentGradDeg	16.1%
	HISPANIC	parentNoColl	30.0%		HISPANIC	parentNoColl	8.4%
		parentColl	27.4%			parentColl	13.5%
		parentGradDeg	27.1%			parentGradDeg	21.8%
	ASIAN	parentNoColl	51.9%		ASIAN	parentNoColl	13.5%
		parentColl	32.9%			parentColl	30.7%
		parentGradDeg	59.1%			parentGradDeg	32.0%

Overall, 21.0% of students major in STEM fields, but this rate is not reflective of either men's or women's rates of STEM majoring (which are 29.7% and 14.3% respectively). Specifically, Table 4.1 highlights a general pattern of difference between male and female rates of STEM majoring by race, income, and parental education level. Yet, the rates do overlap with a range for men of 9.9 - 59.1% and for women of 7.5 - 32.0%. Some of the patterns described in previous research are clear. For example, rates for Asian students do tend to be higher than their same-gender peers. The addition of class measures (both income and parental education) complicates the picture, however. Rates of STEM majoring among Asians are not unilateral across classes. More generally, we see that having more educated parents and coming from a family with a higher income level benefit women regardless of race. Among men, the effects of class vary. Higher levels of parental education appear to positively influence white and Asian men, but negatively influence black and Hispanic men. Similarly, family income negatively influences STEM majors among Asian and Hispanic men such that those from lower income families are more likely to major in STEM fields. Among white men, income appears to make no difference and among black men, it is those from middle-income families ($25,000-100,000) that most often major in STEM fields.

Moreover, these crosstabs demonstrate the inaccuracy of treating race or gender or even class alone as a summary variable. For example, previous studies have claimed that blacks are less likely to major in a STEM field than their white peers, but Table 4.1 demonstrates the incredible variation *among* black men, with those from the middle income group majoring in STEM fields at rates seemingly comparable to their white male peers while those from families making over $100,000 are the least likely group of men to major in a STEM field. Similar class disparities can be seen among Hispanic women. Because these are raw percentages, they reveal the true nature of gender, racial, and class divides within STEM majors at U.S. colleges and universities, but do not account for variation in educational experiences and expectations between social groups. In this chapter, I attempt to distinguish between racial, gender, and class variation in STEM fields mediated by students' academic preparation and expectations and the effect of living daily in these intersectional statuses (i.e., residual effects of these intersectional statuses on the lives of students).

While Table 4.1 clearly suggests a variety of relationships between intersectional status and STEM majoring, these relationships may result primarily from differences in the academic preparation and opportunities afforded to students from different racial and class groups. However, a limited amount of research has shown that even when academic preparation and other confounding variables are held constant, intersectional status effects remain significant predictors of college majors. Effects of parental education, for example, have been shown to differently influence men and women. Specifically, among women, levels of parental education are positively correlated with increased chances of majoring in science; among men, levels of parental education are negatively correlated with majoring in science (Ware, Steckler and Leserman 1985).[7] Class background (both in terms of income and parental education) also appears to impact STEM majoring among white women, but not women of color (Espinosa 2011). Differences in patterns of STEM majoring have also been found between Asian and white women (Song and Glick

[7] The authors suggest that parental education is correlated with less stringent adherence to gender roles and thus parental education may disproportionately benefit women who are choosing to enter male-dominated fields.

2004) and between black and white men (Riegle-Crumb & King 2010). In this chapter, I expand these early explorations of intersectional status effects, examining not only gender gaps in STEM, but also which racial and class groups are over- and underrepresented among women and among men in the competition for STEM degrees.

Differences between status groups, like those described above, highlight the importance of examining inequality across fields of study from an intersectional perspective. In particular, the opposite effects of parental education levels on male and female rates of STEM majoring indicates the need to further examine how the STEM pipeline itself may work quite differently for students from different intersectional status groups. Understanding how these various identities complement or conflict within the context of field of study is critically important for designing policies (at institutional, state and federal levels) that effectively encourage underrepresented populations to enter STEM fields and that provide support for such STEM majors. Without studies that consider these issues from an intersectional perspective, policies that target individuals based on a single ascriptive characteristic may inadvertently discourage portions of the target population. For example, given the intersection of educated parents and gender described above, policies targeting first generation college students may appear to be successfully decreasing inequality, but may actually be exacerbating existing patterns of inequality as men from less educated families are already very likely to enter STEM fields. Instead, recruitment and retention efforts should specifically be directed at first-generation *female* college students, the population least likely to enter and remain in STEM fields.

Data and Methods

For this analysis, I have limited my sample to those students who, in 2009 either had earned or were still working toward a 4-year degree and who indicated a major field of study (even if it is “undecided” or “undeclared”). Due to small cell sizes, I also excluded cases where students self-identified as multi-racial or of an “other” race. The unweighted sample size is approximately 7200. To accommodate the complex survey design of the dataset, I employ both survey design (BPS09PSU) and sampling (WTA000) weights, using the ‘survey’ and ‘mitools’ packages in R (Lumley 2011) to create sub-population procedures ensuring the accuracy of estimated standard errors. I use the ‘mice’ package in R (van Burren and Groothuis-Oudshoorn 2011) to impute for missing data. For more information on the data, see Chapter 3.

As discussed in Chapter 3, the dependent variable for this analysis consists of a dichotomous measure of whether a student majored in a STEM field. STEM fields include those majors collapsed into the following categories: life sciences, physical sciences, mathematics, computer/information sciences, and engineering. Non-STEM fields include: humanities, social/behavioral sciences, education, business/management, health, vocational/technical, other technical/professional and undeclared. If either a student’s first or second major was in a STEM field, they are considered a STEM major for the purposes of this analysis, as their degree will provide them with the opportunities for advancement described in Chapters 1 and 2. Because I follow NCES’ more conservative definition of a STEM field (in contrast to that put forth by the NSF, which also includes social sciences), because the various benefits (in terms of income, job stability, and prestige) associated with STEM fields are less correlated with social science degrees. My analysis uses the majors provided by students in 2009 (i.e., in their sixth year) by which time less than three percent of students still indicated that their major was "undeclared" thus including them as non-STEM majors. Students who had completed a bachelor's degree prior to 2009 reported the major(s) in which they had earned the bachelor's degree.

The independent variables measuring students' intersectional status include: gender, race, income, and parents' education level. Gender and race are simple categorical variables, with male being the primary comparison category for gender and white being the comparison category for race. In models exploring effects *among* women and *among* men, women are compared against white females and men are compared against white males). The racial categories are mutually exclusive (white, black, Hispanic and Asian) and the Asian category includes both Pacific Islanders and Native Hawaiians. Although Hispanic is technically an ethnicity, I include it in my analysis as a racial category because the experiences of Hispanic students within the U.S. higher education system often vary significantly from those of their "racial" peers – be they white or black.

In addition to race and gender, I include two variables that address aspects of class: income and parents' education level (with parents' education capturing, to some extent, effects of social and cultural capital associated with both college and the college-educated labor market). Income is the natural log of the student's reported family income, CINCOME (using student's and/or spouse's income for independent students and parents' income for dependent students). I use two different measures of parental education in my models. Most of the time, I use three categories for parents' education: neither parent has attended college (parentNoColl), at least one parent has attended at least some college (parentColl) and at least one parent has earned a graduate degree (parentGradDeg) – with neither parent has attended college as the excluded category. At other times, parents' education is simply a dichotomous variable indicating whether or not a student has a parent who has earned a bachelor's degree (parentBach). I use this dichotomous measure in order to ensure sufficient cell size in most of the models that include 3-way interactions or in which I am focusing on a smaller subsample. I also include several control variables (described in Chapter 3) identified in the literature on student development theory as influencing educational outcomes across gender, racial and class lines. Again, these fall primarily into two categories: those controlling for students' educational experiences and expectations prior to post-secondary matriculation and those controlling for students' experiences at the time of matriculation and during college. Descriptive statistics for all of these variables can be found in Chapter 3.

I use weighted binary logistic regression models to analyze the influence of intersectional status on majoring in a STEM field. In my later models, to compare most effectively racial and class differences between male and female students, I perform separate regression analyses for these two groups. Between-group significance tests for social background factors are based on pooled analyses with interaction terms (following Cheng, Martin and Werum 2007). My results highlight differences between men and women and identify significant predictors *among* men and *among* women. I have chosen to present significant results at the $p<.10$ level as well as the $p<.05$, $p<.01$, and $p<.001$ levels. While statisticians and academic writers may consider $p<.10$ only marginally significant, an effect that occurs in 90% of samples provides a substantial pattern for administrators and policy-makers, who are frequently asked to solve complicated issues of equity.

Hypotheses

Status competition theory would suggest that competition exists between social classes for access to and control of desirable resources, like STEM education. Extending status competition theory to include challenges based on race and gender, leads me to predict the following relationships within my models. (1) Gender will remain a significant predictor of STEM majoring across races and classes with women significantly less likely than men to enter STEM fields. (2) Racial effects will persist as racial minorities are channeled into non-STEM fields and whites struggle to maintain their status positions. I expect that Asians will be an exception as their designation as a "model minority" often grants them preferential access to high status spaces. (3) Class effects will persist in that they shape students' educational expectations, motivation and goals as well as the resources available to students. I test these results in Table 4.2 and discuss the results in the section below.

If we think of these three forms of inequality (based on gender, race and class) as sides of a prism, intersectionality allows us to look at this prism in 3-dimensional space, considering multiple sides at the same time. Applied to status competition theory, intersectionality would suggest that, in addition to competition *between* men and women for access to these desirable majors, competition would simultaneously exist *among* men and *among* women from different racial and class groups. My analysis thus expands our understanding of traditional status competition theory to identify those students most successful at majoring in STEM fields based on two (or even three) of their statuses at the same time through the use of interaction terms in Tables 4.3 and 4.4.

Results

I begin with two models that assess hypotheses 1-3 (see Table 4.2), exploring the relationship between race, class, gender and STEM majoring with and without controls. Model 1 confirms the existence of a significant gender difference in STEM majors as suggested in Table 4.1, with women being much less likely than men to enter STEM fields. Race (for Asians) and parental education are also significant predictors in this baseline model with Asians and students who have a parent holding a graduate degree being more likely than whites and students whose parents have not attended college to major in a STEM field. As such, there is substantial evidence for all three hypotheses; gender, race, and class all appear to influence STEM majoring. Of course, Model 1 fails to capture the extent to which these race, class and gender effects may be operating through prior achievement and experience.

The introduction of control variables into Model 2 of Table 4.2 shows that the effects of being female and being Asian, as described above, remain after the inclusion of control variables that account for students' academic expectations, achievement and collegiate experiences (I will refer to these as interchangeably as student development effects or control effects). Although the size of the effects for both females and Asians decreases slightly, both remain large. The effect of parental education does not remain statistically significant once these student development controls are added. In other words, Model 2 indicates that the effect of parental education may operate primarily through students' academic experiences, expectations, and achievement. After including controls for student development effects, however, income shows a negative effect on students' majoring in a STEM field such that as a student's family income increases, the likelihood of his/her majoring in a STEM field decreases. Thus, Model 2 also confirms the persistence of separate gender, racial and class effects on STEM majoring (providing evidence for hypotheses 1-3 above).

TABLE 4.2. Weighted Logistic Regression of STEM Majors: Student Status and Control Effects.

	Model 1			Model 2		
	b	se		b	se	
(Intercept)	-0.674	(.332)	*	-2.699	(.452)	***
Female	-0.909	(.087)	***	-0.837	(.091)	***
Black	-0.143	(.147)		0.237	(.162)	
Hispanic	-0.047	(.153)		0.130	(.161)	
Asian	0.745	(.136)	***	0.581	(.146)	***
parentCollege	0.116	(.105)		-0.061	(.112)	
parentGradDeg	0.455	(.113)	***	0.098	(.123)	
ln Income	-0.040	(.030)		-0.074	(.030)	*
Degree Expectations				0.205	(.107)	^
Math SAT				0.004	(.001)	***
Employed - 1st year				0.060	(.170)	
Transferred Schools				-0.182	(.102)	^
Changed Majors				-0.187	(.088)	*
Academic Integration				0.001	(.001)	
Not a U.S. Citizen				0.077	(.212)	

***p<.001 **p<.01 *p<.05 ^p<.10

Table 4.2 also illustrates differences in how status competition processes may play out between class groups that are economically defined (as measured by income) and class groups that are culturally or socially defined (as measured by parental education). Specifically, it appears that having a parent who holds a graduate degree may provide students an advantage in status competition processes earlier in the STEM pipeline – such as higher SAT scores and degree expectations, both of which are positive predictors of STEM majoring in Model 2. In contrast, coming from a higher class background as measured by family income actually appears to discourage students from majoring in STEM fields. This result indicates that STEM majors may be perceived as highly desirable pathways to mobility by students from working and lower class backgrounds. If so, then competition for STEM majors may occur more between students from these economic positions than between students from families with higher incomes.

Model 2 (of Table 4.2) also shows some significant effects among the student development control variables. We see that higher Math SAT scores and expecting to earn a graduate or professional degree are associated with increased likelihood of STEM majoring and having changed majors or transferred between schools are associated with decreased likelihood of STEM majoring. I will address the significance of particular control variables more thoroughly toward the end of this chapter.

Two-Way Intersectional Effects

Intersectional effects allow me to more fully explore status competition processes between groups at the same status level (i.e., between women or between individuals from lower and working class backgrounds). I incorporate intersectional effects into my models in Table 4.3 through the use of two-way interactions.[8]

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[8]Although I present only models incorporating intersectional effects between gender*parental education and race*income, models were also run with two-way interactions between race*parental education, gender*race, and gender*income, but no significance was found.

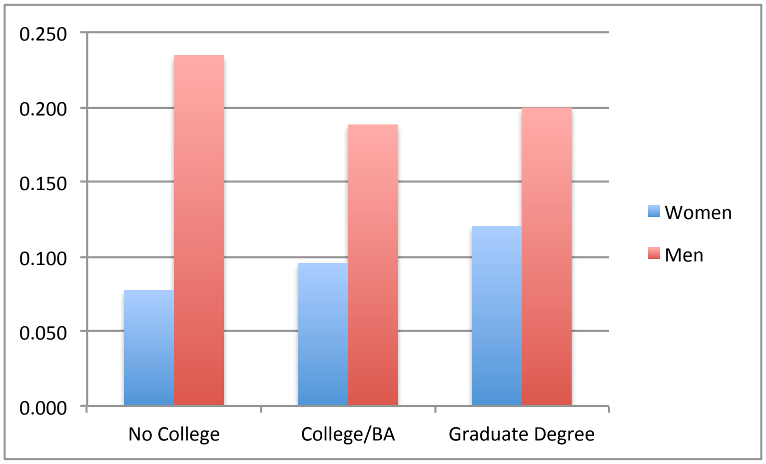
TABLE 4.3. Weighted Logistic Regression of STEM Majors: Intersectional Status Effects.

	Model 1			Model 2		
	b	se		b	se	
(Intercept)	-2.525	(.456)	***	-2.567	(.576)	***
Female	-1.294	(.203)	***	-0.835	(.091)	***
Black	0.226	(.163)		0.095	(.835)	
Hispanic	0.146	(.161)		-1.600	(.832)	^
Asian	0.586	(.146)	***	1.377	(.726)	^
parentCollege	-0.280	(.161)	^	-0.072	(.111)	
parentGradDeg	-0.207	(.165)		0.089	(.124)	
ln Income	-0.073	(.029)	*	-0.085	(.043)	*
Degree Expectations	0.211	(.108)	*	0.211	(.106)	*
Math SAT	0.004	(.001)	***	0.004	(.001)	***
Employed - 1st year	0.088	(.171)		0.078	(.169)	
Transferred Schools	-0.196	(.102)	^	-0.198	(.102)	^
Changed Majors	-0.191	(.088)	*	-0.195	(.088)	*
Academic Integration	0.001	(.001)		0.001	(.001)	
Not a U.S. Citizen	0.068	(.215)		0.087	(.217)	
Female*parentCollege	0.509	(.235)	*			
Female*parentGradDeg	0.694	(.240)	**			
Black*lnIncome				0.013	(.077)	
Hispanic*lnIncome				0.168	(.075)	*
Asian*lnIncome				-0.079	(.066)	

***p<.001 **p<.01 *p<.05 ^p<.10

Model 1 of Table 4.3 includes all of the previous variables with the addition of an interaction between gender and parental education. Here, parental education again becomes significant (even with the student development variables in the model), but its effect significantly differs by gender. For men, having a parent who attended college or earned a bachelor’s degree (parentCollege) marginally decreases the likelihood that a student will major in a STEM field (in comparison to those men whose parents never attended college). For women, having a parent who attended college or earned a bachelor’s degree significantly increases one’s chances of majoring in a STEM field and having a parent who has earned a graduate degree further increases it. Figure 4.1 depicts the probabilities that white women and men will major in a STEM field.[9]

Figure 4.1. Probability of Majoring in STEM:
Intersectional Effects of Gender and Parental Education for White Students



The probabilities for students of color are slightly higher than those of their white peers, but retain the same relationship between gender and parental education. Asian men whose parents never attended college have the highest probability of majoring in a STEM field (based on Model 1) and white women whose parents never attended college have the lowest probability (36.3% and 8.0% respectively). Significantly, the probability for Asian women with a parent holding a graduate degree (20.3%) is very comparable to that for white men with a parent holding a graduate degree (20.5%) and that for white men with a parent who has attended college (19.3%). Thus, Model 1 illustrates the importance of examining STEM majoring from an intersectional perspective. The fact that parental

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[9] Probabilities for this and other figures were calculated using means for other variables.

education influences men and women in opposite directions means that the effects of class background differ by gender. Moreover, while women continue to lag behind men of their own racial group (for all four racial groups), some groups of women are majoring in STEM fields at rates virtually equal to some groups of men. It is worth noting that the interaction effects between gender*parental education identified in Model 1 remain significant in models that include additional interactions between gender*race and gender*income (these models are not presented here as the additional interactions were not statistically significant).

Model 2 of Table 4.3 incorporates intersectional statuses between race and income. Here, we can see how the effects of class depend on race – particularly for Hispanic students. Although Hispanic students are less likely than white students (of their own gender) to major in a STEM field, this effect is significantly less severe for students from higher income families. In other words, the generally negative effect of coming from a higher income family is reversed for Hispanic students for whom coming from a higher income family mitigates the negative effect of race. The strong negative effect of race for Hispanics, however, suggests that even Hispanic students from high-income families remain less likely than their white peers to major in a STEM field. Figure 4.2 shows the probabilities of majoring in a STEM field for white and Hispanic students, clearly illustrating both the fact that racial effects here are stronger than class effects and the obvious interaction between race*income such that as family income increases, STEM majoring decreases among whites but increases among Hispanics.

Figure 4.2. Probability of Majoring in STEM:
Intersectional Effects of Gender and Income for Whites and Hispanics

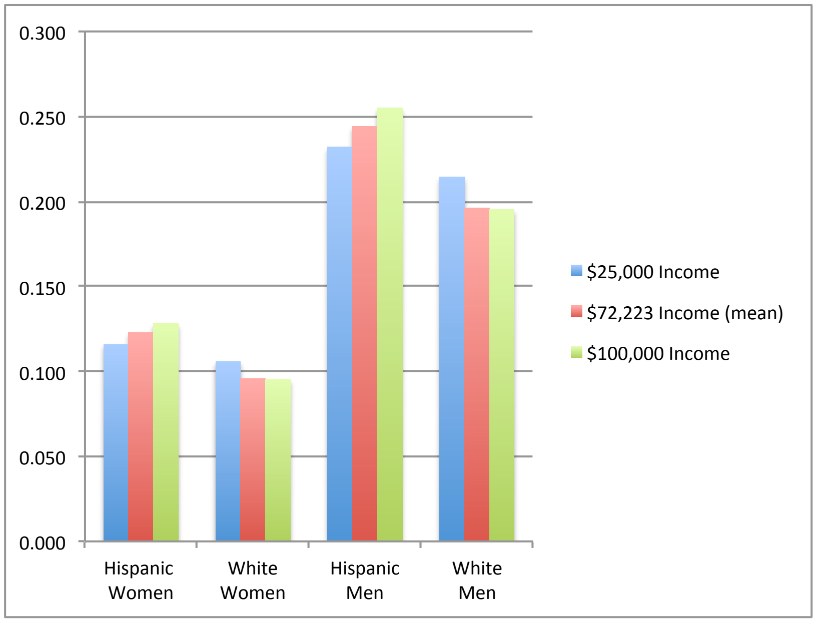


Table 4.3 confirms that intersectional statuses matter above and beyond the simple race, class, and gender inequalities depicted in Table 4.2 and currently described in the STEM literature. First, the effect of being Hispanic varies by economic class. Initial models revealed no significant difference in STEM majoring between whites and Hispanics, but including the race*income interaction demonstrated a strong negative effect of race for Hispanics, mediated to some extent by family income. Such a finding shows how examining intersectional effects can help us understand better how status competition processes vary between population groups. Average rates of income continue to differ by race in the United States. In my sample—which includes only those undergraduates who either had already earned or were still pursuing a bachelor's degree in 2009—the mean income is $72,213, but the average income for Hispanics is $48,400 while the average income for whites is $81,500. As such, white students from families

earning significantly less than their racial mean may still have significantly higher incomes than Hispanic students from families earning more than their racial mean. As such, we should not be surprised that status competition processes based on economic class appear not to function in the same way for Hispanics as for whites. Given the higher average pay among STEM fields, Hispanic students may see STEM majoring as a means of class mobility whereas white students may primarily see STEM majoring as a means of competing to maintain their current status. Unfortunately, one limitation of quantitative data is its lack of ability to capture meaning and motivation; qualitative research seeking to further explore these processes should assess students' motivations for entering or not entering a STEM major and the meanings they attribute to STEM fields.

Second, the effect of parental education, which loses significance once student development controls are added to the baseline model, reappears when interacted with gender. In other words, it appears inconsequential because the effects for men and women balance out, yet we would be remiss in dismissing it as working only through these controls because, when considered intersectionally, we see that parental education continues to significantly influence STEM majoring – but in opposite directions for men and women. The fact that both having a parent who has attended college and having a parent who holds a graduate degree are larger (and more significant) for women than for men suggests that cultural and social categories of class may remain salient for women longer than for men. Thus, we might suggest that status competition processes between class groups may persist among women for access to or retention in STEM fields even after other factors (e.g., motivation, academic performance) have superseded class in influencing STEM majoring among men.

Three-Way Intersectional Effects

While the analyses presented above have demonstrated the importance of examining intersectional effects, the effects have been presented in comparison to white men whose parents never attended college (the excluded category). The analyses in Table 4.4, however, enhance our understanding of *within* gender status competition processes because they include separate comparison groups for women and for men. In other words, these models allow for comparison *among* women and *among* men by racial and class background and *between* men and women on the various regressors. In these split-gender models, the regression coefficients refer to effects *within* gender (i.e., for women, as compared to white women whose parents never attended college and, for men, as compared to white men whose parents never attended college). As such, the standard errors next to the regression coefficients indicate significance *within* gender while the highlighted bars indicate variables where differences between male and female models are significant. This method has the added advantage of providing a clear means of interpreting three-way interactions (that get at the intersection of race, class, and gender simultaneously). It is worth noting that gender remains a strong predictor across models, with women significantly less likely to major in a STEM field.

TABLE 4.4. Weighted Logistic Regression of STEM Majors: Intersectional Status Effects by Gender.

	Model 1				Model 2				Model 3			
	WOMEN		MEN		WOMEN		MEN		WOMEN		MEN	
	b	se	b	se	b	se	b	se	b	se	b	se
(Intercept)	-4.836	(.586) ***	-1.759	(.573) **	-4.674	(.761) ***	-1.842	(.713) **	-4.805	(.786) ***	-1.816	(.724) *
Black	0.426	(.217) *	0.101	(.230)	0.419	(1.160)	-0.194	(1.113)	0.491	(1.154)	-0.197	(1.172)
Hispanic	0.229	(.197)	0.099	(.223)	-2.599	(1.229) *	-0.628	(1.154)	-2.598	(1.249) *	-0.497	(1.171)
Asian	0.463	(.206) *	0.688	(.196) ***	1.514	(1.058)	1.692	(1.017) ^	1.479	(1.083)	1.730	(1.044) ^
parentCollege	0.102	(.163)	-0.207	(.164)	0.074	(.162)	-0.213	(.164)				
parentGradDeg	0.290	(.183)	-0.099	(.167)	0.260	(.182)	-0.106	(.166)				
parentBach									-0.056	(.156)	0.092	(.141)
ln Income	-0.093	(.043) *	-0.074	(.036) *	-0.107	(.065)	-0.066	(.048)	-0.090	(.068)	-0.077	(.050)
Degree Expectations	0.284	(.153) ^	0.161	(.137)	0.296	(.153) ^	0.161	(.136)	0.318	(.153) *	0.151	(.136)
Math SAT	0.006	(.001) ***	0.003	(.001) ***	0.006	(.001) ***	0.003	(.001) ***	0.006	(.001) ***	0.003	(.001) ***
Employed - 1st year	-0.363	(.237)	0.319	(.217)	-0.334	(.237)	0.326	(.217)	-0.360	(.235)	0.347	(.217)
Transferred Schools	-0.031	(.147)	-0.288	(.134) *	-0.052	(.150)	-0.295	(.134) *	-0.059	(.151)	-0.304	(.133) *
Changed Majors	0.052	(.124)	-0.381	(.118) **	0.056	(.123)	-0.396	(.117) **	0.056	(.123)	-0.389	(.118) **
Academic Integration	0.004	(.002) *	-0.001	(.001)	0.004	(.002) *	-0.001	(.001)	0.004	(.002) *	-0.001	(.001)
Not a U.S. Citizen	-0.048	(.290)	0.118	(.282)	-0.015	(.289)	0.096	(.294)	-0.011	(.294)	0.067	(.294)
Black*lnIncome					-0.002	(.106)	0.031	(.105)	-0.021	(.105)	0.063	(.113)
Hispanic*lnIncome					0.273	(.113) *	0.071	(.105)	0.267	(.115) *	0.051	(.115)
Asian*lnIncome					-0.106	(.097)	-0.096	(.091)	-0.131	(.099)	-0.102	(.095)
Black*parentBach									0.246	(.347)	-0.757	(.423) ^
Hispanic*parentBach									0.079	(.392)	0.230	(.409)
Asian*parentBach									0.441	(.420)	0.081	(.343)

***p<.001 **p<.01 *p<.05 ^p<.10

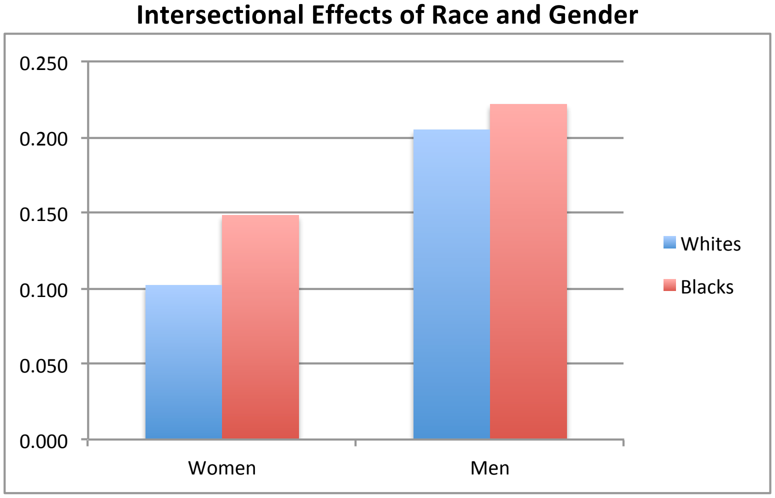
p<.01 between models

p<.05 bewteen models

p<.10 between models

Model 1 of Table 4.4 provides a baseline analysis by gender including all of the race and class measures as well as the student development controls. Here, we see a strong income effect across genders such that, as income increases, rates of STEM majoring decrease. Model 1 also shows that the Asian effect exists both *among* men and *among* women (the difference is the coefficient does not reach statistical significance *between* men and women). Interestingly, this model reveals another racial effect among women—black women are significantly more likely than their white peers to major in STEM fields—that does not exist among men. This effect is not significantly different between models, meaning that the higher rate of STEM majoring among black women (as compared to white women) is not significantly different from the higher rate (although it does not reach statistical significance) of STEM majoring among black men (as compared to white men). See Figure 4.3.

Figure 4.3. Probability of Majoring in STEM: Intersectional Effects of Race and Gender

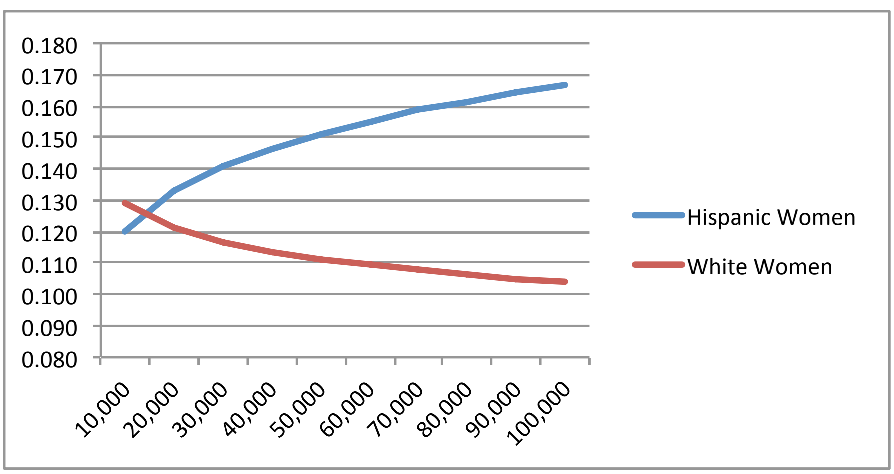


This race*gender effect clearly signals the problems with assuming a summative model of disadvantage as opposed to an intersectional model when it comes to horizontal equity. Although blacks and whites major in STEM fields at roughly equivalent rates and although women are significantly less likely to major in STEM fields than men, black women are significantly more likely than white women to major in STEM fields. Here, being black reduces the negative effect of being female, highlighting the intersectional nature of the effect.

Model 2 of Table 4.4 explores the race*income effect found in Table 4.3 in the context of gender. By splitting the sample, we see that the Hispanic*income effect is significant among women, but not among men. This model also highlights the different racial effect of being Hispanic for men and women. While there is no significant difference between rates of STEM majoring for Hispanic and white men, Hispanic women are much less likely to major in a STEM field than white women, but this racial effect is moderated by the effect of income for Hispanic women. Increases in income increase rates of STEM majoring for Hispanic women; in contrast, for white non-Hispanic women, income remains a depressor effect such that white women from higher income backgrounds are less likely to major in STEM fields. Figure 4.4 compares how race and income influence the probability of majoring in a STEM field for white and Hispanic women. Essentially, their probabilities of majoring in a STEM field are equal if they come from families with incomes of roughly $10,540. At incomes above that, Hispanic women are more likely to major in STEM fields than white women. At incomes below that, white women are more likely.

In Model 3 of Table 4.4, I include both the race*income intersection discussed above and a race*parental education intersection. Including multiple intersections (and splitting the models by gender) decreases cell sizes,[10] so I have had to measure parental education as a simple dichotomous variable indicating whether a student has a parent who has earned a bachelor's degree (parentBach). Still, this model provides several valuable pieces to the status competition puzzle. First, we see that the Hispanic*income effect described in Model 2 remains significant when race*parental education is added. Moreover, the coefficients change very little suggesting that this effect is separate from the race*parental education effects that we have just added to Model 3. In fact, we can conclude from this finding that separate status competition processes are most likely playing out across class groups based on economic capital versus social/cultural capital.

Figure 4.4. Probability of Majoring in STEM:
Intersectional Effects of Income and Race for Women



[10] In this model, cell sizes drop below the ideal 30 cases in ¼ of the cells, but remain above 22 in all of them. Although this is not unexpected when considering interaction effects (particularly when including three-way interactions) and should not unduly influence the weighted regression results, the results should be interpreted with caution.

Second, Model 3 of Table 4.4 shows a marginally significant effect between race*parental education among black students. While there are no significant racial effects for black men as compared to white men and no significant effects for parental education *among* men, in general, there is an effect for black men with a parent holding a bachelor's degree. These men are less likely to major in STEM fields as can be seen in Figure 4.5a. This effect (i.e., for black men with more educated parents) is also significantly different from the effect for black women as is indicated by the shaded bar in Table 4.4 (see Figure 4.5b for comparison). These figures depict the primacy of the gender divide in STEM (i.e., the rates for men ranging from 19.0% to 38.8% and rates for women from 9.9% to 15.5%), but also clearly highlight the variation among intersectional status groups. To some extent then, either black men from more educated families are losing in the competition for STEM majors or the STEM pipeline may look different for this group. In Chapter 5, I explore the relationship between rates of STEM majoring among black students and attendance at historically black colleges and universities (HBCUs), a factor that may partially explain this effect.

Thus, Tables 4.3 and 4.4 highlight how examining intersectional statuses provides a much clearer picture of which population groups are underrepresented in STEM majors. In particular, previous studies have argued that individuals from lower income groups are more likely to major in STEM fields. My results show that this is true for individuals from some racial groups, but not for others. For example, for Hispanic women, increases in family income are associated with *higher* levels of STEM majoring.

Figure 4.5a. Probability of Majoring in STEM:
Intersectional Effects of Race and Parental Education for Men

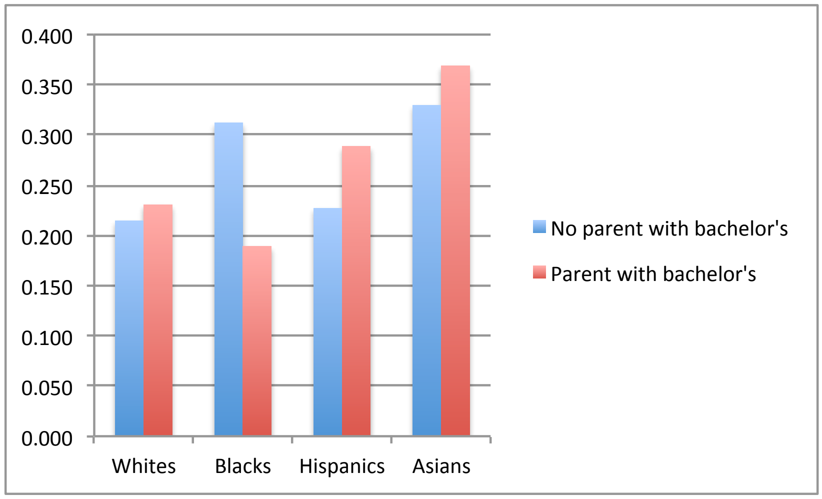
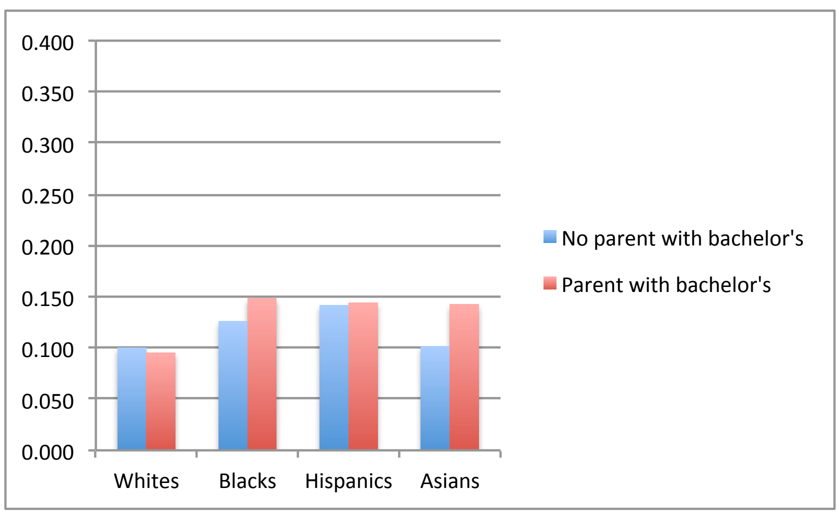


Figure 4.5b. Probability of Majoring in STEM:
Intersectional Effects of Race and Parental Education for Women



In addition to differences between male and female models, my results show clearly the variation *among* men and *among* women. Thus, status competition processes are occurring simultaneously between genders and between racial and class groups *within* genders. In other words, the statuses that matter for “catching up with white men” may be different than the statuses that matter for “maintaining one’s position” among other women (or among men). While traditional studies of stratification have focused almost exclusively on the first, applying intersectionality to status competition theory highlights the existence of multiple processes wherein individuals are simultaneously privileged and disadvantaged and suggests that by only looking at a single dimension of inequality at a time, we risk oversimplifying the complex nature of stratification within the post-secondary system.

Significance of Student Development Controls

Although the significance of the control variables is not the primary focus of this chapter, they are relevant to the discussion of intersectional status effects and status competition processes. Specifically, the significance of control variables in Tables 4.2 and 4.3 show that the status competition for STEM majors begins long before college. The small coefficients for Math SAT are deceptive because SAT is a continuously measured variable (between 200 and 800) whereas most of the other variables in the model are categorical. Math SAT score actually retains the highest impact on STEM majoring across models with each additional 20 points on the SAT resulting in an increase that a student will major in a STEM field of roughly .33 – 1.66% (the effect is nonlinear such that changes in SAT at lower scores have larger increases in the chances whereas changes in SAT at higher scores have smaller increases). Likewise, degree expectations (whether or not a student would eventually earn a graduate degree) measured during a student’s first semester also have a positive effect across models.

Experiences at college can also cause students to fall behind in the status competition—transferring schools and changing majors both decrease a student's chances of majoring in a STEM field—potentially resulting in the need to pick up extra courses if they are to catch up with their peers.

The difference between control variables that matter among men versus control variables that matter among women also merits discussion. Table 4.4 reveals that, although SAT is a significant predictor of STEM majoring among both men and women, Math SAT scores matter more for women than for men (with between model significance at p<.01). Interestingly, however, the effects of other control variables are significant *either* for men *or* for women. Among women, those who expect to eventually earn a graduate or professional degree (reported during their first year of college) are marginally more likely to major in a STEM field than their female peers who never expect to do so. Working full-time during the first year of school also more negatively affects women than men (here, there are no significant differences *among* women or *among* men). Women's level of academic integration[11] also plays a significant role in whether or not women major in a STEM field, with women who report higher levels of integration more likely to major in a STEM field. On one hand, this finding is particularly exciting for administrators and policy-makers because offers a concrete and controllable means of increasing STEM rates among women by intentionally providing female students with more opportunities for academic involvement outside of the classroom. On the other hand, such opportunities are most likely themselves part of the status competition

[11] Derived from the average of how often a student: participated in study groups, had social contact with faculty, met with an academic advisor, or talked with a faculty about academic matters outside of class.

process. STEM majors often require successful completion of a number of prerequisite and lower level courses that have larger class sizes than lower level courses for social science and humanities majors. Because women tend to be underrepresented in STEM majors, faculty members might already disproportionately seek out and encourage female students in these early courses…thus creating a relationship between academic integration and STEM majoring among females. In contrast, male students who intend to major in STEM fields might simply be part of the crowd in these types of courses and thus have less contact with faculty members during their first year.

In contrast, whether a male student majors in a STEM field is more significantly impacted by apparent interruptions to his academic path that may set him behind in the status competition (i.e., transferring between institutions and changing majors). Having transferred between institutions at any point during college makes men significantly less likely to major in a STEM field than their male peers who never transferred (a similar effect appears among women although it does not reach statistical significance). Among men, changing majors at any point during college also significantly reduces men's chances of majoring in a STEM field. The effect of changing majors has a more negative effect on men than on women. These gendered effects of the student development control variables remain relatively stable across models and, although the effect of these control variables is not the focus of my analysis, I believe that such gendered differences merit mentioning and further exploration as they may indicate different critical periods in the status competition process based on gender.

Conclusions

In sum, the analyses in this chapter suggest that there is no single status competition in which various groups compete against upper class white men for resources. Instead, a variety of status competition processes unfold across lines of gender, race and class between groups seeking to advance and/or to maintain their position in the status hierarchy. While I find support for my hypotheses that separate gender, racial and class effects persist, I also find substantial evidence that examining these three patterns in isolation can result in misleading conclusions about individuals' majors because the lived experience exists at the intersection of these three statuses (as well as others).

With regard to social class effects, I find that when income influences men, it does so in a negative way such that men from higher income families are less likely to major in STEM fields. From this, we can infer that STEM majors may be perceived as a path for status mobility among men. Among non-Hispanic women, the picture is similar; women's rates of STEM majoring decrease as family income increases. For Hispanic women though, higher levels of income are associated with higher rates of STEM majoring. Finally, the models seem to indicate that women who are not first generation college students have an advantage, although the effect of having a parent who attended college versus having a parent with a graduate degree varies across models. Among men, parental education does not appear to significantly influence STEM majoring for whites, Hispanics and Asians, but has the opposite impact for black men such that having more educated parents makes one less likely to major in a STEM field.

Although this chapter looks at only a single educational outcome measure (STEM major), the findings suggest that, while status competition processes continue to create horizontal stratification for certain population groups (especially women), status competition processes among groups also play a role. In other words, status competition processes among men and among women may look very different from status competition processes in the full population. Likewise, my findings help us to understand how populations groups with various intersectional statuses are faring in the competition for particular types of majors. Instead, we see here competition happening both between dominant and non-dominant groups and within these groups (e.g., black women entering STEM fields at rates closer to white men than white women). Future research should explore more fully how these in-group processes may influence educational outcomes including, but not limited to, selection into different fields of study.

The results also have clear implications for the study of ongoing gender stratification and the necessity of moving toward quantitative (and qualitative) models that address intersectionality. My results suggest that women's majors may be more influenced by race and class effects, net of academic expectations, prior achievement and collegiate experiences. Specifically, we see that parental education plays a significant role for women in Table 4.3 and that race matters for black, Hispanic and Asian women in Table 4.4 (varying by which race*class interactions are included in the model). Black women appear *more* likely than their white female peers to major in a STEM field whereas black men are not significantly more or less likely than their white male peers to major in a STEM field. I also find as strong positive effect for Asian women compared to white women in early models. Lastly, I find that, among women, whites are the least likely to major in STEM fields, although Hispanic women are least likely at the very lowest levels of family income. These shifts related to family income may parallel differences in the ways that traditional gender roles operate between racial groups. Further research related to racially specific gender norms might clarify how status competition processes may vary depending on the perceived status and desirability of particular majors as paths for social mobility.

How can we interpret such differences? First, the more direct link between race and class effects for women may indicate that women face more contradictory pressures with regard to going into STEM fields (e.g., from parents, teachers, significant others, and even media sources providing negative messages about women's math skills, expectations about family and gender roles, labor market realities, etc.). Second, the complexity of factors that influence both men's and women's entrance into a STEM field stresses the critical nature of exploring social background characteristics as intersectional. In focusing on a single aspect of identity, educational researchers are missing portions of the picture and policy makers are ultimately unable to create policies that effectively target certain populations. Simply stating that gender, race, and parental education have significant effects (as might be concluded from Table 4.2) provides an incredibly simplified picture of current inequality in the horizontal pipeline. I would suggest therefore that we, as sociologists, must encourage the use of an intersectional lens in our analyses of stratification. My results clearly demonstrate that even more applied fields, like the sociology of education, might benefit from the employment of the intersectional perspective.

Finally, the results of Chapter 4 provide insights for university administrators, policy makers and parents about the extreme complexity of factors influencing STEM majors for both men and women. Although confirming what everyone knows—women are severely underrepresented in STEM fields—I am able to suggest more specifically *which* women (and *which* men) may need the most recruitment, intervention and/or support if they are to successfully major in a STEM field. Although my research does not seek to determine the specific experiences, beliefs, and/or norms that shape STEM majoring within each of these social groups (at each intersectional status), it does suggest that different policies may be needed to reach individuals from different intersectional statuses. For example, racial analyses consistently demonstrate that Asians are overrepresented in STEM fields, yet my analysis reveals that Asian women whose parents have not earned a bachelor's degree actually constitute one of the least likely groups to major in STEM fields. If the goal is to minimize stratification in STEM fields and if, "a reasonable criterion is that we have obtained educational equity when representatives of different racial, gender, and socioeconomic origins have about the same probabilities of reaching different educational outcomes" (Levin 1994: 168), then policies that seek targeting of first-generation Hispanic and black women at the expense of first-generation Asian women are actually *increasing* existing racial disparities among women in STEM fields. Likewise, we may need to consider how to better recruit and/or retain men from higher income families into STEM fields.

Creating effective plans for promoting such educational equity will require the cooperation of many stakeholders including college admissions staff, faculty in STEM fields, provosts and department chairs, academic support services, state and national policy-makers, employers, secondary school teachers and counselors, parents, and ultimately students. While this chapter has focused on broadening participation in STEM through individual recruitment, Chapter 5 focuses on field-specific inequalities and

Chapter 6 focuses on institutional context effects. As such, I have chosen to wait to address specific policy recommendations until Chapter 7, at which point I can also discuss ways in which these analyses come together and/or conflict.

Of course this analysis raises many new questions even as it seeks to clarify our understanding of intersectional statuses and horizontal equity in the U.S. higher education system. In Chapter 5, I provide a more detailed analysis of differences between STEM fields by looking at how intersectional status effects differ between the life sciences and the more mathematically-oriented STEM fields (including physical sciences, mathematics, engineering and computer science). More research is also needed to assess exactly how status competition processes play out between and within postsecondary institutions. In Chapter 6, I seek to place the intersectional status effects described here in context by exploring how institutional type can heighten or lessen the effects of particular statuses.

Chapter 5:
Difference in Equity between STEM Majors

This chapter expands upon the questions posed in Chapter 4 by focusing on how intersectional status influences majoring in particular STEM fields. Here, I address several research questions. First, what factors predict majoring in physical sciences and other math-intensive fields (including computer science and engineering)? Second, how are these factors the same or different from factors that predict majoring in life sciences? Finally, how do persisting levels of inequality in the physical sciences compare to those in life science fields? The research reviewed below suggests that different status competition processes may be occurring in physical sciences and engineering than occur in the life sciences. Understanding differences between these fields will allow for a more nuanced understanding of the status competition processes described in Chapter 4. Again, I seek to assess the scope of intersectional status effects on educational equity by field of study in order to paint a clearer picture of enduring horizontal inequality in U.S. higher education and the complexities of status competition processes.

Closing the Gender Gap in the Life Sciences?

Extensive research on STEM fields continues to report the underrepresentation of women in STEM majors, and my results in Chapter 4 document important differences in rates of STEM majoring among women based on racial and class backgrounds. Several recent studies reveal that the gender gap varies significantly by STEM field with newest figures showing that female undergraduates are now entering biological and life science majors at rates equal to, or even surpassing those of men (AAUW 2010; NCES 2009; Riegle-Crumb and King 2010). Gender gaps in the physical sciences and engineering, however, remain large with men outnumbering women 4 to 1. Differences between these fields emerge with regard to students' class backgrounds as well. Students from higher income families and/or who have college educated parents are more likely to major in the biological sciences than the physical sciences, math or computer science (NCES 2009).

Riegle-Crumb and King (2010) explore this gap between physical science/engineering majors and biological science majors at the intersection of gender and race (for black, Hispanic, and non-Hispanic white undergraduates). They find that women of all races are significantly less likely than white men to major in physical sciences or engineering, but find no significant differences among men of different races or among women of different races. In other words, they identify a strong gender effect. Controlling for academic preparation, they find black women and black men significantly more likely to major in these fields than their white same-gendered peers. Thus, black women are closer than white women to closing the gender gap in the physical sciences and engineering. In contrast, they find no significant differences between groups by race or gender in the biological sciences. Their study has several limitations, however. First, their use of the Educational Longitudinal Study (ELS) conducted by NCES limits their dependent variable (i.e., major field of study) to students' sophomore year of college, but undergraduates often change majors during their sophomore or even junior years of college. I improve upon their model by using the major(s) in which students had *completed* their bachelor's degree (or the current major for students who were still working toward degree completion in their sixth year after entering college). As such, my analysis extends this important line of analysis, providing a clearer view of the effects of intersectional status on STEM majoring that controls for changes in major and other effects of the college experience itself. Second, I also include Asian students in my analysis, an important contribution considering that Asians major in STEM fields at higher rates than students from other racial ethnic groups (Maltese and Tai 2011; NCES 2009; Song and Glick 2004).

This chapter also expands existing analyses by including other two-way intersectional effects, looking at intersections of race*class and gender*class as well as race*gender. In this way, I'm able to expand our understanding of how intersectionality influences STEM majoring to include status competition processes *between* types of STEM majors.

Data and Methods

My analysis in this chapter mirrors my analysis in Chapter 4, using binary logistic regression to probe more deeply into how intersectional statuses influence majoring in specific STEM fields. First, I compare students majoring in physical science, math, computer science and engineering to students in non-STEM majors. Ideally, I would be able to analyze each of these majors separately, but the sample size does not permit this level of analysis. Fortunately, the majors in this grouping, which I call "mathematical sciences" or "math sciences," tend to have similar patterns of stratification (c.f. Riegle-Crumb and King 2010). Second, I compare students majoring in biological or life science fields to students in non-STEM fields. For these two analyses, the comparison group is students who do not major in STEM fields (i.e., I use the same comparison group as the analyses conducted in Chapter 4). Finally, I analyze differences between STEM majors looking specifically at the factors that lead students to major in math sciences versus life sciences.

I use the same filter criteria as in Chapter 4, including only students who had earned or were still working toward a 4-year degree in 2009, who indicated a major field of study, and who did not self-identify as multi-racial or of an "other" race. Thus, the unweighted sample size is approximately 7200. I continue to use the same multiply-imputed data that I used in Chapter 4, employing both survey design (BPS09PSU) and sampling (WTA000) weights and using the 'survey' and 'mitools' packages in R (Lumley 2011) to create sub-population procedures ensuring the accuracy of estimated standard errors.

Again, the independent variables measuring students' intersectional status and the student development control variables are the same as in Chapter 4: gender, race, income, parental education, degree expectations, Math SAT score, employment during freshman year, transfer status, changes between majors, academic integration and U.S. citizenship. The analyses in this chapter utilize only the dichotomous measure of parental education (parentBach) indicating whether either of the student's parents has earned a bachelor's degree.[12] In models exploring effects *among* women and *among* men, women are compared against white females and men are compared against white males. Because my analyses compare among different samples (e.g., the one comparing life science to non-STEM majors excludes students who majored in STEM fields that were not life science), I have included a comparative table of means (see Table 5.1) for each of the subsamples.

[12] This is the same parental education measure used in Chapter 4's three-way interaction models.

Table 5.1. Weighted Means and Standard Errors by Subsample

	Full Sample (N=7200)		Math Sciences & Non-STEM (N=6530)		Life Sciences & Non-STEM (N=6350)		STEM Majors* (N=1520)	
	Mean	**se**	**Mean**	**se**	**Mean**	**se**	**Mean**	**se**
Female	0.567	(.009)	0.564	(.010)	0.613	(.009)	0.388	(.018)
White	0.715	(.014)	0.716	(.014)	0.718	(.014)	0.696	(.021)
Black	0.101	(.009)	0.102	(.009)	0.103	(.009)	0.082	(.012)
Hispanic	0.112	(.009)	0.114	(.009)	0.113	(.009)	0.097	(.015)
Asian	0.073	(.006)	0.068	(.007)	0.066	(.006)	0.124	(.014)
parentBach	0.560	(.010)	0.554	(.010)	0.550	(.010)	0.626	(.017)
Income	72213.328	(1118.720)	71830.202	(1152.783)	72180.565	(1165.639)	74142.652	(2106.296)
Degree Expectations	0.731	(.009)	0.720	(.009)	0.730	(.009)	0.785	(.016)
Math SAT	517.281	(3.026)	513.558	(3.003)	510.176	(3.076)	563.602	(5.425)
Employed - 1st year	0.124	(.008)	0.131	(.008)	0.123	(.008)	0.104	(.014)
Transferred Schools	0.369	(.016)	0.376	(.016)	0.376	(.017)	0.310	(.022)
Changed Majors	0.344	(.009)	0.342	(.009)	0.352	(.010)	0.322	(.016)
Academic Integration	82.996	(.952)	82.415	(.974)	83.158	(.991)	84.902	(1.684)
Not a U.S. Citizen	0.061	(.006)	0.062	(.006)	0.058	(.006)	0.076	(.010)
STEM Majors	0.210	(.008)						
Math Sciences Majors	0.122	(.007)	0.134	(.007)			0.581	(.020)
Life Science Majors	0.089	(.005)			0.101	(.005)	0.425	(.020)

*N's do not add up because of double-majoring and rounding

To compare most effectively racial and class differences between male and female students, I perform separate regression analyses for these two groups in later models. Between-group significance tests for social background factors are based on pooled analyses with interaction terms (following Cheng, Martin and Werum 2007). My results highlight differences between men and women and identify significant predictors *among* men and *among* women. Quantitative methodologists often face a tradeoff between maintaining nuances of measures and creating a generalizable model. I face this problem in that the level of specificity in the dependent variable here creates cell sizes that do not allow me to look at three-way intersections. Yet, addressing intersections of gender*race, gender*class, and race*class separately still provides a more nuanced understanding of inequality in STEM fields and of status competition processes. In this model, cell sizes drop below the ideal 30 cases in ¼ of the cells, but remain above 22 in all of them. Although this is not unexpected when considering interaction effects and should not unduly influence the weighted regression results, the results should be interpreted with caution.

As in Chapter 4, I have chosen to present significant results at the $p<.10$ level as well as the $p<.05$, $p<.01$, and $p<.001$ levels because, while statisticians and academic writers may consider $p<.10$ only marginally significant, administrators and policy-makers tend to consider an effect that occurs in 90% of samples a substantial pattern.

Hypotheses

I expect to find comparatively higher rates of gender inequality in the math sciences than in the life sciences, consistent with current empirical research. Status competition theory would suggest that competition exists not just between women and men, as women seek to attain the resources (here, STEM majors) traditionally dominated by men, but also among men and among women as status groups seek to maintain or advance their own status positions. As such, I also expect that race and class (in addition to having direct effects on math science majoring) will also play a significant role in determining *which* women and *which* men major in the math sciences, but that the effects of race and class may differ by gender. Specifically, I expect that the negative relationship of family income on STEM majoring will be most obvious here – as the math sciences include a range of highly technical (and perhaps well-paid), but less prestigious fields than the life sciences (e.g., computer and information systems vs. medicine).

With regard to life science majors, I expect to find little, if any, gender inequality. Yet, status competition theory would argue that access in one domain leads to more fierce competition in another and thus I would expect to see potentially higher levels of racial and class competition for entrance to life science majors. Finally, I expect that by looking at intersectional statuses, I will find that gendered patterns of majoring differ by race and class, helping to determine student success in the competition for educational resources.

In sum, I expect my results in this chapter to demonstrate differences between the general status competition processes for majoring in *a* STEM major (as identified in Chapter 4) and the status competition processes that determine *which* STEM major a student chooses. Recent empirical research has suggested that gender may play a larger role in determining *which* STEM major. I now seek to analyze how race, class, and intersectional statuses fit into this process.

Results

This chapter explores three sets of results: math science majors vs. non-STEM majors, life science majors vs. non-STEM majors, and math science vs. life science majors. For each of these analyses, I begin with a basic model looking only at race, class and gender. I then add student development controls and interaction terms to assess intersectional status effects. Finally, I present split models to explore status competition processes *among* men and *among* women.

Mathematical Science Majors vs. Non-STEM Majors

Table 5.2 shows the weighted logistic regression results for students majoring in the physical sciences, computer and information sciences, and engineering. In Model 1, we see that gender, race and class are all significant predictors of majoring in math sciences, as they are for STEM majors in general. Gender is an even stronger predictor for math sciences than for STEM majors in general, with women much less likely than men to major in the physical sciences, math, computer science and engineering. Asians remain more likely than whites and students with a parent who has earned a bachelor's degree are more likely than those whose parents have not earned a bachelor's degree.

Model 2 of Table 5.2 incorporates the seven student development controls. Just as we saw in Chapter 4, the effect of parental education loses its significance once these variables are included, telling us that status competition processes related to cultural and social capital most likely come into play prior to college. Thus, parental education appears to influence college major indirectly through educational expectations and academic performance. As with STEM majors in general, we see that family income becomes a significant predictor once student development controls are included. This effect is masked in earlier models because of correlations between income and student performance and expectations, which translate into higher levels of STEM majoring. Once student performance and expectations are held constant, we see that students from lower income levels are actually more likely to major in math science fields than in non-STEM fields. The Asian and female effects described above remain significant in Model 2.

TABLE 5.2. Weighted Logistic Regression of Mathematical Science Majors: Student Status and Control Effects.

	Model 1			Model 2		
	b	se		b	se	
(Intercept)	-0.937	(.342)	**	-3.169	(.603)	***
Female	-1.633	(.107)	***	-1.533	(.115)	***
Black	-0.096	(.190)		0.306	(.220)	
Hispanic	0.106	(.212)		0.273	(.230)	
Asian	0.757	(.184)	***	0.623	(.211)	**
parentBach	0.347	(.100)	***	0.098	(.118)	
ln Income	-0.049	(.031)		-0.074	(.032)	*
Degree Expectations				0.003	(.131)	
Math SAT				0.005	(.001)	***
Employed - 1st year				0.394	(.200)	*
Transferred Schools				-0.260	(.132)	*
Changed Majors				-0.352	(.112)	**
Academic Integration				0.000	(.001)	
Not a U.S. Citizen				0.278	(.261)	

***p<.001 **p<.01 *p<.05 ^p<.10

Thus, the analyses presented in Table 5.2 again highlight the complexity of class-based status competition processes. In particular, they suggest that mathematical science fields may be the fields driving the perception of STEM fields as highly desirable pathways to mobility by students from working and lower class backgrounds. These models include race, class and gender as separate factors influencing math science majoring. Chapter 4 suggests, however, that intersectional statuses impact STEM majoring above and beyond the additive effects of race, class and gender. Table 5.3 confirms that intersectional effects also influence math science majoring, replicating the intersectional analyses presented in Table 4.3. The first model explores the intersectional effects of gender*parental education while the second looks at race*income. Let us look at each of these in turn.

TABLE 5.3. Weighted Logistic Regression of Mathematical Science Majors: Intersectional Status Effects.

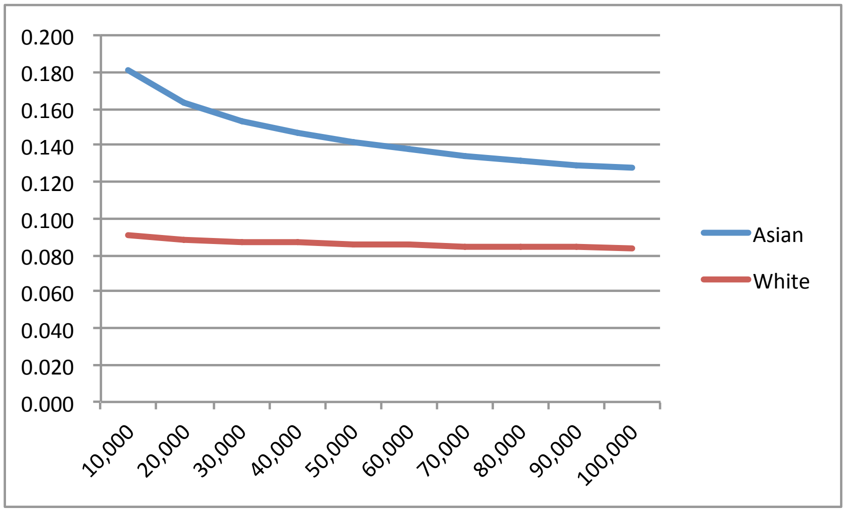
	Model 1			Model 2		
	b	se		b	se	
(Intercept)	-3.096	(.599)	***	-3.513	(.775)	***
Female	-1.797	(.172)	***	-1.529	(.114)	***
Black	0.300	(.219)		1.073	(.974)	
Hispanic	0.277	(.230)		-0.594	(.942)	
Asian	0.618	(.207)	**	2.079	(.893)	*
parentBach	-0.021	(.143)		0.083	(.118)	
ln Income	-0.074	(.032)	*	-0.040	(.047)	
Degree Expectations	0.003	(.131)		0.007	(.130)	
Math SAT	0.005	(.001)	***	0.005	(.001)	***
Employed - 1st year	0.411	(.202)	*	0.415	(.199)	*
Transferred Schools	-0.264	(.132)	*	-0.282	(.133)	*
Changed Majors	-0.355	(.112)	**	-0.365	(.111)	**
Academic Integration	-0.0003	(.001)		-0.0002	(.001)	
Not a U.S. Citizen	0.276	(.261)		0.240	(.274)	
Female*parentBach	0.426	(.221)	^			
Black*lnIncome				-0.074	(.086)	
Hispanic*lnIncome				0.088	(.081)	
Asian*lnIncome				-0.140	(.080)	^

***p<.001 **p<.01 *p<.05 ^p<.10

Model 1 of Table 5.3 reveals that parental education may have a more significant effect for women than for men. The effects of income, gender and being Asian remain significant as in previous models. This gender*parental education effect is not entirely unexpected given similar findings among STEM majors in general. Here, although women are significantly less likely than men to major in math science fields, women with a parent who has earned a bachelor's degree have slightly better odds than do women without a parent with a bachelor's degree. For men, parental education does not appear to affect math science majoring. Status competition for math science fields, may then focus primarily on gender—providing easier access to men—than on cultural/social class such that women with more highly educated parents are at less of a disadvantage than women without such educated parents.

Model 2 of Table 5.3 provides more insight on the positive racial effect for Asians. Across models, Asians have been significantly more likely than whites to major in STEM fields, and specifically in the mathematically-intensive STEM fields that we have designated math science majors. Looking at the intersection of race*income shows that the racial effect for Asians is actually much larger than it previously appeared. In the model without intersectional status effects (Table 5.2/Model 2), an Asian student is 7.3% more likely to major in a math science field than a white student. Here, Asians are 19.2% more likely to major in math science fields than white students, but this effect decreases as family income increases for Asians (see Figure 5.1). This may indicate that math science fields are more desirable paths for economic and social mobility for Asian students than for whites.

Figure 5.1. Probability of Majoring in Mathematical Sciences vs. Non-STEM : Intersectional Effects of Income and Race for Asians and Whites



Finally, Table 5.4 contains two models that demonstrate how status competition processes based on race and class may play out *among* women and *among* men. In Model 1 of Table 5.4, we see that the effects of being Asian and having a parent with a bachelor's are significant *within* genders, as well as *between* genders. In other words, being Asian and having a parent with a bachelor's degree significantly improves the chances of any student majoring in a math science field, but the advantage associated with these statuses is larger for women than for men. Moreover, these statuses are larger determinants of *which* women will major in math science fields than they are of *which* men will major in math science fields. Of course, Model 1 does not include the student development controls that appear to mediate the effects of parental education and, when these effects are included in Model 2 of Table 5.4, the effect of parental education is no longer significant. Such an indirect effect of parental education indicates that women must successfully compete in these earlier status competition where class influences academic achievement and expectations in order to be viable competitors for math science fields when they reach college.

The Asian effect, however, remains a significant predictor *among* men and *among* women, but the effect is no longer significantly different *between* men and women. In other words, we have no reason to believe that the advantage Asian women have in comparison to white women is higher than the advantage Asian men have in comparison to white men. This may indicate that like parental education, a portion of the advantage accruing to Asian women occurs through early academic preparation and/or expectations and experiences.

TABLE 5.4. Weighted Logistic Regression of Mathematical Science Majors: Status Effects by Gender.

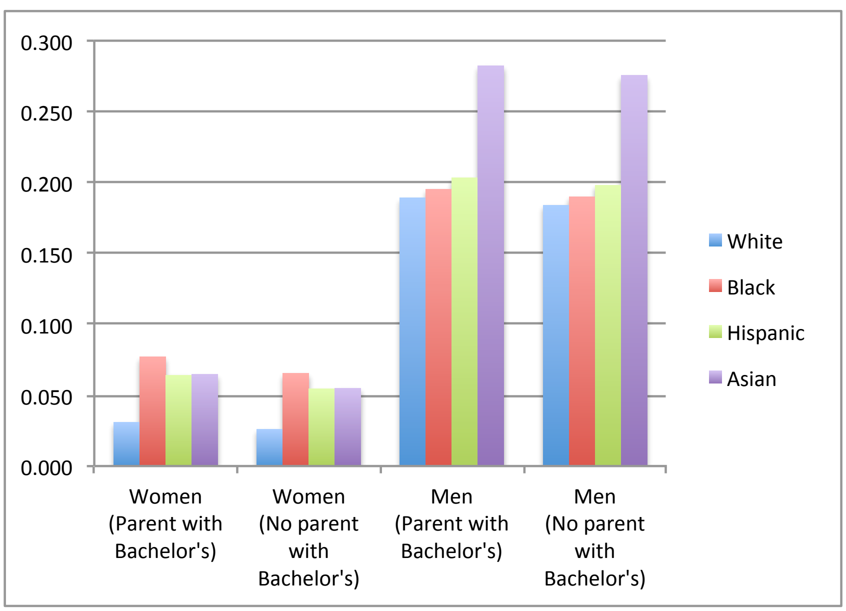
	Model 1						Model 2					
	WOMEN			MEN			WOMEN			MEN		
	b	se		b	se		b	se		b	se	
(Intercept)	-3.496	(.735)	***	-0.588	(.379)		-7.253	(.894)	***	-2.160	(.694)	**
Black	0.263	(.309)		-0.261	(.221)		0.965	(.335)	**	0.039	(.246)	
Hispanic	0.470	(.276)	^	-0.028	(.257)		0.767	(.281)	**	0.090	(.277)	
Asian	1.172	(.254)	***	0.569	(.230)	*	0.778	(.292)	**	0.522	(.270)	^
parentBach	0.654	(.187)	***	0.229	(.127)	^	0.174	(.189)		0.034	(.149)	
ln Income	0.007	(.069)		-0.070	(.035)	*	-0.070	(.060)		-0.093	(.037)	*
Degree Expectations							0.013	(.210)		0.002	(.154)	
Math SAT							0.008	(.001)	***	0.004	(.001)	***
Employed - 1st year							-0.184	(.351)		0.568	(.231)	*
Transferred Schools							0.007	(.218)		-0.340	(.156)	*
Changed Majors							-0.081	(.165)		-0.458	(.139)	**
Academic Integration							0.004	(.003)	^	-0.002	(.002)	
Not a U.S. Citizen							0.223	(.354)		0.280	(.312)	

***p<.001 **p<.01 *p<.05 ^p<.10

Shading: blue = p<.01 between models (Math SAT, Model 2); green = p<.05 bewteen models (Black, Academic Integration, Model 2); pink = p<.10 between models (Asian and parentBach, Model 1; Hispanic, Employed - 1st year, Changed Majors, Model 2)

Table 5.4 also shows the significance of race in status competition processes *among* women for access to math science majors. These effects are particularly evident in Model 2, where both Hispanic and black women are significantly more likely to major in math science fields than white women. These effects do not occur among men, for whom race is significantly only for Asians. While the Asian advantage is not significantly different between men and women, the racial effects for blacks and Hispanics are different between genders, suggesting that status competition between racial groups plays an important role in determining which women will major in math sciences. Figure 5.2 clearly illustrates these differences. In it, we see not only the dramatic gender inequality in math science majors, but also the higher rates of math science majoring among Asian men (as compared to other men) and the higher rates of math science majoring among women-of-color (as compared to white women).

Figure 5.2. Probability of Majoring in Mathematical Sciences vs. Non-STEM: Intersectional Effect of Race and Parental Education by Gender



Finally, Model 2 of Table 5.4 shows that family income plays a role among men, with men from higher income backgrounds less likely to major in mathematical sciences. While income level appears not to significantly predict whether or not women will or will not major in math sciences, the difference between income's effect on men and on women is not significant.

In sum, gender, race and class all significantly impact whether a student will major in a mathematical science field (i.e., physical science, math, computer science and engineering). The gender effect is the most pronounced here, but we also see that intersectional status effects matter with Asian men being most and white women being least likely to major in these fields. The inclusion of intersectional statuses also reveals that class-based status competition processes are occurring *within* genders, with parental education indirectly influencing math science majoring for women and family income directly impacting math science majoring for men.

For men, who are already more likely to enter math science fields, coming from a *lower* income family increases one's chances of majoring in these fields whereas for women, who are already less likely to major in math sciences, having a *higher* class background increases one's chances of majoring in math sciences. This pattern confirms the complexities of class dynamics in the U.S., such that particular ways of measuring class are more or less salient for different population groups. That cultural/social class measures appear more important for women while economic class measures appear more important for men fits historical patterns of class mobility. Cultural and social capital have historically provided more mobility for women, whose class status was determined through birth and then through marriage. Increasing one's social and cultural capital thus provided opportunities for mobility through marriage into higher-class families. For men, however, class position was primarily determined through economic means, with economic success resulting in class mobility (Karabel 2005; Solomon 1985; Steinberg

1981). Today, we see women's cultural and social capital (measured by parental education) resulting in higher levels of academic preparation and expectations and thus in higher levels of math science majoring. For men, we see the push to enter these fields drop among those from higher-income families, whose class position may be considered secured and thus may be less concerned with mobility. As such, we can begin to better formulate how the "science pipeline" may work differently for men and women, incorporating different critical competition along the way. Further understanding of the status competition processes at the intersection of gender*class would be greatly aided by a qualitative examination of the meanings associated with these fields by students from various backgrounds.

Life Science Majors vs. Non-STEM Majors

Of race, class and gender, gender remained a strong predictor of STEM majoring across models in Chapter 4, and its effect increased in the analysis of the mathematical sciences (i.e., physical science, math, computer science and engineering). Interestingly, gender is not significant in the models comparing life science majors to non-STEM majors, a finding consistent with recent research indicating that women have surpassed men in earning life science degrees (Riegle-Crumb and King 2010; NSF 2007). Lack of gender inequality does not, however, indicate that racial- and class-based status competition processes are not employed differently in determining *which* women and *which* men will major in life science fields. In fact, my analysis reveals significant race and class effects (sometimes by gender) in the life sciences.

Aside from the lack of any gender effect, the results in the two basic models (see Table 5.5) are consistent with previous findings. Table 5.5 demonstrates that the Asian advantage persists in the life sciences as well as the mathematical sciences, as we have seen. In Model 1 of Table 5.5 being Asian has a relatively strong effect on whether or not a student will major in life sciences; while this effect decreases slightly with the inclusion of student development controls in Model 2, it remains one of the strongest predictors. In fact, even with the control variables, the racial effect for Asians is stronger for the life sciences than for STEM majors in general (compare to Table 4.2 / Model 2).

TABLE 5.5. Weighted Logistic Regression of Life Science Majors: Student Status and Control Effects.

	Model 1			Model 2		
	b	se		b	se	
(Intercept)	-2.068	(.535)	***	-4.081	(.595)	***
Female	-0.028	(.120)		0.020	(.128)	
Black	-0.177	(.199)		0.160	(.203)	
Hispanic	-0.182	(.201)		0.018	(.200)	
Asian	0.775	(.168)	***	0.650	(.175)	***
parentBach	0.319	(.116)	**	0.025	(.121)	
ln Income	-0.029	(.048)		-0.074	(.041)	^
Degree Expectations				0.553	(.163)	***
Math SAT				0.004	(.001)	***
Employed - 1st year				-0.538	(.242)	*
Transferred Schools				-0.119	(.135)	
Changed Majors				-0.018	(.111)	
Academic Integration				0.002	(.001)	
Not a U.S. Citizen				-0.130	(.277)	

***p<.001 **p<.01 *p<.05 ^p<.10

We also see the significant positive effect of parental education (in Table 5.5 / Model 1) that disappears once student development controls are added in Model 2, indicating that most of the status competition processes related to parental education occur through other academic effects (e.g., competition with regard to SAT scores, expectations around graduate school, and having to work full-time during college). The findings with regard to income are also consistent with the analyses for STEM majors, in general, and for mathematical science majors. Income is not significant in Model 1, but reaches significance once we control for variation in student development effects in Model 2. Again, higher levels of income are associated with lower rates of majoring in life science fields.

Table 5.6 includes two-way interactions with race. In Model 1, we see a significant race*gender interaction among Asians. Essentially, we see that the higher rates of Asians majoring in life science fields (as seen in Table 5.5) occur predominantly among Asian men (there is still a positive effect for Asian women, but it is greatly reduced). Figure 5.3 depicts this different between Asian men and virtually everyone else at mean income levels.

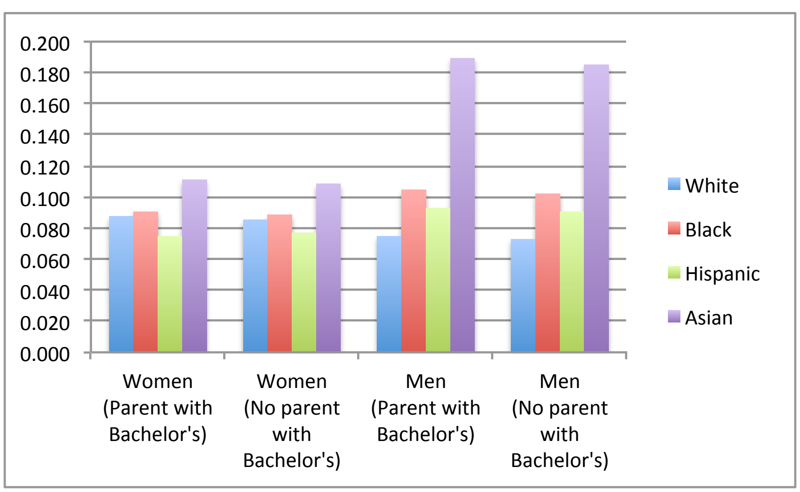
We might interpret this finding as suggesting that when gender disparities decrease (i.e., women are faring relatively well in status competition with men), the racial advantage accruing to Asian women decreases. Meanwhile, the flux of women into the life sciences may actually increase competition among men, resulting in an additional racial payoff for Asian men. In other words, changes in inequality with regard to gender may actually change levels racial and class equality as status competition processes adjust to determine who gains/retains access to scarce resources.

TABLE 5.6. Weighted Logistic Regression of Life Science Majors: Intersectional Status Effects.

	Model 1			Model 2		
	b	se		b	se	
(Intercept)	-4.157	(.596)	***	-3.658	(.714)	***
Female	0.171	(.140)		0.023	(.127)	
Black	0.369	(.344)		-0.900	(.996)	
Hispanic	0.236	(.365)		-2.462	(1.370)	^
Asian	1.062	(.248)	***	0.697	(.889)	
parentBach	0.027	(.121)		0.028	(.121)	
ln Income	-0.077	(.041)	^	-0.114	(.054)	*
Degree Expectations	0.543	(.166)	**	0.557	(.163)	***
Math SAT	0.004	(.001)	***	0.004	(.001)	***
Employed - 1st year	-0.520	(.239)	*	-0.524	(.241)	*
Transferred Schools	-0.129	(.135)		-0.126	(.135)	
Changed Majors	-0.018	(.110)		-0.021	(.111)	
Academic Integration	0.002	(.001)		0.002	(.001)	^
Not a U.S. Citizen	-0.141	(.283)		-0.072	(.277)	
Black*Female	-0.330	(.404)				
Hispanic*Female	-0.346	(.452)				
Asian*Female	-0.795	(.331)	*			
Black*lnIncome				0.102	(.096)	
Hispanic*lnIncome				0.238	(.129)	^
Asian*lnIncome				-0.008	(.081)	

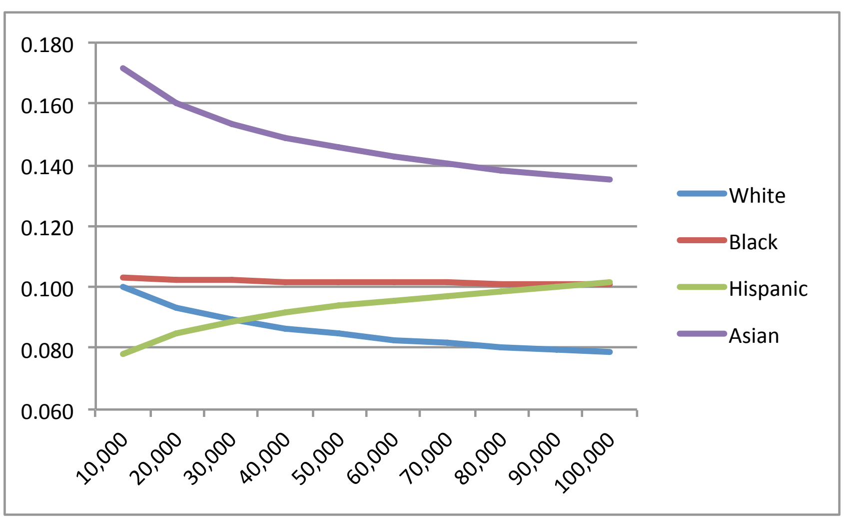
***p<.001 **p<.01 *p<.05 ^p<.10

Figure 5.3. Probability of Majoring in Life Sciences vs. Non-STEM: Intersectional Effects of Race and Parental Education by Gender



In Model 2 of Table 5.6, we see a marginally significant relationship between race and income for Hispanic students. We saw a similar effect among STEM majors, in general, but not among mathematical science majors. Again, income appears to work in the opposite direction for Hispanic students such that students from higher income families are more likely to enter life science fields, whereas the opposite is true among whites. We also see that the coefficient for Hispanic becomes large, negative and marginally significant. In other words, while race penalizes Hispanics, the penalty becomes less severe with increasing income such that around a family income of $30,000, Hispanic students actually major in the life sciences at higher rates than their white peers (see Figure 5.4). It is worth noting here that the effect of race*income for Asians and blacks is not significantly different from its effect for whites, but again we can see here the higher levels of life science majoring among Asians regardless of income.

Figure 5.4. Probability of Majoring in Life Sciences vs. Non-STEM: Intersectional Effects of Race and Income



That the intersection of income and race is significant for Whites and Hispanics signals that, among those less likely to enter life science fields, economic class plays a role in determining which students win the status competition process, gaining access to social resources (here, a major in a life science field). That income works in opposite directions also tells us that status competition processes among whites differ from those among Hispanics, meaning that the winners and losers of *within* race status competition may not be consistent across races. Alternatively, the winners and losers may be consistent, but the prize may be different (i.e., a life science major may be a desirable resources for high income Hispanic students, but not for high income white students). The participation of individuals (and groups) in status competition processes is determined by their initial status position; thus, to continue the metaphor, some students may be mere spectators in the competition for STEM majors, competing instead for an alternate prize (e.g., major in business or finance). Having identified these intersectional status patterns in my quantitative analysis, future qualitative analysis should consider variation in meanings associated with particular majors for students from different intersectional status groups.

Finally, Table 5.7 describes two-way interactions using split gender models, first with only race and class variables and then adding student development controls. Given the lack of significant difference by gender in the life sciences, these models show the significance of race and class in predicting *which* women and *which* men will major in life sciences, as well as how race and class make work differently for men and women.

TABLE 5.7. Weighted Logistic Regression of Life Science Majors: Status Effects by Gender.

	Model 1						Model 2					
	WOMEN			MEN			WOMEN			MEN		
	b	se		b	se		b	se		b	se	
(Intercept)	-1.957	(.735)	**	-2.196	(.601)	***	-4.716	(.706)	***	-3.214	(.808)	***
Black	-0.326	(.246)		0.060	(.328)		0.154	(.244)		0.223	(.356)	
Hispanic	-0.315	(.249)		0.026	(.350)		-0.052	(.250)		0.165	(.348)	
Asian	0.395	(.243)		1.179	(.242)	***	0.192	(.243)		1.108	(.254)	***
parentBach	0.307	(.142)	*	0.347	(.204)	^	-0.060	(.157)		0.147	(.192)	
ln Income	-0.036	(.065)		-0.028	(.056)		-0.100	(.051)	*	-0.051	(.054)	
Degree Expectations							0.484	(.216)	*	0.627	(.239)	**
Math SAT							0.006	(.001)	***	0.002	(.001)	
Employed - 1st year							-0.504	(.287)	^	-0.511	(.398)	
Transferred Schools							-0.088	(.183)		-0.168	(.191)	
Changed Majors							0.106	(.149)		-0.193	(.172)	
Academic Integration							0.004	(.002)	*	0.001	(.002)	
Not a U.S. Citizen							-0.117	(.403)		-0.206	(.389)	

***p<.001 **p<.01 *p<.05 ^p<.10

p<.01 between models (blue shading: Asian, Model 2)
p<.05 bewteen models (green shading: Asian, Model 1; Math SAT, Model 2)
p<.10 between models

Model 1 of Table 5.7 confirms that the higher rate of life science majoring among Asians occurs among Asian men, not Asian women. The model gives us no reason to believe that Asian women are any more likely than white women to major in a life science field. This effect persists even after the addition of student development controls in Model 2 of Table 5.7. We also see a familiar pattern of effects for parental education which matter for both men and women in Model 1, but are not significant once student development effects are accounted for in Model 2.

Model 2 also reveals that family income effects are significant *among* women, but not among men. This difference in this effect is not significant between men and women. In other words, increases in income are associated with decreased rates of life science majoring for both men and women (of course, this is on average and does not account for variations by race), but the impact of income among women is large enough to be a useful predictor of life science majoring whereas the impact of income among men is not.

In sum, analyses in the life sciences suggest that lack of gender inequality does not indicate an absence of racial and class-based status competition *within* genders - determining which men and which women enter a field. Here, we see that women from lower income groups are more likely to enter life science fields, but income has little effect on determining which men enter life science fields. In contrast, racial competition among men help to determine who enters life science fields with Asian men "winning" the largest portion of majors. Thus, only by examining STEM majoring through such an intersectional framework can we begin to understand how status competition processes determine who enters and remains in STEM pipelines and when and where the pipelines may begin for different population groups.

Mathematical Science Majors vs. Life Science Majors

Whereas the previous two sections analyzed the factors that influenced students to major in a STEM field instead of a non-STEM field, this section analyzes the factors that lead students to major in a mathematical science field (including physical science, math, computer science and engineering) instead of a life science field. Thus, the sample of students includes only those who are STEM majors. Students who indicated a double major in a math science and a life science were counted as math science majors for the purpose of this analysis. I chose to place the emphasis on whether or not a student majored in a math science field because, as we have seen, gender inequality persists at relatively high levels in the math sciences whereas women have attained parity with men in the life sciences. I present similar models in this section: exploring the effects of race, class and gender both individually and with student development controls (Table 5.8); adding two-way intersectional statuses (Table 5.9); and looking at effects using split gender models (Table 5.10).

TABLE 5.8. Weighted Logistic Regression of Math Science Majors (versus Life Science Majors): Student Status and Control Effects.

	Model 1			Model 2		
	b	se		b	se	
(Intercept)	1.096	(.490)	**	0.242	(.707)	
Female	-1.589	(.154)	***	-1.503	(.154)	***
Black	0.077	(.290)		0.362	(.305)	
Hispanic	0.353	(.309)		0.551	(.316)	^
Asian	-0.101	(.249)		-0.111	(.274)	
parentBach	0.087	(.160)		0.036	(.164)	
ln Income	-0.019	(.045)		-0.020	(.044)	
Degree Expectations				-0.599	(.195)	**
Math SAT				0.002	(.001)	*
Employed - 1st year				0.850	(.284)	**
Transferred Schools				-0.058	(.191)	
Changed Majors				-0.210	(.138)	
Academic Integration				-0.001	(.002)	
Not a U.S. Citizen				0.451	(.308)	

***p<.001 **p<.01 *p<.05 ^p<.10

Table 5.8 shows that gender can be used to predict whether a student majors in the math sciences versus the life sciences. Women are significantly less likely than men to major in math science fields, an effect that remains significant across models. Perhaps most interestingly, however, Model 1 of Table 5.8 shows that neither race nor class appears to have any significant impact on whether a student majors in the math sciences or the life sciences. Model 2 shows that Hispanic students are marginally more likely to major in math science fields than in life science fields, controlling for educational expectations, academic performance and early college experience. There is no evidence to suggest differences among Asians, blacks and whites, and there is no evidence that class differences measured either as economic capital or social/cultural capital have a significant impact. Hence, Table 5.8 suggests that while racial and class statuses may significantly influence whether a student majors in a STEM field or a non-STEM field, they have little if any impact on the *particular* STEM field that a student chooses (between mathematical sciences and life sciences). Instead, the primary status competition criteria for entrance into mathematical versus life science fields is gender-based.

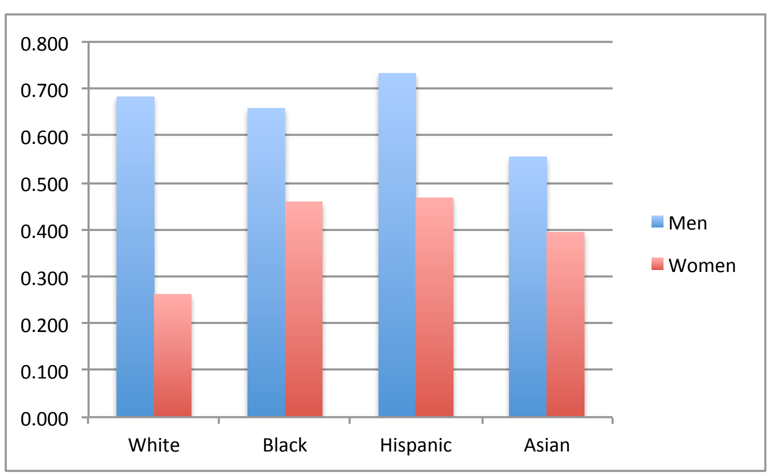
The fact that race and class do not individually influence in which STEM field a student majors does not mean that intersectional statuses do not play a significant role, as we saw with gender in life sciences (i.e., although there were not significant differences by gender, race and class effects varied *within* genders). As such, Table 5.9 presents two models showing that indeed race*gender and race*class intersections do influence whether students enter math sciences or life sciences. In the first, we see size of the gender gap differs by race. Specifically, the largest gender gap exists between white women and white men. The gap between Hispanic women and men does not significantly differ from the gap between white women and men. The gender gaps between black women and men and between Asian women and men, however are significantly smaller than the gender gap among whites (see Figure 5.5). With regard to status competition processes, this indicates that although women are less successful than men in majoring in math science fields, gender-based competition may be particularly fierce among Hispanics and whites. Further research might explore why this is so.

TABLE 5.9. Weighted Logistic Regression of Math Science Majors (versus Life Science Majors): Intersectional Status Effects.

	Model 1			Model 2		
	b	se		b	se	
(Intercept)	0.286	(.706)		-0.786	(.882)	
Female	-1.800	(.189)	***	-1.508	(.155)	***
Black	-0.109	(.337)		2.110	(.996)	*
Hispanic	0.245	(.434)		2.348	(3.662)	
Asian	-0.545	(.347)		1.881	(1.037)	^
parentBach	0.002	(.167)		0.004	(.168)	
ln Income	-0.014	(.043)		0.079	(.061)	
Degree Expectations	-0.603	(.197)	**	-0.603	(.195)	**
Math SAT	0.002	(.001)	*	0.002	(.001)	*
Employed - 1st year	0.854	(.289)	**	0.871	(.280)	**
Transferred Schools	-0.011	(.194)		-0.082	(.190)	
Changed Majors	-0.176	(.135)		-0.202	(.137)	
Academic Integration	-0.001	(.002)		-0.001	(.002)	
Not a U.S. Citizen	0.480	(.302)		0.338	(.308)	
Black*Female	0.980	(.450)	*			
Hispanic*Female	0.660	(.530)				
Asian*Female	1.148	(.466)	*			
Black*lnIncome				-0.166	(.092)	^
Hispanic*lnIncome				-0.166	(.342)	
Asian*lnIncome				-0.188	(.092)	*

***p<.001 **p<.01 *p<.05 ^p<.10

Figure 5.5. Probability of Majoring in Math Sciences vs. Life Sciences: Intersectional Effects of Race and Gender



Model 2 of Table 5.9 suggests that although neither race nor class has an independent effect on the particular STEM field in which a student will major, the intersection of race*class has an impact for black and Asian students as compared to whites. In Model 2, we see that blacks and Asians are significantly more likely to major in math sciences than white students, but that this effect decreases as income increases among black and Asian students. Figures 5.6a and 5.6b illustrate this effect for women and men, respectively. Cell sizes do not permit me to test for gender differences in this interaction (i.e., I cannot include a three-way interaction between gender*race*income). However, I have chosen to create separate figures for this effect to emphasize the fact that the model still includes a significant gendered effect such that women remain less likely to major in math sciences, regardless of race and income. Although the effect of income among Hispanic students appears visually similar to the effects of income among blacks and Asians, greater variance among Hispanics prevents us from concluding that income effects Hispanics differently than it effects whites (as the comparison group).

Figure 5.6a. Probability of Majoring in Physical Sciences vs. Life Sciences: Intersectional Effects of Race and Income for Women

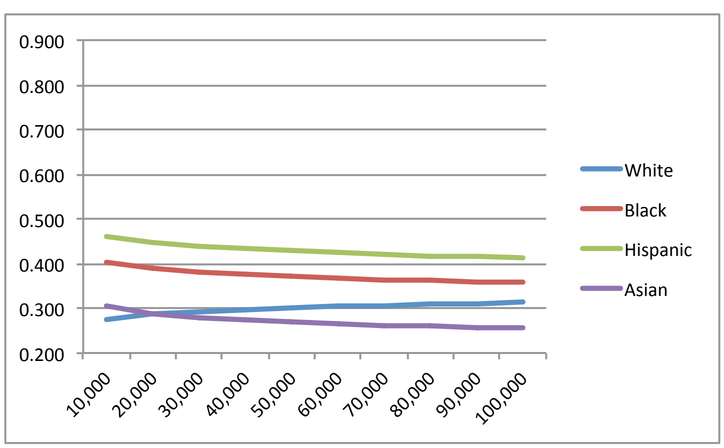
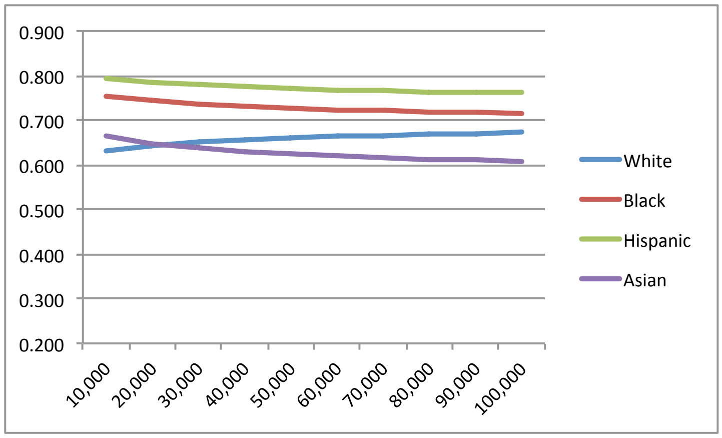


Figure 5.6b. Probability of Majoring in Physical Sciences vs. Life Sciences: Intersectional Effects of Race and Income for Men



Finally, in Table 5.10, I present the split-gender analyses. As in previous analyses, these models allow for comparisons *among* women (in comparison to white women) and *among* men (in comparison to white men) whereas in the initial models, both men and women are compared to white men. Again, the shaded bars in Table 5.10 indicate where the effects among women differ significantly from the effects among men.

TABLE 5.10. Weighted Logistic Regression of Math Science Majors (versus Life Science Majors): Status Effects by Gender.

	Model 1						Model 2					
	WOMEN			MEN			WOMEN			MEN		
	b	se		b	se		b	se		b	se	
(Intercept)	-1.335	(.615)	*	1.843	(.808)	*	-2.613	(.922)	**	1.316	(1.012)	
Black	0.571	(.364)		-0.383	(.343)		0.943	(.382)	*	-0.221	(.357)	
Hispanic	0.839	(.351)	*	-0.066	(.428)		0.984	(.374)	**	0.202	(.423)	
Asian	0.752	(.320)	*	-0.634	(.316)	*	0.637	(.343)	^	-0.548	(.355)	
parentBach	0.306	(.218)		-0.108	(.248)		0.206	(.231)		-0.171	(.237)	
ln Income	0.028	(.057)		-0.063	(.076)		0.032	(.053)		-0.075	(.075)	
Degree Expectations							-0.544	(.316)	^	-0.670	(.251)	**
Math SAT							0.003	(.001)	*	0.002	(.001)	^
Employed - 1st year							0.420	(.413)		1.137	(.445)	*
Transferred Schools							0.210	(.279)		-0.201	(.250)	
Changed Majors							-0.188	(.200)		-0.204	(.202)	
Academic Integration							0.001	(.003)		-0.002	(.003)	
Not a U.S. Citizen							0.496	(.412)		0.384	(.431)	

***p<.001 **p<.01 *p<.05 ^p<.10

p<.01 between models (blue shading)
p<.05 bewteen models (green shading)
p<.10 between models (red shading)

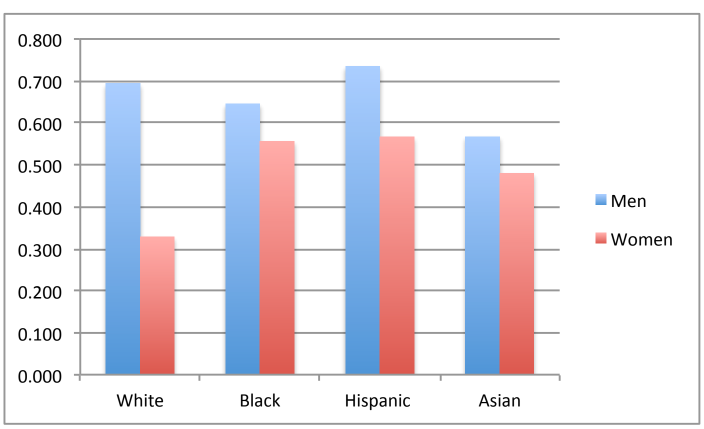
Model 1 of Table 5.10 clearly shows how racial effects differ between men and women (for all races). Although race does not significantly predict *within* gender variance for blacks versus whites, we can see that race significantly increases the chances of majoring a math science (as compared to a life science) for black women more than for black men. This does not mean that black women major in math science fields at higher rates than black men; actual rates of majoring are influenced not only by racial effects, but also by gender, class and most likely other factors. The shaded bar in Table 5.10 simply indicates that race has a more positive effect for black women than for black men (although neither is significantly more or less likely to major in math sciences than their white peers).

Effects for Hispanic and Asian students in Model 1 are more easily understood. Both Hispanic and Asian women are more likely than white women to major in math science fields as compared to life science fields. Moreover, both of these effects are significantly different than the effects for Hispanic and Asian men (compared to white men). This model gives us no evidence that Hispanic men major in math science fields at rates different than those of white men, but demonstrates that Asian men are actually less likely to major in math science fields than white men.

In Model 2 of Table 5.10, we see that, holding constant student development effects, black women are actually more likely to major in math science fields than their white female peers, but Asian men are no longer less likely to major in math science fields than their white male peers. This model particularly confirms that race-based status competition processes play a distinct role in determining which women major in math sciences (versus life sciences). The same is not true for men, among whom race appears to make no significant difference (see Figure 5.7). Figure 5.7 closely resembles Figure 5.5; variations are due to the calculation of separate student development control effects for men and women in Figure 5.7. Thus, we can conclude that different status competition processes are occurring by gender to determining particular STEM majors.

Class processes remain conspicuously absent in the *between* STEM analyses except when they're considered as interactions with race. Yet, class measures were important predictors of whether a student majored in a STEM field (both math sciences and life sciences) or a non-STEM field. This suggests that classic class competition processes may be important in determining *which* students major in science, but then less important in sorting students into *particular* STEM majors. Such a finding suggests that all STEM fields may be perceived as providing opportunities for economic mobility. In contrast, we see that gender greatly influences *which* STEM majors a student enters and that the specific effects of gender differ by race. This implies that individuals may perceive particular STEM fields (or particular pipelines) as better options based on race and/or gender.

Figure 5.7. Probability of Majoring in Math Sciences vs. Life Sciences: Intersectional Effects of Race and Gender



Effects of Student Development Controls

Lastly, differences between the student development controls that influence major (as well differences in control effects by gender) warrant a brief discussion. The analyses in Chapter 4 revealed that, with the exception of Math SAT, which was a significant predictor of STEM majoring for all students, student development controls were significant *either* among women *or* among men. Specifically, degree expectations and academic integration positively influenced STEM majoring among women while transferring between schools and/or changing majors decreased the likely of STEM majoring among men. Full-time employment during a student's first year of college also had a more negative impact on women than on men. The patterns for these controls differ for each of the three analyses presented in this chapter.

In Chapter 5, student development effects on math science majoring compared to non-STEM reveal patterns similar to those in the STEM analysis of Chapter 4. Specifically, Math SAT has a consistently strong effect for all students but especially among women. Academic integration, full-time employment, transferring schools and changing majors retain the significance and relationships described above. Again, this suggests that status competition processes for entrance to the STEM pipeline may happen earlier among women through the formation of educational expectations and early academic preparation. The effects associated with transferring or changing majors imply that when women change majors, they do so *within* mathematical science fields (or from non-STEM field to non-STEM field), whereas men are changing majors *from* mathematical science fields to non-STEM fields. Similarly, transferring between schools appears to interrupt (or mark an interruption in) men's educational trajectories but not women's. If so, then we can conclude that women appear to enter or reject the math science pipeline earlier in their academic careers than men whereas men have more flexibility in deciding to enter and/or leave the STEM pipeline (i.e., academic preparedness and expectations seem to matter less for men, but men are more likely to opt into and then change out-of math science majors). Perhaps more importantly, it confirms recent critiques of the very notion of a STEM pipeline (i.e., students enter and follow a prescribed course toward an eventual STEM career) on the basis that this model discounts opportunities for students to move sideways—into and out of STEM fields—as well as variation between the paths followed by women and men (c.f. Xie and Shauman 2003).

For life science majors (compared to non-STEM majors) degree expectations, Math SAT and employment are significant predictors across models. While expecting to earn a graduate degree increases the chances that any student, male or female, will major in life sciences versus a non-STEM field, Math SAT score is a significant predictor only among women. Among men, there is no evidence that changes in Math SAT are related to rates of life science majoring. Employment and academic integration play a role in determining which women major in life sciences, with negative and positive effects, respectively, but do not significantly influence life science majoring among men. Neither transfers nor changes of major significantly influence life science majoring in any of the models. The only student development control that differs significantly *between* men and women is Math SAT. That student development factors influence life science majoring more unilaterally suggests that pipelines into the life sciences for men and women may look similar and the intersectional status effects described above may play an even more important part in selecting winners and losers.

Finally, my analysis comparing math science majors and life science majors reveals only three significant student controls. First, expecting to earn a graduate degree decreases the chances that a student will major in math science instead of life science. While this may seem counter-intuitive, math science majors prepare students for careers in a number of professional and technical fields that do not require graduate work (particularly in computer science and engineering) whereas a critical proportion of the students majoring in life sciences intend to continue to medical school. Second, higher Math SAT scores make a student significantly more likely to major in math sciences than in life sciences. Third, among men, working full-time significantly increases one's chances of majoring in the math sciences; no similar effect is found among women. These are the only three student development variables that significantly impact choice of a specific STEM major. Yet, gender differences persist between math sciences and life sciences and race plays a significant role in determining which women major in which STEM field. In other words, for women, while student development factors may play a role in predicting that they will major in a STEM field, the decision of *which* STEM major is influenced primarily by Math SAT and race. Among men, coming from a lower income family makes one more likely to major in STEM, but experiences during college are more likely to result in students exiting math science majors (and moving into non-STEM majors). Furthermore for men, decisions about whether to major in a math science or a life science hinge more upon expectations about graduate school and employment and less upon intersectional statuses.

Conclusions

This chapter addresses several research questions. First, what status competition processes influence who majors in the math sciences as compared to non-STEM fields? Second, what status competition processes help determine who majors in the life sciences as compared to non-STEM fields? In answering these questions, I look particularly at the representation of students from various intersectional status groups and so provide a more accurate assessment of current levels of horizontal inequality in the U.S. postsecondary system. Third, I analyze factors that lead students to major in one or the other of these STEM fields (i.e., if a student is going to major in STEM, which status competition processes determine in which STEM field he/she will major). This comparison helps clarify the perceived status of particular STEM fields and identify how policies might better target students from underrepresented status groups. I will address each of these issues below, focusing on both the practical and theoretical implications of my results.

The first section confirmed that gender continues to play a significant role in predicting who will major in the mathematical sciences, with women of all races and classes less likely than men to major in math science fields. Status competition processes related to race and class also appear to play a larger role in determining *which* women major in math science fields. For example, Table 5.3 demonstrates that the effect of parental education differs for men and women, having a larger positive effect on women. Likewise, Table 5.4 shows that race matters among women, with black women, Hispanic women, and Asian women significantly more likely to major in math science fields than white women. In contrast, only Asian men are more likely to major in math science fields, an effect that is marginally significant, and I find no difference in rates between white men, Hispanic men and black men. Moreover, this Asian effect does not differ significantly *between* men and women, and can thus be more accurately termed a racial effect than an intersectional effect, whereas the effects for blacks and Hispanics are clearly intersectional, differing by race*gender.

Such findings indicate that intersectionality may matter more for women than for men. This fits nicely with status competition theory, which would suggest that those who have secured a particular status for their group (in this case, men, who have traditionally maintained a monopoly on math science fields) must simply defend it against those who are attempting to gain access, in this case women. Those attempting to gain access to this much-protected resource, on the other hand, are in competition not only with those who currently and traditionally have controlled it (i.e., men), but also with others in their peer group who are attempting to gain access (i.e., other women). Thus, we would expect multiple status competition processes to be activated in determining *which* women will break through into this male-dominated domain. Of course, the fact that math sciences are traditionally male-dominated may also determine who seeks to engage in the competition. It is possible that white women have the lowest rates of math science majoring not because they are losing in the status competition, but because they are selecting not to compete. In the U.S., for example, a woman's social status has historically been determined through marriage (i.e., by the status of her husband). This pattern has continued disproportionately for white women (in comparison to women of color who have frequently been forced into work outside the home and thus may be more concerned about unemployment and job stability). Further research must explore the motivations of students from various intersectional status groups in order to determine whether and why they are participating in status competition processes for STEM majors. Regardless, my results clearly demonstrate that ignoring intersectionality in analyzing horizontal equity can lead to inaccurate assessments of status group representation in math science fields.

The second section of my analysis, which focused on factors influencing life science majors, reinforces this conclusion. First, my results confirm those of recent studies. I find no evidence of a gender difference in rates of life science majoring. However, my results do indicate that intersectional statuses do predict life science majoring. So, while women and men are majoring in the life sciences at virtually the same rates, there are differences in *which* women and *which* men are majoring in the life sciences. Specifically, we saw no racial differences between women unlike the math sciences, where race appears to play an important role in determining women's majors. In contrast, we saw that the marginally positive effect for Asian men in the math sciences becomes a large and significant positive effect in the life sciences. Here, it's not simply a positive male effect or a positive Asian effect, but specifically an intersectional effect of being male and Asian (see Figure 5.3). Failing to examine intersectional effects, in this case, might have resulted in an incorrect positive finding either for Asian women (who are *not* more likely than other women to major in life sciences) or for black, white and Hispanic men (who are actually no more likely to major in the life sciences than women). I found similar results with regard to the effects of class where intersections of gender and class reveal differences *among* men and *among* women with regard to who majors in life science fields. Thus, my results serve as a warning to educators or policy-makers who may quickly dismiss concerns about equity, citing studies that declare the end of the gender gap in the life sciences without assessing how intersectional statuses influence the educational trajectories of both men and women.

In the third section, I compare students who major in math sciences to students who major in the life sciences, identifying differences among STEM majors by field. To summarize, I find that gender is primary. Those women who do major in STEM, overwhelmingly major in the life sciences. In contrast, I find few direct racial or class effects between the math sciences and life sciences. Instead, I find strong intersectional effects of gender*race. Specifically, Hispanic, white and black men have the highest rates of majoring in the math sciences as compared to the life sciences. Asian men and women of color form a second tier. Finally, white women are the only group significantly more likely to major in life sciences than math sciences (see Figure 5.7).[13]

Interestingly, income effects also differ by race. Here, while family income is positively related to life science majoring for students of color (i.e., as family income increases, so does the chance that a student will major in life sciences instead of math sciences), family income is negatively related to life science majoring for white students. Thus, for white students, math sciences appear more desirable to students from higher income families than life sciences. Again, such a pattern reinforces status competition theories, which both allow for social mobility, but stress the importance of initial status. Status competition theory acknowledges the importance of initial status in determining entry or non-entry into particular status competition processes; likewise, my results in this chapter raise questions about which majors and degrees are considered desirable

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[13] This finding is particularly striking given the fewer possible majors included in the life sciences category than in the math sciences category. Of students in STEM majors, roughly 58% are in the math sciences and only 42% are in the life sciences.

resources for students from particular intersectional status groups. Moreover, differences exist between the opportunities offer by various STEM degrees. For example, students of color from higher income families who major in STEM fields may be looking for majors that grant access to stable employment in a high-status profession (e.g., preparing for medical school, etc.) while students from higher income white families, who may have a longer history of financial security,[14] may be able to pursue riskier career paths (e.g., as a nuclear physicist or theoretical mathematician). The data do not permit me to analyze the perceived value of various majors as resources, but the findings certainly suggest that the status competition processes for majoring in life sciences differ from the status competition processes for majoring in math science majors.

Chapters 4 and 5 have focused on building our understanding of status competition processes to incorporate intersectional status. Expanding on traditional applications of status competition theory to sociology of education, I have analyzed not just how status competition between class groups leads to social exclusion within STEM majors, but also applied status competition theory to explore gender and racial inequalities in field of study. Perhaps more importantly, I have hypothesized and found evidence that status competition works at the intersectional level, meaning that women, as a group, compete not just with men for access to STEM fields, but also with women of other races and class backgrounds. At the individual level, these women also compete with women of their own racial and class background. In Chapter 6, I examine how

[14] See Conley (1999) for a discussion of the accumulation of wealth by race.

institutional context influences these status competition processes by analyzing differences in STEM majors both *within* and *between* types of postsecondary institutions.

Chapter 6:
How Institutional Context Moderates Intersectional Status Effects

In this chapter, I expand my analysis of intersectional statuses and STEM majors to include the effect of postsecondary institutions. The role of institutions is critical to an understanding of status competition processes in higher education because status competition theory argues that, as the negotiation of status hierarchies takes place between and within colleges and universities, individual opportunity may actually be limited by the disproportionate channeling of certain students into particular schools or into less prestigious courses of study within schools (Karabel 2005; Brint and Karabel 1989; Charles and Bradley 2002). Here, I explore the relationship between the diversity of institutional types within the U.S. higher educational system and the social inequalities related to STEM majoring. In doing so, I examine both how status competition processes may be shaped within the context of a particular type of institution and how intersectional status effects may become more or less salient depending upon the status competition processes at work within any given institutional context.

Specifically, I ask how does institutional type influence the actual effects of intersectional statuses (intersections of race, class, and gender) on who majors in STEM fields? To answer this question, I address both status competition processes *within* particular types of institutions (exploring which intersectional status groups are under- and overrepresented in STEM majors at various types of postsecondary institutions) and status competition processes *between* types of institutions (examining institutions as moderators of social inequality around STEM majoring). As such, I seek not to replicate other studies that explore the direct effects of institutional type on STEM majoring (as reviewed in Chapter 2), but to explain how institutional context changes the effects of intersectional status, focusing on five institutional contexts: institutions classified as doctorate-granting according to the Carnegie system, public colleges and universities, land-grant institutions, historically black colleges and universities (HBCUs) and Hispanic-serving institutions (HSIs).

STEM Majors and Institutional Type

The Carnegie Classification of Institutions of Higher Education, developed by the Carnegie Foundation for the Advancement of Teaching, is a system for categorizing postsecondary institutions in the U.S. for means of comparability. The classification system includes all accredited, degree-granting colleges and universities in the U.S. represented in IPEDS. The basic classifications include: doctorate-granting universities, master's colleges and universities, baccalaureate colleges, associates colleges, special focus institutions, and tribal colleges. For the purposes of my analysis, I distinguish only between doctorate-granting universities (a category which includes three subgroups: research universities with very high research activity (RU/VH), research universities with high research activity (RU/H) and doctoral/research universities (DRU)) and other types of institutions.

Current research suggests multiple possible effects with regard to the impact of Carnegie classification on STEM majoring. On the one hand, many studies have found that STEM faculty at research institutions perceive teaching and research as competing priorities, with research the more valued institutional priority (Fairweather 1996; Massy, Wilger and Colbeck 1994). As such, Carnegie Doctorate institutions might have a negative impact on equity in STEM fields, as quality of pedagogy is often cited as a reason for leaving STEM majors, with students complaining both about the availability of faculty members and the use of competitive grading systems that discourages student collaboration (Seymour 1995). On the other hand, the opportunity for undergraduates to participate in faculty research at doctorate-granting universities through part-time jobs as lab assistants, etc. should create a culture of wider interest in STEM fields. As such, STEM fields may be seen as more immediately lucrative fields of study and thus positively impact the majoring decisions of students from underrepresented populations (particularly those from lower-class backgrounds who might be depending upon work-study funding or other part-time employment to support themselves financially).

I then compare public colleges and universities to private colleges and universities. Given that public schools have historically sought to provide greater opportunities for advanced education for all citizens, it is not surprising that they have been found to have been critical in increasing postsecondary enrollment (i.e., vertical equity) among women and racial minorities. In contrast, private colleges tend to have higher retention rates than public schools. This effect stems from both the lower number of part-time students attending private schools (part-time students are much more likely to have interrupted post-secondary educational careers) and their greater ability to screen-out applicants during the admissions process (Tinto 1975). Status competition theory would thus suggest that students from historically marginalized groups would be more likely to major in STEM fields at public institutions, where institutional oversight and funding is less directly tied to alumni control. While some studies have linked institutional control to various patterns of academic study, few have examined the role of institutional control in relation both to students' intersectional statuses and rates of STEM majoring.

Astin (1993) found that students attending a private college are more likely to major in the physical and social sciences, but those attending a public university are more likely to enter the biological sciences, health-related fields and engineering. Such findings address a potential institutional effect, but fail to disaggregate it by gender, race or class (let alone by gender, race and class). Smart and Pascarella (1986) analyzed the effect of institutional control on student socio-economic status nine years after college graduation, conducting separate analyses for white men, white women, minority men, and minority women. They found that attending a private institution had significant positive effects on rates of STEM majoring, but for white males only. Such findings suggest that my analysis, which further distinguishes between intersectional statuses and their contextual importance within institutional contexts, will yield a better understanding of potential differences between public and private institutions.

Land-grant institutions derive their name from their founding and/or funding through the Morrill Land-Grant Acts of 1862 and 1890,[15] which provided federal land and funds to states for the establishment and/or maintenance of one or more colleges devoted to higher-education focused on agriculture and the mechanical arts. These schools were conceived as fulfilling the uniquely American ideal of a system of higher education open to students from all backgrounds – creating opportunities for social mobility (Kerr 1963). As such, we would expect land-grant institutions to yield one of the

[15] The original Morrill Act of 1862 provided each state with land to be used for the establishment and funding of educational institutions focusing on agriculture and the mechanical arts. In 1890, a second Morrill Act was passed that required each state either to demonstrate that race was not a criteria used in admissions or to designate a second land-grant institution for students of color.

more equitable distributions of students into STEM fields. Over the course of the twentieth century, however, many large land-grant universities evolved into elite research institutions and developed the requisite exclusive admission policies, leaving other public institutions to fulfill the dream of a more inclusive postsecondary system. Thus, while public institutions, in general, might be expected to produce more equitable rates of STEM majors because of their educational mission related to inclusion of historically-excluded population groups, Land-grant institutions might serve as the exception to this rule, given their historical focus on postsecondary training in technological fields (many were even named “A&M” or “Tech”) and their racially-segregated history. Interestingly, I am aware of no empirical research exploring the role of land-grant institutions in producing STEM majors (but see Werum 1997, 2001, 2002 for a discussion of race- and gender-related impacts of federal investment into vocational education more generally). Thus, my analysis provides critical insight as to the extent to which land-grant institutions have maintained their original mission by shifting toward science, engineering and technology fields even as they moved away from the training of farmers, miners and mechanics.

Finally, as we will see below, institutions that target particular populations appear successful at increasing STEM majors among those populations. As such, I analyzed models for historically black colleges and universities (HBCUs) and Hispanic-serving institutions (HSIs). Numerous studies have also documented the success of women’s colleges in producing a disproportionate number of female and medical students and scientists (Tidball 1985, 1986). Unfortunately, however, my data did not contain enough enrollees at women’s colleges to permit quantitative analysis.

HBCUs are higher educational institutions originally established to educate the free descendants of former (black) slaves in the U.S. Contention around providing any level of education to this population resulted in debate about appropriate curricula (most famously between Booker T. Washington and W.E.B. DuBois[16]). Most HBCUs were founded during this era (post-Civil War to World War I) either as private or land-grant institutions. As a result, HBCUs vary greatly in size, mission and funding. These institutions played a major role in the education of blacks historically with 62% of all black college students attending HBCUs in 1970 (Orfield 1990). Rates of HBCU attendance have dropped in recent decades though and, by the mid-1990s, HBCUs constituted only 10.6% of total undergraduate enrollments for black students (NCES 2010).

Despite the well-deserved reputation of *private* HBCUs for producing black cultural leaders (especially pastors, teachers, and lawyers), research indicates that HBCUs also produce a disproportionate number of black scientists. For example, more black men and black women attending HBCUs major in a STEM field (22% and 16%) compared to black men and black women attending traditionally white institutions (15% and 9%) (Wenglinsky 1999). Recent research, however, suggests that the advantages of attending an HBCU may be shifting as traditionally white institutions become more adept at and accepting of educating blacks. HBCU graduates experienced a 20% decline in relative wages between the 1970s and 1990s, effectively creating a wage penalty

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[16] While Booker T. Washington argued for a focus on industrial education and vocational training for blacks, leading to stable employment and the accumulation of wealth among blacks, W. E. B. DuBois stressed the need for classical liberal arts education for blacks along with civic rights and leadership. This debate still reverberates in the two distinct types of HBCUs – land-grant/public HBCUs and private HBCUs, respectively.

associated with HBCUs (Fryer and Greenstone 2010). Given the correlation between STEM majors and higher income levels, my analysis seeks not only to update earlier findings related to STEM majoring at HBCUs, but also to clarify how HBCUs may differentially influence black men and women based on their class background.

Hispanic-serving institutions (HSIs) are defined in Title V of the Higher Education Act of 1965 as not-for-profit higher education institutions with a full-time equivalent (FTE) undergraduate student enrollment that is at least 25 percent Hispanic. So, whereas HBCUs were established with the intentional mission of educating blacks and often incorporate curricula reflecting this mission and historical roots to the black community, HSIs are pre-existing institutions that are granted HSI status for financial purposes and an institution's status as an HSI can (theoretically) change over time. Moreover, the designation of HSIs has been a comparatively recent occurrence, stemming from the Higher Education Act of 1965. According to the Hispanic Association of Colleges and Universities, which coordinates research and advocacy efforts of HSIs, 143 4-year colleges and universities in the U.S. held HSI status during the 2009-2010 academic year.

Previous studies have found HSIs to be an important access point to the higher education system more generally, and to STEM majors more specifically, for Hispanic students (NCES 2002). Crisp, Nora and Taggart (2009) find that the odds of declaring a STEM major at a Hispanic-serving institution (HSI) were 1.37 times as large for Hispanics as for whites. Because their sample is limited to students who have earned a 4-year degree from an HSI, however, we cannot say how these Hispanic students (at HSIs) are faring in comparison to Hispanic students at non-HSIs. My analysis remedies this limitation by exploring both how HSIs may influence STEM majors as compared to students attending non-HSIs and how this influence may differ by race and/or gender.

Data and Methods

Construction of the Dataset

The data for this chapter come from both the BPS:04/09 data described in Chapter 3 and a set of institutional variables that I constructed using the National Center for Educational Statistics' Integrated Postsecondary Education Data System (IPEDS) and College Navigator. These two data sets were then merged using the IPEDS ID number listed for each student's "primary institution."[17] I continue to restrict my analysis to those students who, in 2009, either had earned (at any point since they entered the postsecondary system in 2003) or were still working toward a 4-year degree and who have indicated a major field of study (even if it is "undecided" or "undeclared"). To accommodate the complex survey design of the BPS:09, I employed both survey design (BPS09PSU) and sampling (WTA000) weights, using the 'survey' and 'mitools' packages in R (Lumley 2011) to create sub-population procedures ensuring the accuracy of estimated standard errors. I use the 'MICE' package in R (van Burren and Groothuis-Oudshoorn 2011) to impute for missing data.

My analyses in this chapter focus on two groups of independent variables: individual-level social background characteristics and institutional types. In each model, I include the same social background variables as were utilized in Chapter 4: gender, race,

[17] See Chapter 3 for a discussion of the determination of students' primary institutions.

income and parental education level. Again, gender and race are simple categorical variables. The racial categories are mutually exclusive (white, black, Hispanic and Asian) and the Asian category includes both Pacific Islanders and Native Hawaiians. Again, white serves as the reference category in all models. In some of the models, due to sample size, I have had to exclude one or more racial group. When this occurs, I have noted it in the text. In addition to race and gender, I include income and parental education level variables as measures of class. Income is the natural log of the student's reported family, CINCOME (using student's and/or spouse's income for independent students and parents' income for dependent students). In this chapter, I have continued using the dichotomous measure of parental education, indicating whether or not either parent has earned at least a bachelor's degree (parentBach). Although such a measure does not as precisely measure the effects for students at both ends of the educational spectrum, it still allows me to capture effects of social and cultural capital obtained through postsecondary educational experience. See Chapter 3 for a more detailed description of the individual-level social background variables included these institutional models. See Table 6.1 for descriptive statistics pertaining to institutional populations.

The second set of independent variables addresses institutional type. My dimensions of institutional differentiation include: Carnegie classification (for highest degree level offered), institutional control (public/private), land-grant institutions,[18] and

[18] For this analysis, I include both traditionally white and HBCU land-grant institutions as they share historical missions. The comparison group is other (non land-grant) public universities. As such, the analysis does not include the two high-profile private land-grant institutions: Cornell University and M.I.T.

Table 6.1. Table of Means by Institution

	Full Sample		Carnegie Doctorate		Public		Land Grant		HBCU		HSI	
	mean	se	means	se	mean	se	mean	se	mean	se	mean	se
STEM Major	0.210	(.008)	0.248	(.011)	0.209	(.009)	0.261	(.019)	0.264	(.036)	0.183	(.042)
Female	0.567	(.009)	0.540	(.012)	0.560	(.011)	0.537	(.024)	0.680	(.041)	0.643	(.048)
White	0.715	(.014)	0.721	(.014)	0.712	(.017)	0.746	(.025)	0.000	(.000)	0.000	(.000)
Black	0.101	(.009)	0.087	(.009)	0.096	(.011)	0.099	(.020)	1.000	(.000)	0.000	(.000)
Hispanic	0.112	(.009)	0.093	(.008)	0.116	(.010)	0.067	(.011)	0.000	(.000)	1.000	(.000)
Asian	0.073	(.006)	0.099	(.009)	0.076	(.007)	0.088	(.016)	0.000	(.000)	0.000	(.000)
parentBach	0.560	(.010)	0.642	(.013)	0.542	(.012)	0.629	(.024)	0.419	(.035)	0.336	(.046)
Famiily Income	72213.328	(1118.720)	80030.044	(1509.819)	70902.195	(1293.128)	79939.306	(2782.982)	44752.323	(4468.007)	37429.241	(2794.927)
Degree Expectations	0.731	(.009)	0.801	(.009)	0.729	(.010)	0.785	(.018)	0.738	(.069)	0.762	(.036)
Math SAT	517.281	(3.026)	550.182	(3.510)	511.568	(3.297)	549.297	(5.936)	404.082	(11.626)	442.591	(15.757)
Employed - 1st year	0.124	(.008)	0.081	(.008)	0.117	(.008)	0.068	(.012)	0.095	(.046)	0.206	(.053)
Transferred Schools	0.369	(.016)	0.361	(.022)	0.396	(.020)	0.315	(.034)	0.256	(.099)	0.458	(.047)
Changed Majors	0.344	(.009)	0.400	(.012)	0.382	(.011)	0.454	(.021)	0.477	(.063)	0.239	(.034)
Academic Integration	82.996	(.952)	84.254	(1.208)	80.057	(1.050)	89.007	(2.178)	107.902	(5.849)	78.071	(3.409)
Not a U.S. Citizen	0.061	(.006)	0.061	(.008)	0.070	(.008)	0.067	(.018)	0.032	(.019)	0.191	(.052)

status as a historically black college or university (HBCU) or Hispanic-serving institution (HSI). Although institutional types were available in the BPS:04/09 data, the information was often missing or incomplete. As such, the only institutional type variable in my analysis originating in the BPS:04/09 data is HSI. All other institutional types were compiled using IPEDS 2009 survey data files from the NCES, which I then merged with the BPS:04/09 student level data according to the IPEDS ID of students' primary institution.

Effects of Institutional Type

The literature on status inequality and STEM fields tends to address postsecondary institutional type in three ways:

(1) Institutional type is controlled for in assessing inequality by race, class, or gender by examining only students from a single institution (or institutional type)

(2) Institutional type, like race, class and gender, is considered a separate independent variable of interest (unrelated to race, class and gender)

(3) Institutional type is seen as a mediating variable, such that students from certain backgrounds (racial groups, social classes or genders) are more or less likely to attend certain types of schools, which in turn influences their propensity to major in a STEM field.

My analysis expands the above literature in two significant ways. First, I have run models that explore race, class and gender inequality *within* particular types of institutions, comparing the results to the national patterns identified in Chapter 4. These institutional models illustrate how various intersectional status groups are faring within particular types of institutions. Second, I present separate models for each institutional type that explore how attending a particular type of institution may actually *change* the effect of an intersectional status on a student's tendency to major in a STEM field using interaction terms. These analyses incorporate moderating effects testing the idea that intersectional status effects may vary by institutional type. Hence I refer to these as moderating models or *between* institution models.

Method of Analysis

I employ binary logistic regression and include in each model the same student development control variables used in Chapter 4. Again, to compare most effectively intersectional differences between male and female students, I perform separate regression analyses for these two groups with between-group significance tests for social background factors based on pooled analyses with interaction terms (following Cheng, Martin and Werum 2007). It is worth noting that the regression coefficients reported in split models refer to *within-group* effects (e.g., comparing women with women and men with men) while the highlighted bars in the regression tables indicate variables on which the male and female effects differ significantly. For clarity's sake, I have organized my presentation of results by institutional type.

Results

Carnegie Doctorate Institutions

I begin by running several models that explore intersectional status effects (of race, class and gender) *within* Carnegie Doctorate institutions (see Table 6.2). These results compare how status competition processes play out *among* students attending Carnegie Doctorate colleges and universities. Comparing these results with the results of Chapter 4 reveals how institutional context can increase and decrease the salience of particular background statuses.

TABLE 6.2. Weighted Logistic Regression of STEM Majors: Intersectional Status Effects among students at Carnegie Doctorate Institutions.

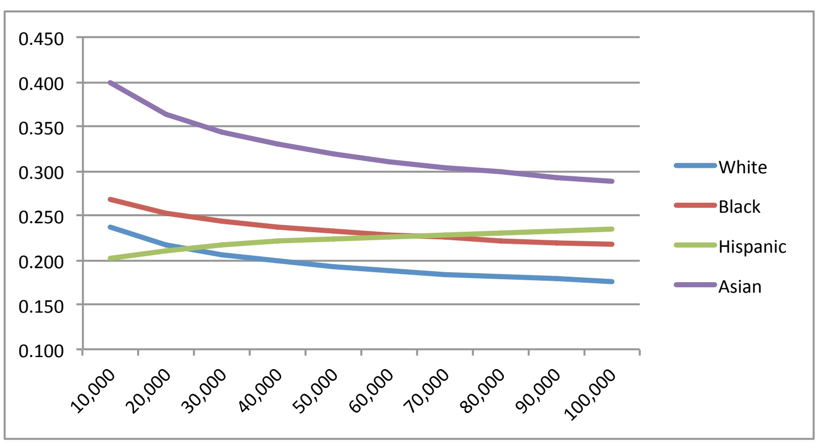
	Model 1			Model 2			Model 3		
	b	se		b	se		b	se	
(Intercept)	0.137	(.502)		-2.060	(.627)	**	-1.852	(.821)	*
Female	-0.890	(.109)	***	-0.787	(.114)	***	-0.778	(.114)	***
Black	-0.233	(.226)		0.202	(.224)		-0.252	(1.071)	
Hispanic	-0.016	(.185)		0.126	(.193)		-2.484	(1.462)	^
Asian	0.889	(.182)	***	0.708	(.200)	***	1.194	(1.023)	
parentBach	0.339	(.123)	**	0.063	(.133)		0.063	(.132)	
ln Income	-0.104	(.046)	*	-0.145	(.039)	***	-0.165	(.061)	**
Degree Expectations				0.141	(.141)		0.132	(.141)	
Math SAT				0.005	(.001)	***	0.005	(.001)	***
Employed - 1st year				0.017	(.272)		0.017	(.272)	
Transferred Schools				-0.211	(.151)		-0.216	(.151)	
Changed Majors				-0.272	(.111)	*	-0.271	(.111)	*
Academic Integration				-0.001	(.002)		-0.001	(.002)	
Not a U.S. Citizen				0.003	(.267)		0.003	(.272)	
Black*lnIncome							0.045	(.102)	
Hispanic*lnIncome							0.247	(.133)	^
Asian*lnIncome							-0.048	(.094)	

***p<.001 **p<.01 *p<.05 ^p<.10

Models 1 and 2 of Table 6.2 demonstrate the persistence of gender, race and class effects even among students at Carnegie Doctorate universities. In fact, class appears to play a larger effect within this student population than in the general population. For example, the decrease in STEM majoring that occurs as family income goes up happens more steeply at Carnegie Doctorate institutions. As the mean income is higher among this population (roughly $80,000 as compared to $72,000 in the larger sample), this may indicate that STEM majors are less desirable among students from higher economic classes and/or that STEM majors may be even more desirable paths to mobility for students from lower economic classes who have chosen to attend an institution where their peers are mostly from higher income families.

Model 3 of Table 6.2 provides a more nuanced view of income effects *within* Carnegie Doctorate institutions. Here, we see that the effect of income varies by race; for Hispanic students in Carnegie Doctorate institutions, income is positively associated with majoring in a STEM field. Figure 6.1[19] clearly illustrates how income works differently for Hispanics than for whites, blacks or Asians within Carnegie Doctorate institutions. Moreover, this benefit of higher income is even larger for Hispanic students in Carnegie Doctorate institutions than the effect for Hispanic students in the population in general (as described in Chapter 4).

Figure 6.1. Probability of Majoring in STEM:
Intersectional Effects of Race and Income among students at Carnegie Doctorate Institutions



[19] Probabilities for figures have been calculated using a weighted average for all variables that are not presented (i.e., here, the impact of gender is weighted by the proportion of women in the sample). Thus, the proportions are for the *average* student. In reality, while the race*income pattern remains consistent, gender effects remain substantial in this model such that women's probabilities are lower and men's higher.

Moderating models compare intersectional status effects for students attending Carnegie Doctorate institutions and intersectional status effects for students attending other types of institutions (see Table 6.3). Thus, interaction coefficients can be interpreted to answer the question: does the effect of parental education or any other status variable differ by institutional context? Model 1 of Table 6.3 suggests that attending a Carnegie Doctorate institution has no direct effect on whether or not students major in STEM fields.

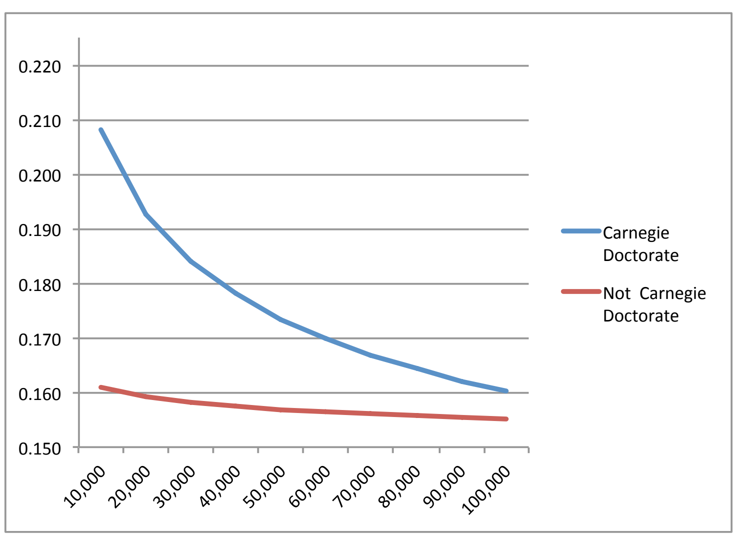
TABLE 6.3. Weighted Logistic Regression of STEM Majors:
Moderating Effects of attending a Carnegie Doctorate University on Intersectional Status Effects.

	Model 1			Model 2			Model 3		
	b	se		b	se		b	se	
(Intercept)	-2.702	(.453)	***	-3.296	(.556)	***	-3.329	(.680)	***
Female	-0.836	(.092)	***	-0.839	(.091)	***	-0.839	(.092)	***
Black	0.230	(.162)		0.218	(.165)		0.380	(1.425)	
Hispanic	0.130	(.161)		0.146	(.160)		-0.728	(.943)	
Asian	0.562	(.147)	***	0.553	(.146)	***	1.692	(.996)	*
parentBach	0.069	(.087)		0.073	(.087)		0.063	(.087)	
ln Income	-0.076	(.029)	**	-0.019	(.041)		-0.013	(.049)	
Degree Expectations	0.201	(.106)	^	0.200	(.106)	^	0.200	(.106)	^
Math SAT	0.004	(.001)	***	0.004	(.001)	***	0.004	(.001)	***
Employed - 1st year	0.082	(.170)		0.097	(.169)		0.100	(.168)	
Transferred Schools	-0.194	(.101)	^	-0.209	(.102)	*	-0.218	(.101)	*
Changed Majors	-0.201	(.087)	*	-0.206	(.087)	*	-0.212	(.086)	*
Academic Integration	0.001	(.001)		0.001	(.001)		0.001	(.001)	
Not a U.S. Citizen	0.084	(.211)		0.102	(.212)		0.099	(.219)	
Carnegie - Doc	0.129	(.093)		1.419	(.606)	*	1.753	(.885)	*
lnIncome*Carnegie-Doc				-0.120	(.055)	*	-0.150	(.079)	^
Black*Carnegie-Doc							-0.748	(1.787)	
Hispanic*Carnegie-Doc							-1.953	(1.757)	
Asian*Carnegie-Doc							-0.658	(1.417)	
Black*lnIncome							-0.008	(.128)	
Hispanic*lnIncome							0.090	(.086)	
Asian*lnIncome							-0.137	(.093)	
lnIncome*Black*Carnegie-Doc							0.052	(.164)	
lnIncome*Hispanic*Carnegie-Doc							0.171	(.160)	
lnIncome*Asian*Carnegie-Doc							0.102	(.134)	

***p<.001 **p<.01 *p<.05 ^p<.10

Model 2 of Table 6.3, however, demonstrates clearly that Carnegie Doctorate institutions do significantly impact STEM majoring, but that the effect of attending a Carnegie Doctorate institution varies with students' family income. Specifically, attending a Carnegie Doctorate institution increases STEM majoring significantly for students at the lower end of the income distribution. This effect decreases as family income increases (see Figure 6.2). In contrast, it appears that class-based status competition processes matter very little at institutions that do not have Carnegie Doctorate status. The increase in STEM majoring among students from lower income families at Carnegie Doctorate institutions may arise from the greater focus on research, and thus the larger awareness of the possibilities and prestige associated with STEM fields, at Carnegie Doctorate institutions. Specifically, emphasis on and publicity of research at Carnegie Doctorate institutions may increase the perceived rewards associated with STEM occupations, creating greater demand and thus more status competition for

Figure 6.2. Probability of Majoring in STEM:
Income Effects for Students at Carnegie Doctorate Institutions vs. Non-Doctorate Institutions



these majors. Moreover, the grants, fellowships and other research monies may provide undergraduates at Carnegie Doctorate institutions with more opportunities to engage STEM fields as a means of earning money during college.

Of course, Table 6.2 revealed that income effects *within* Carnegie Doctorate institutions differ by race. As such, Model 3 of Table 6.3 tests whether intersectional status effects of race*income differ with institutional context. In other words, Model 3 seeks to determine if these patterns at Carnegie Doctorate institutions are different from the patterns at other institutions. Interestingly, Model 3 reveals that the effect of income differs with institutional context for whites, but not for students from any other racial group. Figures 6.3a-6.3d illustrate the income*institutional type effects by race.

Clearly we can see that the impact of income for whites varies with institutional type such that whites are more likely to major in STEM at Carnegie Doctorate institutions. The (between-institution) effects for blacks and Hispanics are not different enough to reach significance. Models not presented here reveal a nearly significant effect for Asians at Carnegie Doctorate institutions, but this effect is unrelated to income (i.e., Asians are more likely to major in STEM at Carnegie Doctorate institutions regardless of income). In sum, the advantage of attending a Carnegie Doctorate institution accrues mostly to lower income whites and, to some extent, to Asians. Perhaps these are the students most likely to seek and be selected for employment in scientific laboratories and other elite facilities available at Carnegie Doctorate institutions. Further investigation might explore the similarities and differences between the experiences of these two groups in order to fully understand the mechanism by which they are advantaged at Carnegie Doctorate institutions.

Figure 6.3a. Probability of Majoring in STEM: Income Effects for *White* Students at Carnegie Doctorate Institutions vs. Non-Doctorate Institutions

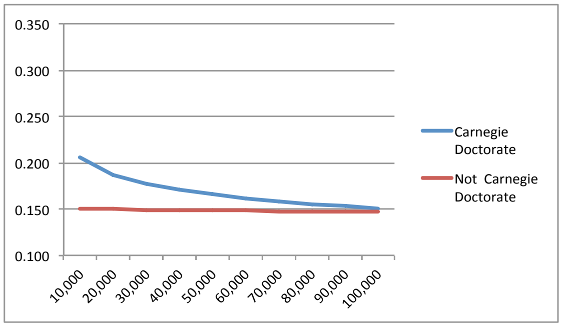


Figure 6.3b. Probability of Majoring in STEM: Income Effects for *Black* Students at Carnegie Doctorate Institutions vs. Non-Doctorate Institutions

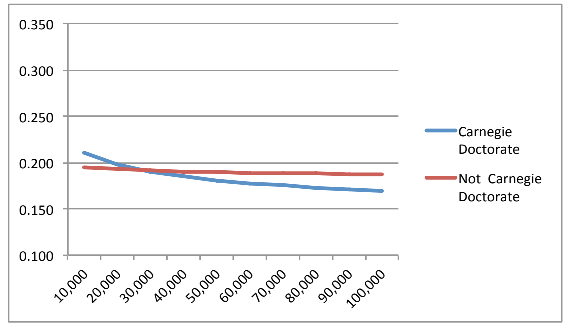


Figure 6.3c. Probability of Majoring in STEM: Income Effects for *Hispanic* Students at Carnegie Doctorate Institutions vs. Non-Doctorate Institutions

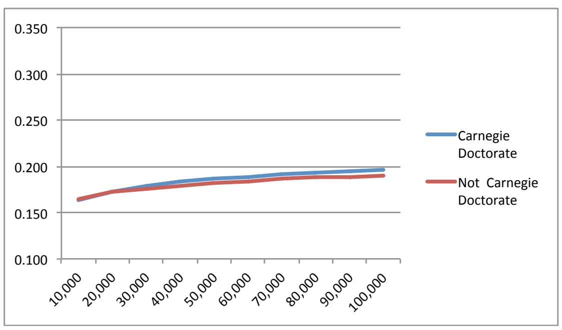
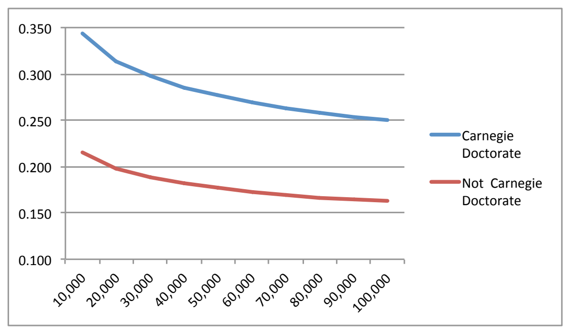


Figure 6.3d. Probability of Majoring in STEM: Income Effects for *Asian* Students at Carnegie Doctorate Institutions vs. Non-Doctorate Institutions



Finally, Table 6.4 provides an analysis of the effects of attending a Carnegie Doctorate institution *among* men and *among* women. Model 1 of Table 6.4 shows a marginally significant direct positive effect of attending a Carnegie Doctorate institution among men. Model 2 of Table 6.4 shows that attending a Carnegie Doctorate institution also increases the chances of majoring in STEM for women whose parents have not earned a bachelor's degree. Figure 6.4 illustrates these patterns for both men and women. Here, we can see that the effect of attending a Carnegie Doctorate institution matters for men, regardless of parental education, and that women from less educated families are more likely to major in a STEM field if they attend a Carnegie Doctorate institution. Yet, this figure also depicts the persistence of gender inequality in STEM.

TABLE 6.4. Weighted Logistic Regression of STEM Majors:
Moderating Effects of attending a Carnegie Doctorate University on Intersectional Status Effects by Gender.

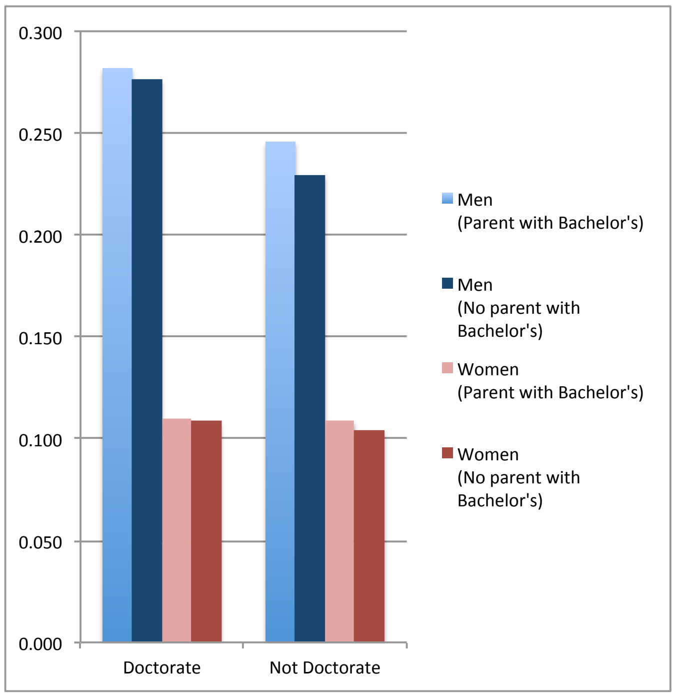
	Model 1						Model 2					
	WOMEN			MEN			WOMEN			MEN		
	b	se		b	se		b	se		b	se	
(Intercept)	-4.872	(.596)	***	-1.671	(.574)	**	-4.882	(.602)	***	-1.690	(.573)	**
Black	0.426	(.219)	^	0.099	(.228)		0.426	(.219)	^	0.098	(.228)	
Hispanic	0.201	(.196)		0.115	(.226)		0.202	(.196)		0.115	(.226)	
Asian	0.431	(.205)	*	0.676	(.199)	**	0.432	(.206)	*	0.675	(.198)	***
parentBach	0.035	(.129)		0.062	(.125)		0.050	(.176)		0.090	(.182)	
ln Income	-0.088	(.043)	*	-0.087	(.035)	*	-0.088	(.043)	*	-0.087	(.035)	*
Degree Expectations	0.303	(.152)	*	0.129	(.137)		0.302	(.152)	*	0.129	(.137)	
Math SAT	0.006	(.001)	***	0.003	(.001)	***	0.006	(.001)	***	0.003	(.001)	***
Employed - 1st year	-0.397	(.237)	^	0.368	(.217)	^	-0.396	(.237)	^	0.370	(.218)	^
Transferred Schools	-0.029	(.145)		-0.299	(.133)	*	-0.029	(.145)		-0.301	(.134)	*
Changed Majors	0.048	(.123)		-0.401	(.117)	**	0.048	(.123)		-0.401	(.117)	***
Academic Integration	0.004	(.002)	*	-0.001	(.001)		0.004	(.002)	*	-0.001	(.001)	
Not a U.S. Citizen	-0.037	(.291)		0.118	(.278)		-0.036	(.291)		0.117	(.278)	
Carnegie - Doctorate	0.027	(.134)		0.209	(.120)	^	0.048	(.181)	**	0.249	(.199)	
ParentBach*Carnegie-Doc							-0.034	(.232)		-0.064	(.247)	

***p<.001 **p<.01 *p<.05 ^p<.10

p<.01 between models (blue shading: Math SAT, Changed Majors)
p<.05 bewteen models (green shading: Employed - 1st year, Academic Integration)
p<.10 between models

In sum, while STEM majoring among most groups seems to increase at Carnegie Doctorate institutions, they also reflect (or drive) the wider patterns of inequality in STEM. Carnegie Doctorate institutions are institutions that serve a clear social reproductive function in terms of race and gender, with men, whites and Asians overrepresented in STEM fields. Institutional context can perpetuate, exacerbate or mitigate these existing patterns of inequality through formal policies and practices as well as through informal channels and cultures. How these groups come to disproportionately major in STEM at Carnegie Doctorate institutions cannot be answered with my data, and should be an issue of future research.

**Figure 6.4. Probability of Majoring in STEM:
Intersectional Effects of Gender and Parental Education for Students at
Carnegie Doctorate Institutions vs. Non-Doctorate Institutions**



Public Institutions

I begin by running several models that explore intersectional status effects (of race, class and gender) *within* public institutions (see Table 6.5). These results compare status competition processes playing out among students attending public colleges and universities. Comparing these results with the results of Chapter 4 reveals how institutional context can increase and decrease the salience of particular background statuses.

Table 6.5 shows that at public schools, gender, race and class all significantly impact STEM majoring (see Model 1) and that, with the inclusion of the control variables, parental education effects become non-significant (see Model 2). These first two models reveal no new patterns *within* public institutions, although we see a decrease in the significance of control variables, most likely because students attending public institutions are more alike on these factors. Otherwise, we might note that women are significantly less likely to choose a STEM major than men; Asians are significantly more likely than whites; and income has a depressing effect on STEM majoring. These effects parallel the findings for Carnegie Doctorate institutions, with the exception that changing majors appears to have no negative effect among students at public institutions while it decreases changes of majoring in STEM at Carnegie Doctorate institutions.

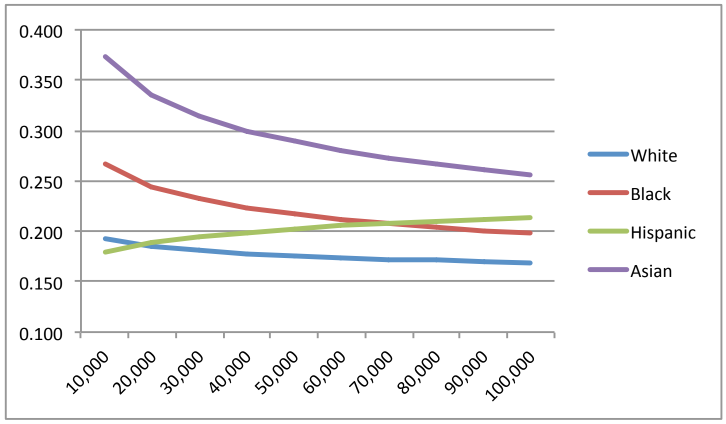
TABLE 6.5. Weighted Logistic Regression of STEM Majors: Intersectional Status Effects *among* Public University Students.

	Model 1			Model 2			Model 3		
	b	se		b	se		b	se	
(Intercept)	-0.445	(.394)		-2.686	(.544)	***	-2.902	(.752)	***
Female	-0.991	(.102)	***	-0.912	(.109)	***	-0.909	(.109)	***
Black	-0.056	(.194)		0.331	(.212)		1.292	(1.088)	
Hispanic	-0.123	(.171)		0.069	(.181)		-1.632	(1.019)	
Asian	0.874	(.190)	***	0.737	(.205)	***	2.463	(.936)	**
parentBach	0.294	(.100)	**	0.070	(.103)		0.059	(.103)	
ln Income	-0.059	(.035)	^	-0.093	(.033)	**	-0.071	(.054)	
Degree Expectations				0.178	(.126)		0.188	(.127)	
Math SAT				0.005	(.001)	***	0.005	(.001)	***
Employed - 1st year				-0.035	(.208)		0.003	(.206)	
Transferred Schools				-0.152	(.126)		-0.179	(.128)	
Changed Majors				-0.170	(.108)		-0.176	(.108)	
Academic Integration				0.001	(.001)		0.001	(.001)	
Not a U.S. Citizen				-0.073	(.242)		-0.093	(.253)	
Black*lnIncome							-0.095	(.099)	
Hispanic*lnIncome							0.167	(.094)	^
Asian*lnIncome							-0.168	(.087)	^

***p<.001 **p<.01 *p<.05 ^p<.10

Model 3 of Table 6.5, however, reveals that the effect of income on STEM majoring at public institutions differs by race. For black and white students, higher incomes decrease rates of STEM majoring. For Asians this effect is even stronger, such that while Asians at the lowest levels of income are much more likely to major in STEM fields, at higher levels of income, their rates of STEM majoring become more comparable to students of other races. For Hispanics, again we see that income *increases* the chances of majoring in a STEM field. Figure 6.5 clearly illustrates the variation in impact of the intersectional status of race*income within public postsecondary institutions. Such differences indicate that, within public institutions, attempts to explain inequality in STEM majors by either race or class background alone will be misleading. Specifically, while Asians are more likely to major in STEM than other students, their chances of STEM majoring vary greatly (with odds ranging from 2:5 to 1:4) over the income distribution. Furthermore, Figure 6.5 clearly shows the importance of intersectional status in comparing STEM rates by race. In fact, here, we could correctly say that Hispanics are most likely, followed by blacks and then whites (at highest levels of income); but one could also accurately say that blacks are most likely, followed by Hispanics and then whites (at middle income levels) or that blacks are most likely followed by whites and then hispanics (at lowest levels of income). Thus, in order to paint a clearly picture of inequality between STEM majors and non-STEM majors at public institutions, one must look at the intersection of race and income.

Figure 6.5. Probability of Majoring in STEM:
Intersectional Effects of Income and Race among Public University Students.



Moderating models compare intersectional status effects for students attending public colleges and universities to intersectional status effects for students attending private colleges and universities. These models include my full sample of students (i.e., not just the ones attending public schools). Thus, interaction coefficients can be interpreted to answer the question: does the effect of parental income or other status variable differ significantly and in which direction at public institutions than it does at private institutions? In Table 6.6, I present a base model and two moderating models, examining differences in race*income and gender*race.

Model 1 of Table 6.6 shows the now familiar effects of various background characteristics as well as the not significant direct effect of attending a public post-secondary institution. Yet, although attending a public institution does not appear to have a significant impact on STEM majoring amongst the full sample of students, my analyses help pinpoint how the institutional context of a public school impacts the intersectional status effect experienced by some groups of students. Model 2 reveals that, in fact, attending a public school significantly changes the effect of income for Asian and black students (see Figures 6.6a and 6.6b).

TABLE 6.6. Weighted Logistic Regression of STEM Majors:
Moderating Effects of attending a Public University on Intersectional Status Effects.

	Model 1			Model 2			Model 3		
	b	se		b	se		b	se	
(Intercept)	-2.832	(.469)	***	-2.274	(.753)	**	-2.858	(.475)	***
Female	-0.834	(.092)	***	-0.826	(.091)	***	-0.669	(.165)	***
Black	0.246	(.162)		-1.523	(1.139)		0.472	(.434)	
Hispanic	0.133	(.162)		-0.326	(1.404)		0.341	(.487)	
Asian	0.575	(.147)	***	-2.729	(1.347)	*	-0.218	(.330)	
parentBach	0.081	(.086)		0.077	(.086)		0.080	(.086)	
ln Income	-0.075	(.029)	*	-0.123	(.065)	^	-0.078	(.029)	**
Degree Expectations	0.215	(.107)	*	0.222	(.107)	*	0.213	(.108)	*
Math SAT	0.004	(.001)	***	0.004	(.001)	***	0.005	(.001)	***
Employed - 1st year	0.078	(.169)		0.118	(.167)		0.091	(.170)	
Transferred Schools	-0.195	(.102)	^	-0.219	(.102)	*	-0.208	(.102)	*
Changed Majors	-0.199	(.089)	*	-0.211	(.087)	*	-0.212	(.086)	*
Academic Integration	0.001	(.001)		0.001	(.001)		0.001	(.001)	
Not a U.S. Citizen	0.079	(.212)		0.091	(.220)		0.077	(.213)	
Public	0.094	(.105)		-0.527	(.926)		0.143	(.157)	
Female*Public							-0.191	(.203)	
Public*Black				2.784	(1.598)	^	-0.324	(.513)	
Public*Hispanic				-1.558	(1.754)		-0.188	(.543)	
Public*Asian				5.019	(1.630)	**	1.159	(.480)	*
Public*Income				0.053	(.084)				
Black*Female							-0.709	(.545)	
Hispanic*Female							-0.043	(.534)	
Asian*Female							0.688	(.454)	
Black*lnIncome				0.160	(.108)				
Hispanic*lnIncome				0.059	(.123)				
Asian*lnIncome				0.269	(.125)	*			
Female*Black*Public							1.040	(.640)	
Female*Hispanic*Public							-0.188	(.614)	
Female*Asian*Public							-1.203	(.613)	*
Black*lnIncome*Public				-0.256	(.148)	^			
Hispanic*lnIncome*Public				0.129	(.157)				
Asian*lnIncome*Public				-0.422	(.159)	**			

***p<.001 **p<.01 *p<.05 ^p<.10

Figure 6.6a. Probability of Majoring in STEM:
Intersectional Effects of Income and Race at Private Universities.

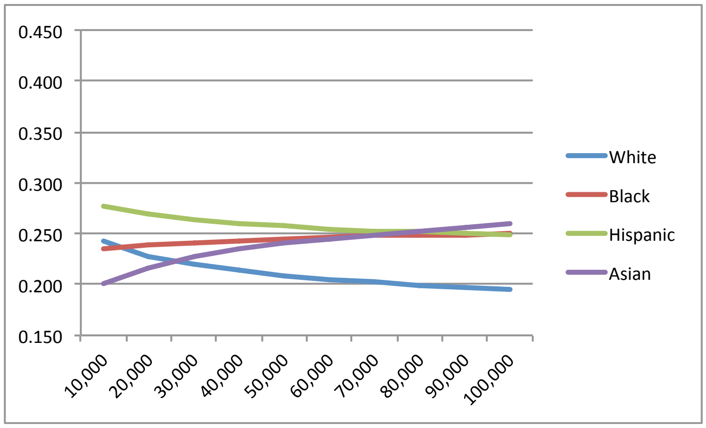
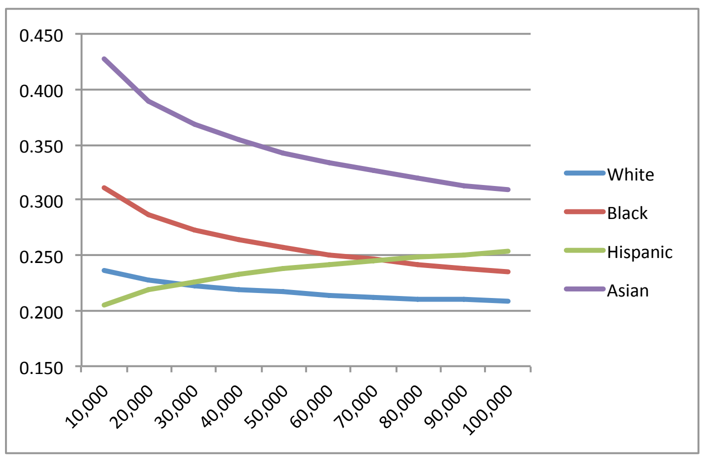


Figure 6.6b. Probability of Majoring in STEM:
Intersectional Effects of Income and Race at Public Universities.



At private universities, black and white students are equally likely to major in STEM fields. Black students attending a public university, however, are significantly more likely to major in STEM than their white peers across the income distribution. The difference between blacks and whites at public universities decreases as family income increases. For Asians, the effect of income actually reverses between schools. At private schools, Asians from lower income families are *less* likely than their whites peers to major in STEM, but increases in income *increase* STEM majoring among Asians while *decreasing* it among whites. Thus, at high income levels, Asians who attend private colleges and universities are more likely than their white peers to major in STEM. This effect of income on white students remains the same at public institutions, but is opposite for Asians. In other words, at private universities, increases in income are more likely to result in STEM majors for Asian students, but at public universities, increases in income sharply decrease the chances of Asian students majoring in a STEM field. Before discussing more fully the theoretical implications of such findings, I want to discuss similar differences in the effect of gender*race intersections between public and private institutions.

Model 3 of Table 6.6 shows that the strength of the positive Asian effect depends upon both gender and institutional type. There is little difference in rates of STEM majoring among Asian women (at public or private institutions) and Asian men at private institutions. Moreover, STEM rates among these groups do not differ significantly from those of students from other intersectional status groups at public and private institutions as can be seen in Figures 6.7a and 6.7b. Instead, the effect is driven by the incredibly high rates of STEM majoring among Asian men at public institutions, particularly from lower income families as seen in Model 2.

Thus, Table 6.6 shows that gender-based status competition processes operate more in determining who majors in STEM at public institutions, but race and class-based status competition processes are more prevalent at private institutions.

Figure 6.7a. Probability of Majoring in STEM:
Differences in Racial Effects for Women at Public vs. Private Schools

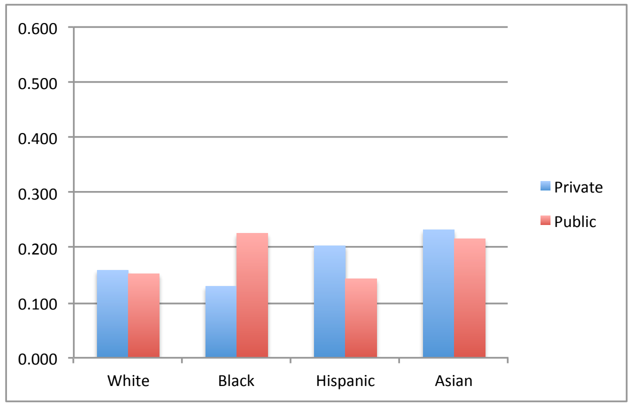
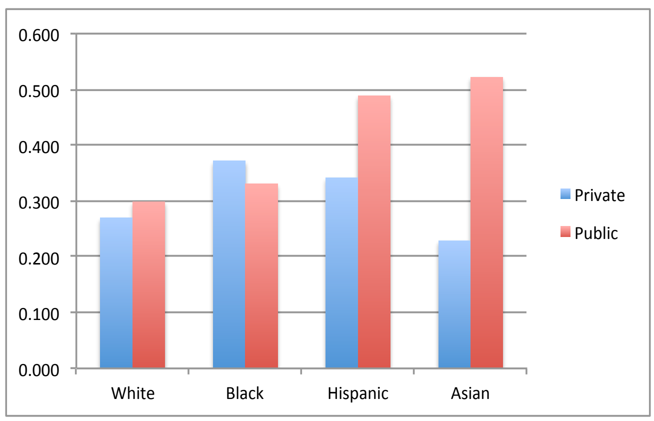


Figure 6.7b. Probability of Majoring in STEM:
Differences in Racial Effects for Men at Public vs. Private Schools



Finally, Table 6.7 tests whether these effects are significant predictors *among* women and *among* men, as well as *between* women and men. Specifically, Model 1 of Table 6.7 confirms that attending a public institution (vs. a private institution) has no direct effects on all women or all men. Model 2 of Table 6.7 confirms the positive impact of race for Asian men attending public institutions as seen above; Asian women are more likely than white women to major in STEM regardless of whether they attend a public or private institution.

TABLE 6.7. Weighted Logistic Regression of STEM Majors:
Moderating Effects of attending a Public University on Intersectional Status Effects by Gender.

	Model 1						Model 2					
	WOMEN			MEN			WOMEN			MEN		
	b	se		b	se		b	se		b	se	
(Intercept)	-4.897	(.580)	***	-1.906	(.607)	**	-4.843	(.575)	***	-1.897	(.593)	**
Black	0.429	(.217)	*	0.126	(.228)		0.014	(.308)		0.228	(.427)	
Hispanic	0.203	(.196)		0.115	(.228)		0.420	(.322)		0.234	(.462)	
Asian	0.434	(.204)	*	0.691	(.199)	**	0.564	(.295)	^	-0.190	(.327)	
parentBach	0.039	(.128)		0.075	(.124)		0.040	(.129)		0.070	(.124)	
ln Income	-0.088	(.043)	*	-0.086	(.036)	*	-0.094	(.043)	*	-0.083	(.035)	*
Degree Expectations	0.305	(.153)	*	0.159	(.137)		0.302	(.152)	*	0.154	(.137)	
Math SAT	0.006	(.001)	***	0.003	(.001)	***	0.006	(.001)	***	0.003	(.001)	***
Employed - 1st year	-0.398	(.236)	^	0.365	(.215)	^	-0.386	(.240)		0.359	(.217)	^
Transferred Schools	-0.029	(.147)		-0.308	(.133)	*	-0.032	(.146)		-0.312	(.134)	*
Changed Majors	0.050	(.125)		-0.405	(.117)	***	0.043	(.124)		-0.419	(.114)	***
Academic Integration	0.004	(.002)	*	-0.001	(.001)		0.004	(.002)	*	-0.001	(.001)	
Not a U.S. Citizen	-0.039	(.292)		0.111	(.280)		-0.042	(.291)		0.106	(.282)	
Public	0.017	(.130)		0.194	(.139)		0.010	(.141)		0.128	(.151)	
Black*Public							0.620	(.400)		-0.145	(.504)	
Hispanic*Public							-0.330	(.403)		-0.168	(.519)	
Asian*Public							-0.205	(.374)		1.166	(.482)	*

***p<.001 **p<.01 *p<.05 ^p<.10

p<.01 between models (blue shading: Math SAT, Changed Majors)
p<.05 bewteen models (green shading: Employed - 1st year, Academic Integration, Asian*Public)
p<.10 between models (red shading: Asian, Model 2)

Again, such findings reaffirm the need to explore inequality in STEM fields from an intersectional perspective. Here, it's not just a matter of race and institutional context. We see that the positive Asian*public effect takes place at the intersection of race *and* gender *and* public institutions such that it is not all Asians attending public institutions who are more likely to major in a STEM field, but only Asian men. Comparing the coefficients for whites and Asians for each gender by public or private institution reveals that Asian men attending private institutions fare little better than Asian women *despite* the gender disadvantage experienced by Asian females.

In sum, distinctions between STEM majoring patterns at public and private universities highlight multiple fallacies in our current conceptions of STEM majoring. First, the variation between races across the income distribution and across gender lines reveals the futility of attempting to draw conclusions about race, class or gender effects independently. Clearly, research on STEM majoring must take an intersectional approach to truly understand which groups remain underrepresented and how to effectively include them. Second, if status effects were merely additive instead of intersectional, the existing research would lead us to conclude that Asian men from lower income families would be *the most* likely to major in STEM fields. Yet, examining these effects in context suggest that this conclusion is correct among students attending public schools, but not among students attending private schools, where Asians from lower income families are among *the least likely* to major in STEM. Thus, we see that, with regard to STEM majoring, intersectional statuses are contextually salient.

Finally, my analysis suggests that status competition processes based on economic capital play a more significant role in determining who majors in STEM fields at public colleges and universities than at private colleges and universities. This directly contradicts the notion that public postsecondary institutions provide (and, in fact, exist to provide) equal educational opportunity to students from all backgrounds. Thus, admissions staff, academic advisors and administrators at public schools should consider how current policies and practices may engage students differently based on race and class, resulting in less equity among STEM majors at public schools than is found at private institutions (again, see Figures 6.2a and 6.2b).

Land-Grant Institutions

Table 6.8 shows that the disadvantage to women and advantage to Asian students existent in the wider population (see Chapter 4) also accrue among students attending land-grant institutions (see Model 1). Unlike in the wider population, however, income does not become significant with the addition of student development controls (Model 2). Thus, among students at land-grant institutions, class initially appears to have little impact on STEM majoring.

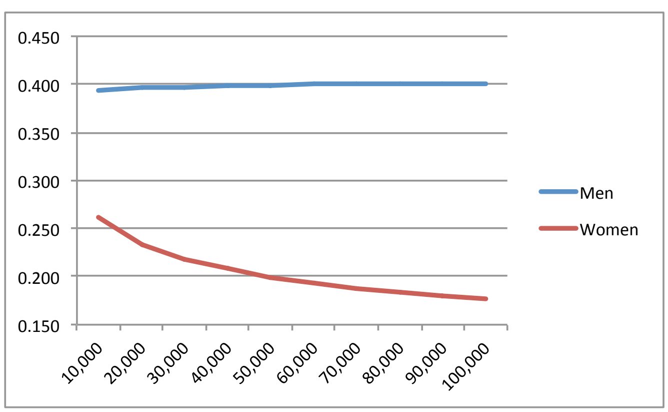
Models 3 and 4 show that income-based status competition processes do impact STEM majoring at land-grant institutions though. The effects of income simply differ for students from different intersectional status groups. Specifically, Model 3 indicates that, as family income increases, women are less likely to major in STEM fields. The same effect is not significant for men at land-grant institutions; men are significantly more likely to major in STEM than women, regardless of income, and income does not change the probability that men at land-grant institutions will major in STEM (see Figure 6.8). Figure 6.8 clearly demonstrates that gender matters within land-grant institutions – specifically, the underrepresentation of women in STEM (once they're admitted to land-grants) limits the goal of broader participation in STEM, but selection into a land-grant institution slightly increases the odds of STEM participation by women, as we will see shortly.

TABLE 6.8. Weighted Logistic Regression of STEM Majors:
Intersectional Status Effects *among* students at Land-Grant Institutions.

	Model 1			Model 2			Model 3			Model 4		
	b	se		b	se		b	se		b	se	
(Intercept)	-0.183	(.922)		-1.878	(1.227)		-3.129	(1.258)	*	-1.852	(.821)	*
Female	-1.131	(.181)	***	-1.007	(.178)	***	1.510	(1.412)		-0.778	(.114)	***
Black	-0.166	(.418)		0.399	(.414)		0.424	(.411)		-0.252	(1.071)	
Hispanic	-0.067	(.339)		0.081	(.336)		0.061	(.342)		-2.484	(1.462)	^
Asian	0.706	(.294)	*	0.559	(.317)	^	0.540	(.319)	^	1.194	(1.023)	
parentBach	0.395	(.202)	^	0.240	(.207)		0.222	(.204)		0.063	(.132)	
ln Income	-0.058	(.083)		-0.102	(.081)		0.014	(.086)		-0.165	(.061)	**
Degree Expectations				-0.058	(.204)		-0.053	(.204)		0.132	(.141)	
Math SAT				0.005	(.001)	***	0.005	(.001)	***	0.005	(.001)	***
Employed - 1st year				0.287	(.432)		0.283	(.433)		0.017	(.272)	
Transferred Schools				-0.293	(.240)		-0.289	(.240)		-0.216	(.151)	
Changed Majors				-0.473	(.175)	**	-0.468	(.176)	**	-0.271	(.111)	*
Academic Integration				-0.001	(.003)		-0.001	(.003)		-0.001	(.002)	
Not a U.S. Citizen				0.013	(.466)		0.057	(.459)		0.003	(.272)	
Female*lnIncome							-0.230	(.126)	^			
Black*lnIncome										0.045	(.102)	
Hispanic*lnIncome										0.247	(.133)	^
Asian*lnIncome										-0.048	(.094)	

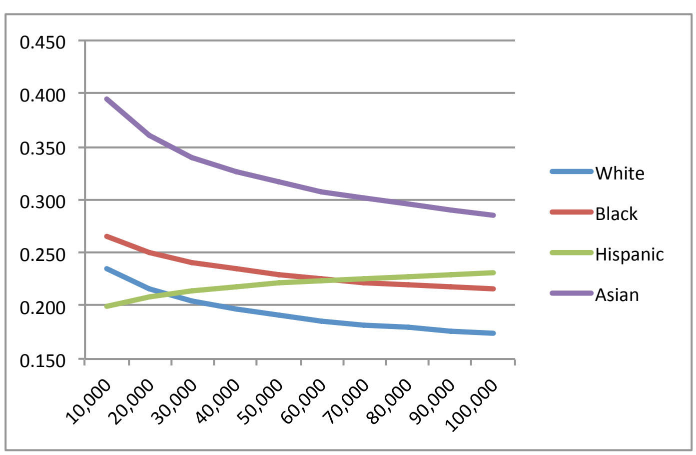
***p<.001 **p<.01 *p<.05 ^p<.10

Figure 6.8. Probability of Majoring in STEM:
Intersectional Effects of Gender and Income among students at Land-Grant Institutions.



Similarly, Model 4 demonstrates changes in the effect of income by race; Figure 6.9 depicts the now familiar pattern of this interaction, with family income negatively related to STEM majoring among whites and the reversed effect for Hispanics. The consistency of this finding is not unexpected as land-grant institutions constitute a special subset of public colleges and universities. Yet, this pattern's persistence across student populations at Carnegie Doctorate institutions and public institutions (both land-grant and non land-grant) provides further evidence for the stability and impact of intersectional effects on STEM majors. The significantly different pattern found at private institutions (see Figure 6.2a) suggests that institutional context does play a role in defining the types of status competition processes, and thus the salience of particular intersectional statuses, leading to overrepresentation of certain groups (and underrepresentation of others) in STEM majors. In the next section, I explore differences in intersectional status effects *between* land-grant institutions and other public colleges and universities.

Figure 6.9. Probability of Majoring in STEM:
Intersectional Effects of Race and Income among students at Land-Grant Institutions.



While these models have shown differences between intersectional status groups *within* land-grant institutions, the moderating models that follow analyze the effects of intersectional statuses *between* land-grant institutions and other public institutions. For example, the within institution models compare black women and white women who attend land-grant schools while the moderating models compare the effects for black women attending land-grant institutions and black women attending other public schools (as well as whether these effects are different from the effects for white women at these two types of institutions).

Table 6.9 shows that, while there are no perceivable direct effects of attending a land-grant institution (see Model 1), interactions between institutional type and intersectional statuses reveal that women are more likely to major in STEM at land-grant institutions than at other public institutions (Model 2). This effect decreases with family income though, such that women from lower income families are more likely to benefit from attending a land-grant institution, but women from higher income families major in STEM fields at virtually the same rates whether they attend a land-grant institution or another type of public institutions. Income does not have a similar effect upon women at non land-grant public universities meaning that this intersectional status effect is contextually dependent. In other words, the effect of gender*income described above (see Figure 6.8) for women attending land-grant institutions differs significantly from the effect of gender*income for women attending other types of public institutions (see Figure 6.10). Although the patterns for men in Figure 6.10 appear to show a distinct income effect for those attending land-grants versus those not attending land-grants, the difference does not reach statistical significance.

TABLE 6.9. Weighted Logistic Regression of STEM Majors: Moderating Effects of attending a Land-Grant Institution on Intersectional Status Effects.

	Model 1			Model 2		
	b	se		b	se	
(Intercept)	-2.640	(.548)	***	-2.361	(.653)	***
Female	-0.912	(.109)	***	-1.413	(.755)	^
Black	0.323	(.213)		0.324	(.213)	
Hispanic	0.079	(.181)		0.081	(.180)	
Asian	0.738	(.207)	***	0.729	(.209)	***
parentBach	0.068	(.104)		0.070	(.105)	
ln Income	-0.095	(.033)	**	-0.121	(.040)	**
Degree Expectations	0.173	(.127)		0.173	(.127)	
Math SAT	0.005	(.001)	***	0.005	(.001)	***
Employed - 1st year	-0.027	(.208)		-0.021	(.207)	
Transferred Schools	-0.147	(.127)		-0.150	(.128)	
Changed Majors	-0.178	(.108)	^	-0.178	(.108)	
Academic Integration	0.001	(.001)		0.001	(.001)	
Not a U.S. Citizen	-0.084	(.245)		-0.078	(.244)	
Land-Grant	0.160	(.126)		-1.406	(1.110)	
Land-Grant*Female				3.017	(1.654)	^
Land-Grant*lnIncome				0.148	(.099)	
Female*lnIncome				0.050	(.069)	
Female*lnIncome*Land-Grant				-0.289	(.148)	^

***p<.001 **p<.01 *p<.05 ^p<.10

Figure 6.10. Probability of Majoring in STEM:
Differences in Income Effects for Students at Land-Grant vs. Other Public Institutions.

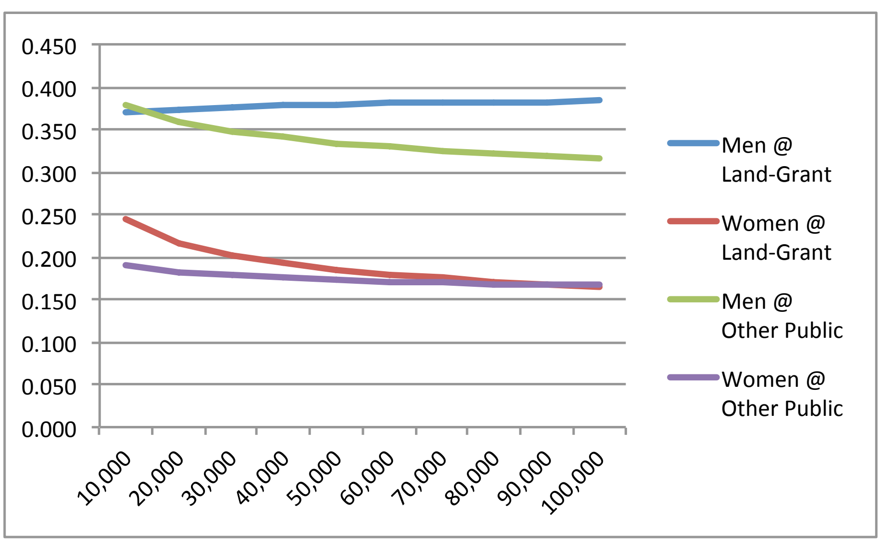


Table 6.10 further elaborates upon this gender*income finding. Specifically, it compares the effects of income *among* women and *among* men. Model 1 shows that men are marginally more likely to major in a STEM field if they attend a land-grant institution (regardless of income level). We see this effect in Figure 6.10 where STEM majoring rates for men at land-grant institutions are above those for men at non land-grant public institutions at all but the very lowest levels of income (i.e., below approximately $15,000). This effect does not reach significance among women, but is close enough that the effects of attending a land-grant on men and on women are not significantly different.

TABLE 6.10. Weighted Logistic Regression of STEM Majors:
Moderating Effects of attending a Land-Grant Institution on Intersectional Status Effects by Gender.

	Model 1						Model 2					
	WOMEN			MEN			WOMEN			MEN		
	b	se		b	se		b	se		b	se	
(Intercept)	-4.428	0.724	***	-2.023	0.724	**	-4.614	0.758	***	-1.787	0.733	*
Black	0.619	0.272	*	0.104	0.273		0.622	0.272	*	0.111	0.27	
Hispanic	0.084	0.246		0.116	0.239		0.079	0.247		0.119	0.239	
Asian	0.369	0.268		0.978	0.298	**	0.357	0.272		0.974	0.297	**
parentBach	0.118	0.171		0.018	0.145		0.119	0.171		0.015	0.145	
ln Income	-0.117	0.048	*	-0.091	0.042	*	-0.099	0.056	^	-0.111	0.043	**
Degree Expectations	0.267	0.194		0.108	0.159		0.268	0.194		0.107	0.159	
Math SAT	0.006	0.001	***	0.004	1E-03	***	0.006	0.001	***	0.004	1E-03	***
Employed - 1st year	-0.554	0.294	^	0.282	0.268		-0.540	0.292	^	0.281	0.269	
Transferred Schools	0.105	0.181		-0.309	0.164	^	0.100	0.181		-0.308	0.163	^
Changed Majors	0.084	0.162		-0.372	0.137	**	0.087	0.162		-0.376	0.137	**
Academic Integration	0.003	0.002		-0.001	0.002		0.003	0.002		0.000	0.002	
Not a U.S. Citizen	-0.136	0.404		-0.046	0.308		-0.145	0.407		-0.037	0.307	
Land-Grant	-0.009	0.182		0.276	0.158	^	1.488	1.325		-1.408	1.08	
lnIncome*Land-Grant							-0.138	0.118		0.154	0.097	

***p<.001 **p<.01 *p<.05 ^p<.10

p<.01 between models (blue)
p<.05 bewteen models (green)
p<.10 between models (red)

Model 2 of Table 6.10 shows that there are significant differences between these two populations once income is considered intersectionally. Specifically, income works in opposite directions for men and women attending land-grant schools – with men from higher incomes more likely to major in STEM and women from lower incomes more likely to major in STEM as can be seen in Figure 6.10. As income decreases among men, the impact of attending a land-grant school diminishes; for women, as income increases, the impact of attending a land-grant school diminishes. Thus, institutional context influences the salience of intersectional statuses (here of gender*income), potentially through the creation of different status competition processes for STEM majors.

In sum, men are more likely to major in a STEM field if they attend a land-grant institution (vs. another public institution), as are women from lower-income families. It is important to note here that although these two populations both gain advantages, their relative likelihoods of majoring in STEM fields are not equal, as the positive effect of income*landgrant among women does not compensate for the much larger negative effect of being female.

Historically Black Colleges and Universities (HBCU)

My analysis of HBCU students is limited to black students as the numbers of non-black HBCU students is too small to include in the analysis. As such, the models here differ slightly in that none of them include racial variables.

Institutional models (looking *within* the population of HBCU attendees) paint a picture of the HBCU student population as potentially influenced by different factors than the general postsecondary student population (see Table 6.11). Among HBCU students, neither gender nor class is a significant predictor of STEM majoring (see Models 1 and 2). It may also be worth noting that for the first time in any model, Math SAT is not a predictor of STEM majoring. The mean Math SAT score for students at HBCUs is significantly lower than the mean in the larger sample, and there is more variation in Math SAT scores within this population (see Table 6.1 for institutional sample descriptives) which may prevent the effect from reaching statistical significance.

TABLE 6.11. Weighted Logistic Regression of STEM Majors: Intersectional Status Effects among students at HBCUs.

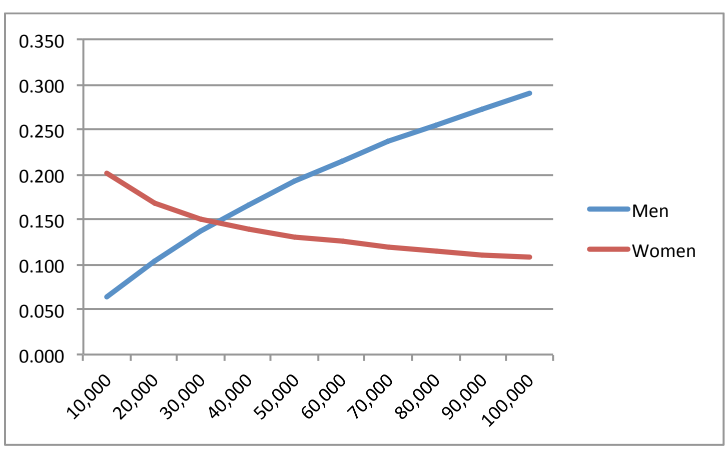
	Model 1			Model 2			Model 3		
	b	se		b	se		b	se	
(Intercept)	0.492	(1.293)		-1.524	(1.402)		-12.893	(5.122)	*
Female	-0.419	(.531)		-0.141	(.500)		11.395	(4.804)	*
parentBach	0.305	(.447)		0.335	(.467)		-0.046	(.432)	
ln Income	-0.137	(.137)		-0.212	(.163)		0.775	(.426)	^
Degree Expectations				0.436	(.583)		0.099	(.534)	
Math SAT				0.004	(.004)		0.005	(.004)	
Employed - 1st year				-3.877	(1.128)	**	-3.929	(1.146)	***
Transferred Schools				0.191	(.588)		0.588	(.530)	
Changed Majors				0.285	(.502)		0.487	(.499)	
Academic Integration				0.006	(.006)		0.010	(.007)	
Not a U.S. Citizen				-3.585	(1.387)	**	-2.983	(1.469)	*
Female*lnIncome							-1.095	(.453)	*

***p<.001 **p<.01 *p<.05 ^p<.10

Model 3 of Table 6.11 suggests that income does, in fact, influence rates of STEM majoring among black students at HBCUs, but that its effect differs significantly by gender. Thus, intersectional effects greatly matter in predicting STEM majoring within HBCUs. Specifically, we see that increases in income increase the chances of majoring in STEM for men, while decreasing the chances for women. This effect is similar to the effect among students at land-grant institutions (see Table 6.8 and

Figure 6.8), but whereas men were always more likely to major in STEM than women (at any given level of income) at land-grant institutions, the same is not true at HBCUs. In fact, at HBCUs, black women with an annual family income of less than $32,000 are actually more likely to major in a STEM field than their male peers (see Figure 6.11). This trend reverses as income increases until men from families earning roughly $90,000 are about twice as likely as their female peers to major in STEM. Such an interaction suggests that motivation for entering the STEM pipeline for black women and black men at HBCUs may be distinctly different with these upper class black men and lower class black women segregated between STEM fields. The sample of students attending HBCUs in the BPS:04/09 data is not large enough to test this hypothesis, but future research might assess the particular STEM fields of black women vs. black men and their motivations for majoring in STEM. HBCUs, as institutions, might then consider the gender- and class-based status competition processes between STEM fields that result in this unusual pattern (e.g., stereotypes about occupational fields, academic advising, etc.).

Figure 6.11. Probability of Majoring in STEM: Intersectional Effects of Gender and Income among students at HBCUs.



Above and beyond the obvious evidence that STEM inequality should be assessed from an intersectionality framework, this finding is particularly noteworthy because it suggests that institutional context can potentially reduce the persistent gender gap in STEM. At HBCUs, some women are actually majoring in STEM at higher rates than their male peers. While this is not true *across* the income spectrum (and if it was, it would simply indicate another form of gender inequality in STEM) the distribution is such that gender differences are not significant predictors of STEM majoring at HBCUs (see Models 1 and 2 of Table 6.11).

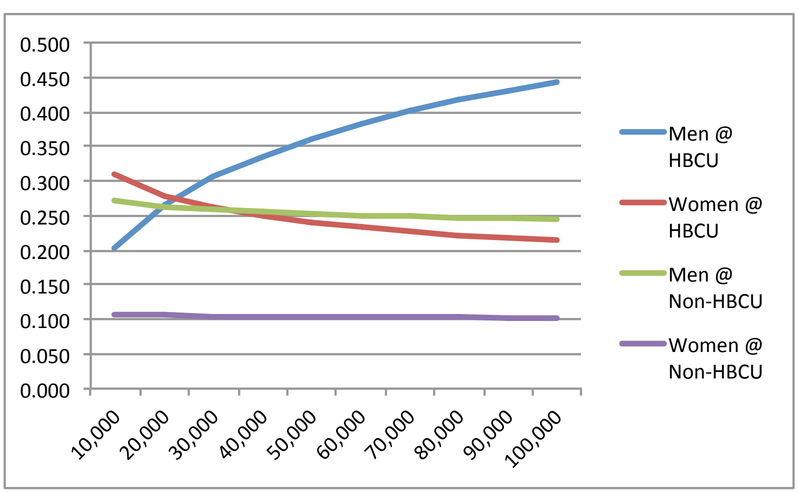
Table 6.12 shows that historically black colleges and universities have a direct positive effect on black students' STEM majoring (see Model 1). This model provides a deceptively simple picture of the actual impact however. Model 2 of Table 6.12 more clearly shows that the increase in STEM majoring associated with attendance at an HBCU differs by gender and income. Figure 6.12 helps us to understand this complex relationship. For black women, attending an HBCU increases their likelihood of majoring in a STEM field regardless of family income, but for black men, attending an HBCU increases the chances of majoring in a STEM field only for those from middle and upper-class families. In fact, black men from families with an annual income of about $20,000 or less are actually more likely to major in STEM fields if they *do not* attend an HBCU. It is also interesting to note that income obviously impacts STEM majoring for black students in the institutional context of an HBCU but appears to have very little impact on black students not attending an HBCU. Here, the green and purple lines (indicating men's and women's probabilities of majoring in STEM fields at non-HBCUs) are relatively flat across the income spectrum. Finally, income effects for students *at* HBCUs work in opposite directions with income positively related to STEM majoring among men and negatively related to STEM majoring among women.

TABLE 6.12. Weighted Logistic Regression of STEM Majors: Moderating Effects of attending an HBCU on Intersectional Status Effects.

	Model 1			Model 2		
	b	se		b	se	
(Intercept)	-2.401	1.004	*	-2.669	1.368	^
Female	-0.888	0.289	**	-1.372	1.3715	
parentBach	-0.184	0.236		-0.267	0.2452	
ln Income	-0.075	0.068		-0.058	0.0932	
Degree Expectations	0.05	0.288		-0.037	0.2814	
Math SAT	0.0042	0.002	*	0.0045	0.0017	**
Employed - 1st year	-0.324	0.445		-0.378	0.4345	
Transferred Schools	-0.297	0.282		-0.177	0.2931	
Changed Majors	-0.077	0.261		0.0298	0.2681	
Academic Integration	0.0029	0.003		0.0038	0.0029	
Not a U.S. Citizen	-0.13	0.55		-0.155	0.5869	
HBCU	0.8067	0.263	**	-5.467	3.9863	
HBCU*lnIncome				0.5533	0.3932	
HBCU*Female				8.4742	3.9507	*
Female*lnIncome				0.0279	0.1322	
Female*lnIncome*HBCU				-0.738	0.3816	^

***p<.001 **p<.01 *p<.05 ^p<.10

Figure 6.12. Probability of Majoring in STEM: Intersectional Effects of Gender and Income at HBCUs vs. non-HBCUs.



These patterns are further developed in Table 6.13, which explores the moderating effects of institutional type *among* men and *among* women – still testing for differences *between* institutional types. In Model 1 of Table 6.13 we see that black women who attend an HBCU are more likely to major in a STEM field than black women attending a non-HBCU institution, but that no similar relationship exists for black men. Again, as Figure 6.12 shows, the relationship depends upon income such that men from the lowest-income families may be more likely to major in STEM at non-HBCUs. Yet, these effects (among women and among men) are not so different as to be statistically different from each other and, in general, a black student's probability of majoring in STEM increases if he or she attends an HBCU (see Figure 6.13).

The complicated history of HBCUs may explain why we see this gender-specific income effect among students at HBCUs, but not among black students at other types of schools. As described above and in Chapter 2, most HBCUs were founded between the end of the Civil War and the beginning of World War I. Most HBCUs had historical missions linked either to the rhetoric of W.E.B. DuBois (i.e., liberal arts education for the Talented Tenth in order to create a black elite) or of Booker T. Washington (i.e., occupational and technological training for blacks as a means of securing economic independence and building black wealth) (DuBois 1995(1903)). At the time, postsecondary institutions catered primarily to male elites. As a result, HBCUs have a long history of educating upper class (or at least upwardly mobile) black men in science and medicine. In contrast, women at HBCUs, like women everywhere, were not encouraged to enter these traditionally masculine fields. Thus, STEM patterns for men at HBCUs may be influenced by the informal networks created by institutional history (with career networks assisting black men from HBCUs to enter medical or other graduate schools, to find optimal employment after college, etc.), while similar networks remain undeveloped for upper class black women. As such, income patterns for black women at HBCUs reflect the more general income patterns in the population – with STEM fields perceived as means of mobility for those from lower and middle class backgrounds, for whom adherence to cultural gender roles is overpowered by opportunities for economic security and social mobility.

Model 2 of Table 6.13, however, shows that when we consider the intersection of income and gender, the differences between men and women are statistically significant. Higher family income has a more negative effect for women attending HBCUs than for men attending HBCUs, although HBCU attendance itself has a more positive effect for women than for men as seen in Figure 6.12.

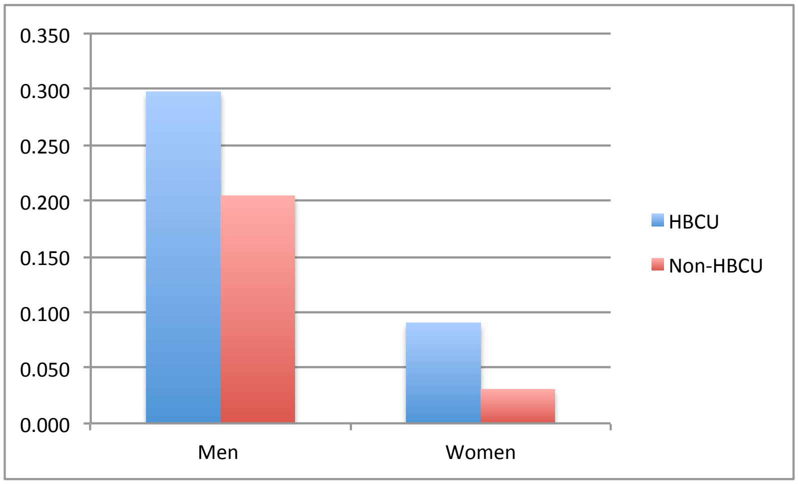
TABLE 6.13. Weighted Logistic Regression of STEM Majors:
Moderating Effects of attending an HBCU on Intersectional Status Effects by Gender.

	Model 1						Model 2					
	WOMEN			MEN			WOMEN			MEN		
	b	se		b	se		b	se		b	se	
(Intercept)	-4.972	1.479	***	-1.083	1.571		-5.798	1.672	***	-1.060	1.559	
parentBach	0.050	0.342		-0.653	0.409		0.044	0.345		-0.723	0.41	^
ln Income	-0.190	0.088	*	-0.057	0.108		-0.111	0.085		-0.078	0.103	
Degree Expectations	1.039	0.491	*	-0.375	0.408		1.070	0.51	*	-0.514	0.414	
Math SAT	0.007	0.003	**	0.003	0.002		0.007	0.003	**	0.004	0.002	
Employed - 1st year	-4.993	1.057	***	0.220	0.558		-5.114	1.06	***	0.237	0.558	
Transferred Schools	-0.403	0.453		-0.116	0.339		-0.298	0.437		-0.028	0.356	
Changed Majors	0.090	0.32		-0.284	0.384		0.188	0.34		-0.180	0.404	
Academic Integration	0.009	0.004	*	-0.003	0.004		0.009	0.004	*	-0.002	0.004	
Not a U.S. Citizen	0.264	1.078		-0.365	0.672		0.252	1.07		-0.410	0.692	
HBCU	1.142	0.371	**	0.500	0.417		3.634	1.722	*	-5.789	4.586	
HBCU*lnIncome							-0.250	0.162		0.605	0.454	

***p<.001 **p<.01 *p<.05 ^p<.10

p<.01 between models
p<.05 bewteen models
p<.10 between models

Figure 6.13. Probability of Majoring in STEM:
Effects of Gender and Institutional Type for Students at HBCUs vs. non-HBCUs.



How might we interpret these findings from a status competition perspective? First, institutional contexts can moderate the effects of intersectional statuses. At HBCUs, we see an intersectional effect of gender and income that is not present at non-HBCU institutions. As such, we can conclude that the salience of particular intersectional statuses can vary by institutional context and institutions must consider students' intersectional statuses in their STEM recruitment and retention efforts if they truly seek to develop a diverse population of STEM majors. Second, HBCUs demonstrate that institutional context can shift status competition processes such that even those from the most disadvantaged groups (like women in STEM) can successfully compete and even surpass their male colleagues. Additional research should focus specifically on the experiences and motivations of female STEM majors at HBCUs in addition to the structure of recruitment, advising and academic support available at HBCUs in order to more fully understand how the success of black women in HBCUs might be translated into other types of institutional contexts.

Hispanic-Serving Institutions (HSI)

The last type of institution that I examine is Hispanic-serving institutions. Although HSIs tend to be more racially diverse than HBCUs, I have limited my analysis to Hispanic students attending HSIs because this is the target population of interest (i.e., my focus is on how attending an HSI influences STEM majoring among Hispanic students). Like the institutional models for HBCUs, the institutional models for HSIs also demonstrate that very different factors may be at play among students who attend HSIs.

Table 6.14 shows significant predictors of STEM majoring among Hispanic students at HSIs. Like at HBCUs, Math SAT does not significantly impact rates of STEM majoring, but working full-time during the first year of college does significantly decrease a student's chances of majoring in a STEM field. Unlike at HBCUs, however, gender is the strongest predictor of STEM majoring among students at HSIs with Hispanic women significantly less likely than Hispanic men. Neither measure of class (i.e., income or parental education) is significant within this institutional context though. The apparent lack of class effects is particularly notable given the interaction between race*income for Hispanic students in the larger sample (and especially at Carnegie Doctorate and public institutions). Given that the mean family income of Hispanic students attending HSIs is $37,000—as compared to $48,400 for Hispanics in the full sample and $72,000 for students of all races in the full sample—the lack of income effect may be related to a flattening of class-based status competition processes in response to a flattening of class differences between students at HSIs.

TABLE 6.14. Weighted Logistic Regression of STEM Majors: Intersectional Status Effects among Hispanic students at Hispanic Serving Institutions.

	Model 1			Model 2		
	b	se		b	se	
(Intercept)	-1.524	(.749)	*	-0.598	(1.124)	
Female	-1.478	(.429)	***	-1.606	(.498)	**
parentBach	0.232	(.380)		0.128	(.401)	
ln Income	0.074	(.074)		0.004	(.081)	
Degree Expectations				0.321	(.791)	
Math SAT				0.000	(.002)	
Employed - 1st year				-1.115	(.566)	*
Transferred Schools				-0.402	(.477)	
Changed Majors				0.110	(.542)	
Academic Integration				0.002	(.004)	
Not a U.S. Citizen				-0.739	(.701)	

***p<.001 **p<.01 *p<.05 ^p<.10

Although I tested for intersectional effects of gender and class *within* HSIs, I found no significant intersectional effects. Thus, we must conclude that the status competition processes determining STEM majors among students at HSIs are primarily based on gender (see Figure 6.14). Figure 6.15 depicts the primacy of this gender effect across the income distribution.

Figure 6.14. Probability of Majoring in STEM: Effect of Gender among students at Hispanic Serving Institutions.

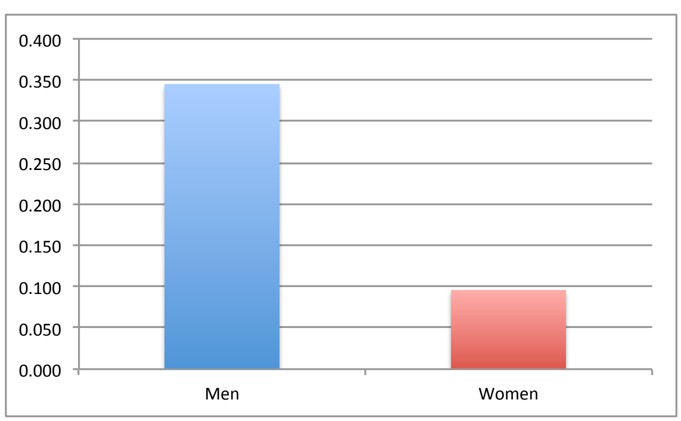
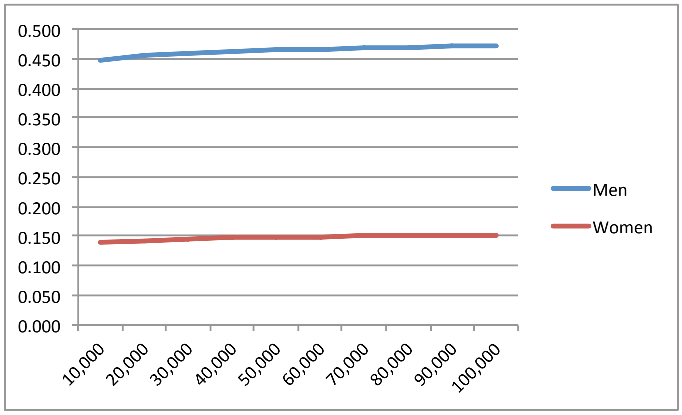


Figure 6.15. Probability of Majoring in STEM:
Effects of Gender and Income among students at Hispanic Serving Institutions.



The moderating models and split gender models testing for direct effects and interactions between Hispanic-serving institutions and non-Hispanic-serving institutions also revealed no significant effects. Specifically, rates of STEM majoring among Hispanic students at HSIs and non-HSIs appear virtually the same, even when compared by gender, economic class or level of parental education (or any combination thereof). So interestingly, while other institutional types have demonstrated effects on the salience of intersectional status competition processes, the effects of gender and class for Hispanic students remain unchanged in any way by the institutional context of Hispanic-serving institutions. This is not entirely surprising though, given that HSI institutions are defined based on enrollment rates of Hispanic students, not based on historic ties or any particular institutional mission, and thus vary widely on a range of other criteria (e.g., size, prestige, institutional control, Carnegie classification). Future research might seek to explore in more depth how particular policies, practices or informal cultures at Hispanic-serving institutions might give rise to different patterns of STEM majoring.

Conclusions

To summarize, in this chapter I seek to answer the question: how does institutional type influence the actual effects of intersectional statuses (i.e., intersections of race, class, and gender) on who majors in STEM fields? In answering this question, I explore three themes. First, I address status competition processes *within* particular types of institutions, exploring which groups are dominating STEM majors. Second, I analyze status competition processes *between* types of institutions, asking how status effects differ by institutional type. This conceives of institutional context as moderating patterns of social inequality around STEM majoring through cultures and structures that emphasize certain status competition processes over others. Third, I consider how context plays a role in the salience of various intersectional statuses such that intersectional effects occurring at one type of institution are less relevant at another. Here, I return briefly to these three themes, evaluating the evidence based on the analyses in this chapter and providing specific examples. I also discuss some methodological issues in my analysis and suggest directions for future research. In the following chapter, I more thoroughly discuss the both the theoretical implications of my research and provide specific policy recommendations based on my results.

My analyses of status competition within institutions reveals that institutional context may very well determine the status competition processes that matter and dictate the primacy of certain status characteristics in controlling access to STEM majors. For example, income significantly impacts whites' and Hispanics' rates of STEM majoring at Carnegie Doctorate institutions (but not Asians' or blacks' rates) whereas at public institutions, income influences Hispanics and Asians, but not blacks or whites. Similarly, gender-based status competition processes are in effect at most types of institutions, but not at historically black colleges and universities. Women from lower income families are more likely than women from higher income families to major in STEM at land-grant institutions and HBCU, but income does not significantly matter for women's STEM rates at public or Carnegie Doctorate institutions. These relationships demonstrate the complexity of status competition processes based not only on class (as status competition theory has been classically constructed) but also on gender, race and the intersections of these statuses. Here we see that different status competition processes may occur simultaneously in a single context or that processes may overlap. For example, racial competition determine *which* women gain access to scarce resources, while women, as a group, compete with men for control of the same resources.

As such, attempts to diversify STEM majors (i.e., reduce inequality) must first consider the particular status competition processes functioning within an institution or institutional type. Policies seeking to create equity by targeting females, for example, would be misplaced at HBCUs where women are not underrepresented. Likewise, policies seeking to increase economic diversity among STEM majors at public institutions should carefully consider intersections of race and income so that, low-income Hispanics are not overlooked in the overrepresentation of lower income Asians.

My analyses of status competition processes *between* institutions demonstrate that institutional contexts may work differently for different students. Thus, there is no *single* institutional type that may be held up as a model for STEM equity. Specifically, we see that income effects have little influence at schools that are not Carnegie Doctorate institutions; gender has no significant effect at HBCUs; and there are virtually no racial differences between blacks, whites and Hispanics at public institutions. Yet, we see gendered, racial and class effects in the population.

While it would be easy to assume that *everyone* would like to major in a STEM field and then suggest some institutional matches (e.g., Asian men should be sure to attend public institutions and Carnegie Doctorate institutions while black women should enroll at HBCUs), this ignores several aspects of status competition theory. First, because individuals and groups are constantly competing both within and between institutions, the field of competition is constantly shifting. When an institution recruits additional women into its STEM majors, they shift the population and thus shift the status competition processes at play. As such, the best that any quantitative analysis can provide is a series of cross-sectional snapshots (of which my dissertation is one) that help us to understand the current scope of inequality and the trajectories that we have followed to arrive at this particular distribution. Second, and related to the first, participation in status competition processes are shaped by student *perceptions* of the occupational structure. Thus, real or perceived changes in the labor market can greatly transform these trajectories. Third, institutions themselves are involved in status competition with other institutions for prestige, for funding, and for the 'best' students. Hence, changes in institutional policies and practices have ripple effects, changing perceived status competition and the cost/reward structure associated with particular educational and occupational outcomes. What *is* clear, from my analyses, is that, in the competition for STEM majors, different institutional contexts provide certain advantages and disadvantages to students from different intersectional status groups. Further research on particular institutional types will need to address the mechanisms by which an institution eases STEM majoring for some groups and raises hurdles for other groups (e.g., through advising, availability of faculty mentors, opportunities for career networking, etc.).

The above findings can be interpreted to suggest that STEM majors are highly desirable as pathways to mobility, but not necessarily as means of maintaining social status for elites. Qualitative data on the motivations and strategies of individual students in selecting majors would allow for testing of this theory. My purpose in this analysis, however, is not to assess student motivation, but to describe patterns of inequality in STEM majors, how these patterns are influenced by intersectional status, and how institutional context modifies the salience of particular status characteristics or combinations thereof. As such, let me turn now to one last issue.

Intersectionality theorists have stressed that experiences of status are mutually informing (i.e., neither independent nor additive – see Chapter 2), but debate exists around whether intersectional statuses always shape experience or whether intersectionality, above and beyond the separate effects of race or gender (or class), is activated in particular contexts or interactions. While some theorists argue that experience of gender, for example, are necessarily shaped by race (and class, etc.) and thus intersectional effects are ever-present, others stress changes in meaning associated with race and gender depending on historical and/or spatial context (Lorber 1994; Omi and Winant 1994) and find that context can make particular social identities more or less salient during social interactions (Ridgeway and Smith-Lovin 1999).

My analyses here support the latter perspective. I find that intersectional statuses, as they relate to inequality in STEM majors, are activated in certain institutional contexts, but not in others. For example, the intersectional effect of income*race plays a substantial role in predicting STEM majoring among men at Carnegie Doctorate and public institutions, but appears to have little effect at HSIs. Similarly, the race*income intersection matters for Asian men at public institutions, but not at private institutions. As such, I suggest that the activation of particular intersectional statuses in certain institutional contexts results from variation in status competition processes determining who majors in STEM fields. Further theoretical research on intersectionality should examine other ways in which institutional, geographical or social context influences the salience of particular intersections.

In focusing only on these five institutional types as measures of institutional context, my analysis does not include measures of campus climate (e.g., prejudice and discrimination) which have been associated with postsecondary withdrawal among minorities (Hurtado 1992, 1994; Hurtado, Carter, & Spuler 1996). Yet, Cabrera et al. (1999) found that among African Americans, perceptions of prejudice did not influence academic performance or goal commitment. Furthermore, most of the studies assessing the impact of campus climate focus only on a single minority group, and results are mixed when multiple groups are studied simultaneously (Arbona and Novy 1990). Thus, while this chapter does not encompass every aspect of institutional context, it provides a significant foundation for future research that might focus on the particular mechanisms within and between various types of institutions that elevate competition between certain status groups and reduce it among others.

Chapter 7:
Conclusions: Pipelines, Pathways and Policies

In beginning this project, I wanted to integrate two strains of research on gender inequality: the quantitative methodological rigor of sociologists of education concerned with underrepresentation of non-dominant groups in elite spaces and the theoretical perspective of feminist researchers who challenge assumptions about power implicit in many traditional studies of inequality and call for changes in social structures that disadvantage women. My dissertation bridges these two research traditions. I have sought to explore persisting gender inequality by field of study in the U.S. postsecondary educational system, while simultaneously considering how patterns of STEM majoring differ among women (and among men) based on intersectionality. I explain these variations using the framework of status competition theory, which acknowledges the constant negotiation of status faced by individuals and social groups in order to advance or maintain their social position. As such, status competition theory provides an apt avenue for understanding the complexities of inequality in STEM fields. In this final chapter, I review the key findings of my analysis, analyze the theoretical implications for both of these strains of research and discuss some policy implications of my results.

Methodological Issues

Before I address these larger issues, however I want to briefly acknowledge and discuss some of the methodological and design issues in my study. Using secondary data raises a number of issues related to reliability and validity of measures. Reliability refers to the accuracy of data across cases or across waves of data collection. In my analysis, I had to address several problems related to data reliability - mostly related to the institutional type data. For example, as discussed in Chapter 3, the BPS data did not include institutional type codes for students' primary institution and so I sought a more reliable source (IPEDS) for information related to institutional type. I also used multiple imputations to correct for missing data. Simultaneously analyzing five multiply-imputed datasets allows me to increase the reliability of my results by not excluding cases with some missing data points from my analysis while accounting for possible variation in those missing data points. In sum, I am confident that the data presented here are as reliable as possible.

Validity refers to whether variables accurately represent the constructs they are intended to measure. Validity is harder to address than reliability. I attempted to increase the validity of my measures by running a variety of preliminary models that incorporated different measures for each concept. When I found consistently different effects for a single construct, I could be relatively certain that the measure was not valid. In these cases, I attempted to be more specific in my constructs - even splitting a construct into two (e.g., including both income and parental education as different measures of class - one representing economic capital and one representing social/cultural capital).

Perhaps a larger issue than reliability and validity is the probability that my models do not include other important factors influencing students' decisions about field of study. Debate exists around the best means of avoiding this issue with some researchers advocating an "add everything" approach (c.f. Astin 1993) while most advocate model testing with the goal of parsimony. Because my models include three-way interaction terms, including every imaginable predictor would severely limit my degrees of freedom. Yet, I did not want to overlook key factors. Determining the final form of my models was particularly challenging given the difficulty of addressing model fit in multiply-imputed regression analyses. Drawing from the existing literature, I ran a host of preliminary models that included a wide range of variables. I found that variables tended to be either consistently significant or consistently not significant. The seven student development control variables that I employ in my final analyses were those that consistently predicted STEM majoring.

Another potential issue with my analysis involves generalizability, given the cell size of intersections. In my analyses, I have noted where interactional cell sizes are lower than desirable and should be interpreted with caution. In other places, I have had to simplify my analyses (e.g., using only the dichotomous measure of parental education in 3-way interactions) in order to ensure a reasonable cell size. Despite these precautions, the results of interactional models should be interpreted with caution and ideally should be replicated using other available data sets, as they become available.

Perhaps the largest issue involves my decision to use multiply-imputed data with weighted logistic regression in order to find the most accurate estimates for coefficients and standard errors, despite the resulting difficulty of analyzing model fit. As discussed in Chapter 4, typical measures of model fit (e.g., pseudo R^2, log likelihood, Wald statistic) cannot be calculated in R (or other statistical software packages) for weighted logistic regression models that use multiply-imputed datasets. Hopefully, continued development of statistical programs will address this issue, but until then, researchers must either opt to exclude cases with missing data and/or exclude survey and sampling weights, potentially biasing estimated coefficients and standard errors, but calculate statistics to assess model fit *or* choose to include all cases and survey and sampling weights, ensuring the accuracy of coefficients and standard errors, but not calculate statistics to assess model fit. I have followed the best-practices identified for the BPS data. As such, I am confident that my analyses provide the most accurate estimates possible, but am unable to provide summary statistics regarding model fit.

Key Findings and Contributions

How does Intersectional Status Influence STEM Majoring?

As discussed in Chapter 1, feminist theorists have used the concept of intersectionality to illustrate that an individual can simultaneously experience privilege and disadvantage (Baca Zinn and Thornton Dill 1996; Higginbotham 1997). Status competition theory has traditionally focused on class- or ethnic-based processes of mobility and reproduction (e.g., Karabel 2005; Steinberg 1981), but has the potential to explain much more complicated stratification processes when applied to the multi-dimensional construct of status identity as defined by intersectionality. In my dissertation, I have neatly woven the two together - applying status competition theories to understand inequalities between individuals and groups at the intersectional level. This counters traditional research on stratification, which tends to assume the disadvantage of various groups in comparison to upper-class white men (who were the primary beneficiaries of early schooling) and test for movements toward equity. While empirical studies have identified a variety of advantages held by upper-class white males, such a dichotomous perspective oversimplifies the complex race, class, and gender dynamics in higher education. From a status competition perspective, competition exists not only between dominant and subordinate groups, but also between status groups at each level of the social hierarchy (e.g., between men and women for access to STEM fields and simultaneously between women from different racial groups for access to STEM fields, etc.). As such, my dissertation clearly demonstrates the connection between these two theoretical constructs: intersectionality provides a crucial perspective for understanding status competition processes and status competition theory lends itself to explorations of *within* group stratification and thus to studies of intersectional inequality. My results clearly identify both direct effects of race, class and gender *and* locations where the intersections of these statuses play a significant role in determining STEM majors.

As discussed in Chapter 1, empirical research on intersectionality necessitates a compromise in which one can *either* use smaller-scale qualitative studies that richly describe the lived experiences and meanings of individuals *or* employ larger quantitative data that reveal patterns related to inequality and intersectionality, but which lack the nuance and depth of the smaller-scale qualitative patterns. Although both are valid and integral research strategies for clarifying the interlocking nature of race, class, and gender within social systems, this dissertation follows the second path - elucidating the scope of intersectional status effects with regard to college major. Although my research does not seek to determine the specific social structures, experiences, beliefs, and/or norms that shape STEM majoring within particular intersectional status groups, the use of national survey data and quantitative enables me to identify *which* women (and *which* men) may need the most recruitment, intervention and/or support if they are to successfully major in a STEM field.

In Chapter 4, my analyses provided a clear picture of the scope and pattern of intersectional status effects on undergraduate students' chances of majoring in a STEM field. I began by confirming previous findings that gender, race, and class all impacted STEM majoring independently. Indeed, I found that women were much less likely to major in a STEM field than men, that Asians were more likely than whites (or other students of color) to major in a STEM field, that family income is inversely related to rates of STEM majoring (for most students), and that parental education affects STEM majoring primarily through early educational experiences, preparation and expectations. These patterns exist even controlling for a variety of student development variables indicating that these statuses directly shape educational trajectories well into students' postsecondary years *above and beyond* the ways that race, class, and gender set students on separate (unequal) educational paths through early educational experiences, preparation and expectations.

These models also reveal differences in how status competition processes may play out between class groups that are economically defined (as measured by income) and class groups that are culturally or socially defined (as measured by parental education). Specifically, it appears that having more highly educated parents provides students an initial advantage in developing the skills necessary to succeed in a STEM major (and be recruited into one). Students from these families tend to have higher test scores and expect to earn a graduate or professional degree. Yet, when we look at class from an economic perspective, students from upper-class families (i.e., higher income families) appear less likely to major in STEM fields. This does not necessarily suggest, however, than students from higher economic classes *could not* successfully compete for STEM majors, but perhaps that they opt out of the status competition process. In other words, while social and cultural capital provides students with opportunities and preparation advantageous to majoring in STEM fields, economic capital plays a significant role in determining the desirability of a STEM major as a means of status attainment. My results suggest that STEM majors are perceived as highly desirable pathways to mobility for students from working and lower class backgrounds, but not as ideal paths for status maintenance for students from higher class backgrounds.

I also found significant evidence that intersectional statuses impact STEM majoring, above and beyond the independent effects of race, class, and gender. For example, the effects of parental education continue to matter for women, but not for men. The rate of STEM majoring among women from families where at least one parent has a graduate degree is 150% that of women from families where neither parent has attended college. Why? One possibility is that stereotypes about women's ability to succeed in the sciences leads to harsher screening (by institutional gatekeepers and/or self) of female students seeking to enter STEM majors and results in the encouragement and/or admittance of only those women who, through social and cultural capital, are able to signal their ability to succeed. In contrast, men may be "assumed" to be competent in math and science and thus social and cultural capital signals carry less weight for them.

Likewise, I find that, in the general population, income has a depressor effect on STEM majoring, but for Hispanic students (and especially Hispanic women), income effects are consistently positive. To some extent this interaction may be an effect of the lower economic position of most Hispanic families in the U.S. On average, the family income of Hispanic students is substantially lower than the family income of white students (means of $48,417 vs. $81,535, respectively). Although STEM majors are perceived as pathways to social mobility, either they do not appear as desirable to

Hispanic students from lower income levels and/or, as with women, stereotypes about Hispanics, which may operate at both the individual and institutional levels, may lead to a more intensive screening process for Hispanic students entering STEM fields, resulting in higher levels of class competition among Hispanics that benefit students from higher income families. While the stereotypes for women result from traditional gender roles, stereotypes about occupations open to Hispanics are created and reinforced by U.S. immigration policies that encourage (or tolerate) immigration of Hispanic workers from the lowest economic classes for agricultural and physical labor positions (Lemay 1987). In contrast, the U.S. has actively recruited and encouraged the immigration of Asian intellectuals, whose children are second and even third generation college students (ibid). As such, a portion of the Asian effect may be attributed to particularities of, or at least stereotypes about, Asian populations in the U.S. While these are only two examples, they clearly exemplify a larger pattern whereby intersectionality matters more for students from non-dominant status groups. Thus, research on inequality that ignores intersectionality effectively describes the effects for dominant group members and risks replicating a history of empirical research that has assumed the white male experience as a baseline from which other status groups deviate. Future research *must* consider intersectional statuses as multiple, but not hierarchical. Applied to the idea of the STEM pipeline then, my results suggest that we should avoid assuming that there is a single STEM pipeline, which is “leaking” women. Instead, it lends credence to the argument that there are multiple pathways (Xie and Shauman 2003; Espinosa 2011; Tyson et al. 2007) with various entry and exit points, followed more or less readily by students from varying intersectional status groups.

How Do Intersectional Status Effects Differ by STEM Major?

By looking at differences between the factors that predict students will major in life science fields or in math science fields, my analysis highlights the importance of intersectionality in assessing inequality. Specifically, the fact that gender itself is not a significant predictor of whether students will major in a life science field (or a non-STEM field) does not mean that no differences exist between women and men in the life sciences. My results clearly show significant differences by race and class with regard to *which women,* and particularly, *which men* major in life sciences - indicating that achievement of parity along one status dimension (here, gender) may actually *change* levels of equality along other status dimensions as status competition processes adjust to determine who gains/retains access to scarce resources. Such an effect reinforces the root argument of feminist theorists that status characteristics are experienced as intersectional, with any given status influencing one's experience of other status characteristics (here, race and class effects do not occur independently of gender, but vary with it).

Furthermore, my results confirm the need for specificity in future research, both in terms of STEM majors and intersectional statuses. We see that status competition processes that influence students' majoring in life sciences differ significantly from those influencing students' majoring in math sciences. Specifically, while gender remains a strong predictor of *which* STEM field a student enters (with women being much less likely to enter math science fields), the size of the gender gap differs by race. I find that the largest gender gap exists between white women and white men (with the gap between Hispanic women and men not significantly different from whites). The gender gaps among blacks and Asians, however, are significantly smaller. With regard to status competition processes, this indicates that although women are less successful than men in majoring in math science fields, gender-based competition may be particularly fierce among Hispanics and whites. Future research should explore whether this escalation in competition is related to gender-socialization within Hispanic and white communities, the desirability of math science majoring among students from particular racial*gender intersections, or some other causal factor.

Finally, I find that class-based status competition processes remain conspicuously absent *between* STEM majors. In other words, a student's class background is significant in determining whether or not he/she will major in a STEM field, but less so in *which* STEM field. This seems to confirm the perception of STEM fields as providing opportunities for economic mobility, with race and gender determining the type of STEM field(s) in which a student majors. This finding, in particular, highlights the value of my approach, suggesting that as students travel into, out of, and through various STEM pathways, they engage in different status competition processes, based on their own intersectional status and the intersectional statuses of those with whom they are competing (whether they are competing to gain social mobility or to maintain their own social position). As such, my dissertation expands current theoretical conceptualizations of status competition that envision a single, ongoing process (a pipeline) into a series of processes (pathways) that are mutually informing (those influencing entrance into STEM and then entrance into specific fields within STEM). Further research must explore the motivations of students from various intersectional status groups in order to determine *whether* and *why* they are participating in these various status competition processes.

How does Institutional Context Influence Intersectional Status Effects on STEM Majoring?

My dissertation also addresses several questions related to the influence of institutional context. In particular, I explore status competition processes *within* particular types of institutions and *between* types of institutions, considering how context plays a role in the salience of various intersectional statuses. Although such an analysis could examine any number of institutional characteristics, I focused on five types of institutions. My results suggest that institutional context does influence the status competition processes involved in determining who majors in STEM fields, with various statuses more or less significant within particular institutions. For example, the intersectional status of income*gender is operative at Land-grant institutions and HBCUs, where women from higher income families are less likely to major in STEM fields, but is not operative at Carnegie Doctorate or public institutions. These effects are *above and beyond* the additive effects of gender and income. Among students at HBCUs, for example, gender does not have a significant independent effect, but the effect of income varies by gender such that the male students who major in STEM and the female students who major in STEM come from different economic backgrounds. Likewise, looking only at income, one might conclude that income has little effect on STEM majors at HBCUs. Yet, this conclusion overlooks the fact that STEM majors from lower income families are disproportionately female while those from higher income families are disproportionately male (at HBCUs). Thus, we see not only the importance of considering intersectional status in measures of stratification, but also the effect of institutional context - only at HBCUs do I find evidence that have women have achieved gender parity in STEM fields.

If we assume that status competition processes for STEM majors happen only *within* a given institutional context, then we seemingly could make suggestions to optimize STEM majoring among particular groups. For example, Asian men should be sure to attend public institutions (versus private) and Carnegie Doctorate institutions. Black women should enroll at HBCUs. White men from higher income families will have the best chances at a Land-grant institution, but white men from lower income families should matriculate at Carnegie Doctorate institutions. Women from families in which neither parent has earned a bachelor’s degree should also aim to attend Carnegie Doctorate institutions. Lower income Hispanics should definitely head for HSIs – where there is no income effect - and black men from lower income families should probably avoid HBCUs.

Institutions do not exist in isolation however. Institutions themselves participate in complex systems - engaging in status competition processes with other institutions to earn or maintain prestige, to recruit certain student populations (whether based on status characteristics or more vague notions like “academic potential”) and to build areas of specialty (like STEM). Thus, status competition processes influencing STEM majoring are simultaneously occurring between individuals (e.g., between two white women), between groups (e.g., between black women and white women), and between the very institutions that are recruiting and educating these students.

The results of the moderating models in Chapter 6, which explore status competition processes *between* institutions, demonstrate that institutional contexts work differently for different students. There is no *single* institutional type that may be held up as a model for STEM equity. In the competition for STEM majors, different institutional contexts provide different advantages and disadvantages. Further research on particular institutional types will need to address the mechanisms by which an institution eases STEM majoring for some groups and raises hurdles for other groups (e.g., through advising, availability of faculty mentors, opportunities for career networking, etc.).

Theoretically, my analysis contributes to the continuing debate about the salience of intersectionality across times and spaces. My findings, with regard to how institutional context *moderates* the effects of intersectional status on STEM majoring, strongly suggest that salience varies with context. This is not to say that individuals ever cease to experience their *identity* from an intersectional perspective; my analysis does not address individual or group identity. Instead, I find that the structural and cultural processes of stratification activate or focus upon particular statuses or intersectional statuses of individuals or social groups and that *which* statuses or intersectional statuses are activated varies by context. For example, the intersectional effect of income*race matters significantly for Asian men at public institutions, but not at private institutions. Likewise, for some women, the intersectional effect of gender*parental education depends on whether or not they attend a Carnegie Doctorate institution, with women from families where neither parent holds a bachelor’s degree much more likely to major in STEM if they attend a Carnegie Doctorate institution. As such, my dissertation supports the claim that the salience of intersectionality depends on historical and/or spatial context (Lorber 1994; Omi and Winant 1994) and I suggest that the activation of particular intersectional statuses in certain institutional contexts (and not in others) results from variation in status competition processes leading to particular outcomes – here, determining who majors in STEM fields. Further research on intersectionality should examine other ways in which institutional, geographical, or social context influences the salience of particular intersections.

Policy Implications and Recommendations

In the award winning 1999 film, *The Matrix,*[20] when the main character, Neo, wakes up in the world outside of the matrix, he must let go of his assumptions about how the system works before he can be an effective agent of change. While he struggles to come to grips with this new reality, he is told by a young boy: "Do not try to bend the spoon — that's impossible. Instead, only try to realize the truth: there is no spoon." Likewise, while educational researchers, administrators, and policy-makers have desperately sought to identify and repair "leaks" in the STEM pipeline, my research suggests that there is no STEM pipeline. Instead, the pipeline might better be conceived as multiple pathways (as argued by Xie and Shauman 2003; Espinosa 2011; Tyson et al. 2007). In particular, I suggest that the pathways followed by students from different intersectional status groups vary significantly and that understanding these different pathways will be the beginning of developing more effective policies for broadening participation in STEM fields. In essence, we need to change our own perceptions - allowing for multiple, equally effective pathways into STEM and acknowledging the

[20] Wackowski, Larry and Wackowski, Andy. 1999. *The Matrix.* Warner Brothers and Village Roadshow Productions.

ability of students to move into, through, out of and between these pathways along the course of their educational journey.

The rest of this chapter provides some specific policy recommendations, based on the analyses presented above. Part of the difficulty in creating effective STEM-related policies is the wide range of stakeholders, including state and national policy-makers, postsecondary institutions, primary and secondary institutions, families, and a host of not-for-profit and for-profit para-educational organizations (e.g., the College Board, Kaplan, etc.). Each of these stakeholders is a part of the status competition process such that changes in these institutions will change the process. In other words, there is no *final solution* for broadening STEM participation – only a constant process of monitoring and revising.

For the purpose of discussion, I will assume that the shared goal of these stakeholders is to broaden participation in STEM by encouraging the recruitment, retention and success of women and other underrepresented groups in STEM majors. It is worth noting that broadening participation does not merely mean *increasing* participation, but creating more equitable rates of STEM participation among different social groups. Here, I provide a list of stepping-off points and best practices directed at target stakeholders and based on the results of my analyses. Again, I must note that my analysis empirically identifies *which* status competition processes are primary in determining STEM majors, but can only theorize the particular mechanisms by which these status competition processes play out. As such, I provide suggestions for the target populations on which various stakeholders may wish to focus and then point to some existing empirical literature for suggestions on *how* stakeholders might proceed.

Although the range of stakeholders is wide, as noted above, many of these groups fall outside the scope of my analyses. As such, I direct my policy recommendations primarily to postsecondary institutions and state and national policy-makers.

Postsecondary Institutions

At the individual level, stereotypes and early academic experiences decrease the likelihood that students from some intersectional statuses will have considered or be adequately prepared for a STEM major. Moreover, students' perceptions of the occupational structure will play a primary role in motivating their selection of a major field of study. Postsecondary institutions seeking to broaden participation in their STEM majors can address this in several ways. First, promotional and recruitment materials should inform potential students about opportunities available in STEM fields and highlight the accomplishments of faculty and students from underrepresented groups in STEM. Promotional materials that outline the *path* by which someone from a particular intersectional status group became a STEM major provide opportunities for students to envision themselves following this path. Second, colleges should recognize that students from certain intersectional status groups are less likely to arrive at college prepared to major in STEM. As such, colleges should encourage first year students to take introductory courses in STEM areas and should design introductory courses that appeal to students with a wide range of previous academic exposure (AAUW 2010). Whitten et al. (2007) notes that because few women begin college intending to major in physics, faculty at women's colleges must actively recruit students into these majors. Thus, other institutions might look to faculty at women's colleges as models for re-envisioning the idea of one pipeline into STEM into a multiple pathways approach; if all colleges could adopt such a perspective, instead of the older approach by which faculty attempt to “weed students out” of STEM majors through introductory courses, we should see broader participation in STEM fields.

Postsecondary institutions should also concern themselves with the particularities of STEM majors, as demonstrated by my analysis of math science and life science fields. In particular, my analysis shows higher levels of segregation in the math sciences than the life sciences, which may provide a starting point for policies seeking to broaden participation. In fact, holding student development effects constant, students from all intersectional status groups (of race and gender), with the exception of Asian men, major in the life science at roughly equal rates. In contrast, a large gender gap exists across races in the math sciences. More specifically, we see four major groups emerging: Asian men at the top; then white, black and Hispanic men; followed by women of color; and finally white women, who are least likely. Postsecondary institutions would do well to keep this pattern of intersectional stratification in mind when considering strategies for broadening participation in math sciences.

While the above discussion applies to all postsecondary institutions, my analysis of institutional context effects in Chapter 6 also lends itself to the creation of policies addressing particular institutional-level issues. Most significantly, while intersectional status effects vary between institutions, gender remains a strong predictor of majoring in STEM fields across institutions (with the exception of HBCUs - which I discuss below). While many schools already focus on recruiting more women into STEM fields, Fox, Sonnert, & Nikiforova (2009: 340) have determined that the STEM programs most successful at broadening participation in science and engineering majors paid greater attention to the *structural* causes of underrepresentation, focusing not only on recruitment and retention, but also on a variety of environmental factors (e.g., "faculty and classroom bias against underrepresented groups; grading systems that function to ''weed-out'' students; and a ''pipeline of support'' for continued (graduate) study that is less helpful to women than to men undergraduates").

Below, I detail some additional policy implications specific to the various types of institutions in my analysis. My analyses help to identify the particular status competition processes at play in different institutional contexts. For example, I find that, at certain institutions economic class is a strong predictor of STEM majoring. Many questions remain: Are class processes playing out through biased faculty evaluation of students? Through recruitment efforts into majors? Through structural barriers such as the cost of lab equipment? Or through student perception of the desirability of career opportunities associated with a major? In all likelihood, it is some combination thereof. Further research will be needed to identify the particular mechanisms by which these status competition processes play out in particular institution contexts. Here, I identify *which* intersectional status groups are under- or overrepresented at particular institutions (i.e., which status competition processes are in play), thus indicating a direction for policies and more detailed internal assessments.

Carnegie Doctorate institutions should be aware that, in comparison to non-Carnegie Doctorate institutions, their STEM majors are coming disproportionately from lower income families and that, among women, they are producing more STEM majors from among first-generation college students. Thus, although it seems ironic with regard to typical arguments about equity in higher education, in order to broaden participation in their STEM majors, Carnegie Doctorate institutions might consider why they have fewer STEM majors from higher-class backgrounds than non-Carnegie Doctorate institutions. Among *Hispanics* attending Carnegie Doctorate institutions, however, STEM majors are coming disproportionately from higher income families. As such, Carnegie Doctorate institutions might devote additional resources to helping Hispanic students from lower income families overcome potential obstacles of entering and graduating in STEM fields (be they cultural or structural).

Public institutions should be most concerned about the intersectional effects of income and race on STEM majors. Specifically, public institutions should be aware of the much greater impact of economic class on STEM majoring at their institutions as compared to private institutions and of the overrepresentation of Asian men, particularly at lower levels of family income. Public institutions might consider whether the diversity of their STEM faculty is contributing to the perpetuation of this pattern - such that Asian men are most likely to see themselves represented and to find mentors among STEM faculty. Public institutions should also consider the effect of income*race for Hispanics, who are only half as likely as Asians to major in STEM fields at lower levels of income. Rates of STEM majoring for Hispanics across the income spectrum at public institutions has a pattern similar to, but slightly higher than, at Carnegie Doctorate institutions.

Land-grant institutions appear to have a slightly higher gender gap in STEM than other types of public institutions or Carnegie Doctorate institutions. This gap arises not because women at land-grants are majoring in STEM at lower rates, in fact, women from lower-income families major in STEM at *higher* rates at land-grant institutions, an advantage that decreases as family income increases such that women from higher income families have virtually the same rates whether or not they attend a land-grant institution. Instead, the more pronounced gender gap at land-grant institutions appears to stem from the *positive* income effect for men within this institutional context. Thus, other institutions might benefit from understanding why STEM majors are so appealing to men from higher economic classes *at land-grant institutions,* but not in other institutional contexts. Land-grant institutions, however, essentially create/re-create gender- and class-based inequality through the disproportionate educating of upper-class male students in STEM. I find no significant racial effects (or intersectional effects by race) at land-grant institutions. Thus, land-grant institutions might seek to assess the processes by which students select and/or are selected into majors and the diversity of their STEM faculty in order to broaden participation in STEM fields. Land-grants may also consider working with faculty to raise awareness of stereotypes and bias in student evaluation and academic advising.

Historically black colleges and universities (HBCUs) appear to have the most unique institutional context, of the institutions that I analyzed. I find no gender effect among black students at HBCUs. Intersectional status models, however, show that the women and men majoring in STEM at HBCUs come from different economic classes. Specifically, the women likely to major in STEM at HBCUs are from lower income families while, for men, rates of STEM majoring are positively related to family income at HBCUs. While my data cannot provide such detailed information, I would first encourage HBCUs to look specifically at the fields in which these upper-class men and lower-class women are majoring - it may be that HBCUs are providing are two very separate pathways leading to two very separate outcomes (i.e., segregation by major within STEM). If so, then policies can be directed at broadening participation along both of these pathways. If these are not essentially different pathways to different majors, then it does not seem that HBCUs are structurally excluding students from STEM along gender or class lines. Instead, I would urge HBCUs to focus on understanding and shifting student perceptions of STEM fields, perhaps through institutional publications, student orientation and academic advising.

My limited findings on Hispanic-serving institutions (HSIs) suggest that, to broaden participation among Hispanic students, HSIs should focus on increasing participation among females. Changing existing patterns may consist of a two pronged attack: first on changing gendered perceptions of labor within the student population (or the prospective student population) and second on changing aspects of institutional environment and departmental culture that reinforce those gendered divisions. For example, HSIs might invite prospective female students to tour laboratory facilities, sit in on introductory STEM courses and talk to alumnae who have successfully pursued scientific careers. HSIs might also assess the ease with which students can change majors into and out of STEM fields - providing more opportunities for women to move *into* STEM fields via later pathways. Finally, I find a strong negative effect for students working full-time at HSIs. To address this issue, HSIs may seek to incorporate internship or co-op programs or other work-study opportunities *into* STEM majors such that students could simultaneously provide for themselves financially while gaining experience in their chosen field.

State and National Policy-Makers

Finally, state and national policy-makers could play a pivotal role in broadening undergraduate participation in STEM. First, the critical contribution of HBCUs to the production of black scientists and engineers, and especially black female scientists and engineers, should not be overlooked. Although they constitute a rather small proportion of postsecondary institutions, they are making a significant contribution to the diversity of STEM majors in the U.S. Recent reductions in state-level funding to postsecondary institutions have also disproportionately affected HBCUs who, because of their smaller target audience, tend to lack the financial endowments and public support (both at the population level and within elite circles) of traditionally white institutions. If we are serious about seeking to broaden participation in STEM fields at the national level, we must encourage and support the success of HBCUs.

Second, we have in place national programs of enrichment for at-risk students. For example, *Upward Bound Math-Science,* a program of the U.S. Department of Education seeks to "help students recognize and develop their potential to excel in math and science and to encourage them to pursue postsecondary degrees in math and science, and ultimately careers in the math and science profession" (U.S. Department of Education 2012). My results suggest that defining at-risk populations is a complex process depending on the outcome of interest (specifically, I identify groups that are at-risk of being underrepresented in STEM majors). As such, I would recommend that state and national policy-makers consider re-evaluating the qualifying criteria for these programs (so as not to exclude students who appear not-at-risk based on a single status characteristic, but instead to identify at-risk populations using an intersectional lens).

Third, state and national policy-makers might seek to broaden student interest in and awareness of STEM careers through the creation of tuition scholarships and/or prestigious research fellowships for undergraduate students who major in STEM fields in which they constitute an underrepresented minority. The criteria for these scholarships/fellowships could be set either at the institutional level or the state level (i.e., with either institutions or states analyzing and determining which intersectional status groups are underrepresented). Even the publicity around these prizes would create heightened interest in STEM and greater awareness of the opportunities associated with STEM majors among students and parents, and might also discourage the perpetuation of gendered and racial stereotypes about STEM.

Finally, state and national policy-makers should create a series of grants and/or funding opportunities for postsecondary institutions that seek to broaden participation in STEM fields. These programs might follow the example of NSF's ADVANCE program, which funds institutions attempting to develop systems for increasing female representation (both recruitment and retention) in STEM careers, or might assist institutions implementing new methods of STEM education. Broadening participation of faculty from underrepresented groups in STEM fields would increase the availability of STEM role models and, indirectly, reduce stereotype-based biases in student evaluation and advising. New methods of STEM education might include internship or work-study programs like the one discussed above - allowing students who must work part- or full-time during school to earn credit for work completed in a laboratory setting might encourage these students to major in STEM fields at higher rates. Alternatively, institutions might seek to develop new series of introductory STEM courses that more fully engage students across the curricula, exposing them to STEM fields and careers as they fulfill general education requirements.

Future Directions

The results of my analyses raise several questions that I hope to address in my own future projects, both quantitative and qualitative. First, I hope to explore intersections of horizontal and vertical equity by analyzing the effects of intersectional statuses on enrollment in graduate studies in STEM fields. In my dissertation, I limited my analysis to undergraduates, partially due to the availability of data. Fortunately, NCES has decided to continue following the BPS:04/09 cohort gathering data on their employment, further education and other involvements. The next wave of data is being collected currently (2012) and should be available to researchers within the next year or two. The availability of such data provides a unique opportunity for extending my analysis of horizontal equity (between fields of study) in a vertical direction (levels of education).

Second, I will expand my quantitative analysis to focus more specifically on the mechanisms by which particular institutional contexts influence intersectional status effects. In this project, I will look at how specific institutional characteristics associated with institutional types - such as student body composition and size, faculty diversity, campus climate and others - differentially impact certain status groups. To do so quantitatively, I can further integrate the IPEDS and BPS data, and expand my sample by incorporating similar institutional data for students in the Baccalaureate and Beyond (B&B) dataset collected by NCES. The results of such an analysis should allow for increasingly specific policy suggestions to individual institutions hoping to broaden undergraduate participation in STEM.

Finally, having assessed the scope and importance of intersectionality in determining STEM majors, I am interested in exploring the meanings and experiences of majoring in a STEM field for students from different intersectional status groups. I envision this as an educational ethnography, following a sample group of students from the summer before they enter college to the completion of their bachelor's degree. Student interviews and participant-observation on campuses will allow me to explore variation between groups regarding the social construction of STEM majors as desirable paths for mobility. Some of the questions I would seek to address are raised in the analyses above: Which majors are desirable and for whom? Why? What factors are considered in the selection of a major (including individual interests, experiences and aptitudes; family influences; and institutional factors)? To what extent do students consider their own race, class, and/or gender when choosing a major? What factors result in students' changing majors? How do these patterns differ by intersectional status? I intend to begin laying the groundwork for this project, in terms of arranging locations and identifying participants, this autumn with the hope of beginning interviews next summer. In addition to clarifying the mechanisms by which institutional contexts influence students' decisions about STEM majoring, such a project will help in identifying for whom STEM education is a desirable resource and thus why certain groups of students are engaging in these status competition processes while others appear to have chosen not to compete. It will also allow me to address the other aspect of intersectionality - the meanings and experiences attributed to particular statuses by individuals.

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