Black STEM Students and the Opportunity Structure

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Abstract

Since co-curricular activities enrich students' experiences in STEM and support academic success, they comprise what we term "the STEM opportunity structure." Utilizing longitudinal data from the 2004 Freshman Survey and 2008 College Senior Survey administered by the Cooperative Institutional Research Program, this study investigates the pre-college characteristics, college experiences, and college environments that significantly influence Black students' participation within the STEM opportunity structure, compared to their White counterparts. The dataset is comprised of a sample of 792 Black students, and an equal number of randomly selected White students, who intended to major in a STEM discipline in their freshman year, across 175 and 91 institutions respectively. We include participation in supplemental instruction and receipt of faculty mentorship and support as two major components of the opportunity structure. HLM analysis shows institutional size, designation as an HBCU (versus a non-HBCU), and the structural composition of the student body (i.e. the proportion of White students and proportion of STEM students) influenced Black students participation in one of the two components of the opportunity structure. Further a students' pre-college preparation, achievement, and experiences are most predictive of the frequency with which Black students participate in SI whereas campus climate is most predictive of the frequency with which Black students receive faculty mentoring and support. Relatedly there are no overlapping predictive variables between the likelihood that Black students participate in SI and the frequency with which they receive faculty mentorship and support. This suggests that the frequency with which students participate in the opportunity structure depends on the activity in question, which is then predicted by different dimensions of the campus environment and different student behaviors. These findings can inform and direct the practices of STEM educators and student affairs practitioners concerned with developing programming which aims to support the persistence and degree completion of Black students in STEM. Ultimately, this paper contributes to the literature on how educators can better cultivate academic excellence in STEM among Black undergraduates.

A highly educated workforce in science, technology, engineering, and mathematics (STEM) is critical for the vitality of the economy (Carnevale, Smith, & Strohl, 2010;), yet too few students graduate with STEM degrees in the United States with only 18% of bachelor's degrees awarded in 2009 being STEM-related US (U.S. Congress Joint Economic Committee, 2012). Comparing this statistic to that of other countries, such as Mexico and the United Kingdom which respectively confer 28% and 31% of all bachelor degrees in STEM disciplines, the United States is losing momentum and falling further and further behind (U.S. Department of Education, National Center for Education Statistics [NCES], 2012). Additionally, Black students have persistently lower rates of STEM degree completion compared to their White and Asian counterparts (Espinosa, 2011), which limits the diversity and ability of the field to creatively make technological advancements needed by society.

There are a number of hurdles that Black students face to persistence and completion in STEM majors. Challenges include less rigorous academic preparation at the high school level (Perna, Gasman, Gary, Lundy-Wagner, & Drezner, 2010), negative assumptions by peers and faculty about their intellect (Solórzano, Ceja,& Yosso, 2000), and learning environments in STEM that reflect White male norms and that have a narrow perception of who a scientist can be (Carlone & Johnson, 2007). There are also a number of experiences that contribute to the success of Black students in higher education. Participation in supplemental instruction and receipt of faculty mentorship and support not only enrich students' experiences in the discipline (Hurtado, Cabrera, Lin, Arellano, & Espinosa, 2009), but also support academic success (Hurtado, Newman, Tran, & Chang, 2010). These interventions are therefore two important components of the what we term the "STEM opportunity structure." Despite the many benefits associated with participation in the opportunity structure, there is a shortage of literature pertaining to the institutional and student level predictors of involvement as they relate to Black STEM aspirants specifically, compared to White peers.

The purpose of the study is twofold: 1) to investigate the factors that are predictive of Black students' participation in SI and receipt of faculty mentorship and 2) to draw systematic comparisons of the predictors of participation between Black and White STEM aspirants. Findings from this study will inform and direct the practices of STEM educators and student affairs practitioners concerned with developing programming that supports the persistence and degree completion of Black students in STEM. Ultimately, this paper will contribute the existing body of literature related to cultivating academic excellence in STEM, particularly for Black undergraduates.

Literature Review

What largely distinguishes those who remain committed to STEM disciplines and those who do not has less to do with ability and more to do with the supports within the environment to which students have access that can help them overcome, or at least manage, the challenges that arise (Seymour & Hewitt, 1997). Supplemental instruction and faculty mentorship are two approaches to providing Black students additional support, both of which can enhance Black students' experiences as they navigate the STEM pipeline. The following sections examine Black students' participation in supplemental instruction and receipt of faculty mentoring and support, and discuss how participation in these experiences impact students' academic trajectories, degree aspirations, and/or persistence.

Supplemental Instruction (SI)

In an effort to increase STEM degrees, institutions of higher education have allocated a great deal of capital (both human and monetary) to support STEM-related programs that generate or strengthen student interest in STEM, support them in their academic endeavors, and increase persistence and completion rates within STEM programs (Hu, Scheuch, Schwartz, Gayles & Li, 2008). Supplemental instruction is one such intervention that many universities offer to students.

Supplemental instruction is a widely used co-curricular activity in which students taking traditionally difficult introductory courses are given additional time outside of the regular lecture to receive instruction that complements course content, and to work collaboratively with peers to solve problems (Wilson et al., 2011). Enrollment in SI courses is voluntary (Arendale, 1998), and students who enroll come from diverse ethnic, gender and economic backgrounds (Arendale, 1998; Malm, Bryngfors, & Mörner, 2010; Peterfreund, Rath, Xeos & Bayliss, 2008). Students with less familiarity of complicated course concepts and lower levels of academic efficacy especially benefit from the interactive structure of SI courses (Coletti et al., 2012). SI also equips students with effective study strategies than can help counteract the impact of inadequate academic training at the secondary level (Barlow & Villarejo, 2004). Indeed supplemental instruction is not just a pedagogical method but an approach to learning wherein students develop a keen sense of curiosity and inner motivation via collective learning (Olstedt, 2005).

Participation in SI has also been found to facilitate the academic success of students majoring in STEM specifically (Armstrong, Power, Coady, & Dormer, 2011; Blat & Nunnally, 2004; Hands, Reid & Younger, 1997; Malm et al., 2010). On average students enrolled in SIs are more likely to pass the related course (Peterfreund et al., 2008), and achieve higher grades than their peers who do not take SI (Armstrong et al., 2011; Blat & Nunnally, 2004; Rath, Peterfreund, Xenos, Bayliss & Carnal, 2007). Given that successful completion of gateway math and science courses are critical to persistence in a STEM major, SI workshops provide students with the necessary support to advance in the STEM course sequences (Peterfreund et al., 2008, Malm et al., 2010) and thereby ultimately help students complete STEM degrees (Rath et al., 2007).

Interestingly a few studies have attempted to conduct a cost-benefit analysis of supplemental instruction, and have found that from an economic standpoint, gains from supplemental instruction , which include the higher credit acquisition of students as a result of not having to drop class, far outweighs the cost (Congos, 2001; Malm, Brynfors, & Mörner 2012). One study found that for every dollar spent on SI, institutions save roughly ten dollars (Congos, 2001) . Thus SI appears to be an economically sound investment for universities experiencing retention problems in STEM, especially as they relate to Black and other racial minority students

Faculty Mentoring and Support

While there is extensive literature on student-faculty interactions, this study is particularly concerned with the extent Black students receive *intentional* mentoring and support from faculty, because quality connections with faculty shape students' experiences in college and can help propel them into a STEM career. As Black students progress within STEM disciplines, validating experiences from faculty reinforce a sense of self worth and self-efficacy in students' abilities (Rendon, 1994) with mentorship being critical for the development of science identity (Hurtado et al., 2010). Since even successful students who are persisting can be dealing with obstacles with respect to self-esteem in STEM (Graham, 2013), they also benefit from mentorship. Close interactions with a faculty member can solidify students' interest within their major, socialize them to the norms of their STEM discipline, and help students build their professional networks (Lopatto, 2004). Students who are mentored by faculty also tend to thrive in STEM disciplines and pursue STEM related advanced degrees (George, Neale, Van Horne, & Malcom, 2001; Hu, Scheuch, Schwartz, Gayles & Li, 2008).

Furthermore, positive recognition from faculty also draws students further into the discipline (Carlone & Johnson, 2007) with positive interactions serving to reinforce students' belief in their ability to become a professional in their field (Coldbeck, Cabrera, & Terenzini, 2001). Students who receive quality mentorship tend to have higher grades in STEM courses, increased engagement, and higher rates of degree completion (McHenry, 1997; Strayhorn & Terrell, 2007; Cole, 2007; Kim & Sax, 2009). Considering the numerous benefits of mentorship for STEM aspirants, it is imperative such relationships are established at the beginning of students' undergraduate careers.

Despite the impact of mentoring relationships on student academic success, most students do not interact with faculty frequently (Cotten & Wilson, 2006; Cox & Orehovec, 2007), and such interactions can be especially problematic for students of color to initiate (Nettles, 1990; Hurtado, Eagan, Tran, Newman, Chang & Velasco, 2011). The hesitancy (or enthusiasm) students experience in seeking out-of-class contact with their professors may be explained by professors' behaviors inside and outside the classroom (Hawk & Lyons, 2008; Hurtado et al., 2011) with students being more inclined to interact with faculty when they are both accessible and approachable (Eagan, Figueroa, Hurtado, & Gasiewski, 2012). More specifically the language, attitudes, advice, and body language faculty exhibit send subtle messages that can either affirm students and encourage more interactions or perpetuate inequities and discourage contact (George & Malcolm, 2011), Unsurprisingly, a number of studies indicate that students of color attending PWIs gravitate towards faculty of color when looking for mentors and support (MacKay, 1997; Tierney & Bensimon, 1996; Williams & Williams, 2006), or seek out faculty who understand the cultural issues they experience while in graduate school (Patton & Harper, 2003). The inverse is also true; Black professors appear to reach out to students of color more frequently because of shared experiences with racism or marginalization in higher education (Reddick, 2005; Griffin, 2012).

Conceptual Framework

The conceptual framework offered here draws from critical theoretical perspectives and literature related to engagement, interactions with peers and faculty, and the institutional context to aid our understanding of the variables that may impact Black students' involvement in the opportunity structure.

Critical Perspectives: Microaggressions and Campus Climate

As a racialized population, Black students have unique experiences in higher education. How the campus "feels" to a student – otherwise known as campus climate – affects students' engagement in academic and social activities (Cabera, Nora, Terenzini, Pascarella, & Hagedorn, 1999; Sutton & Kimbrough, 2001), especially for racial ethnic minority students (Sutton & Kimbrough, 2001). Students who perceive the level of prejudice at predominately White institutions (PWIs) to be high or who perceive the campus negatively are likely to disengage (Harper & Quaye, 2009), and are less likely to participate in activities occurring out of the classroom (Eimers, 2001; Harper et al., 2005). Microaggressions – intentional or unintentional communications that hold derogatory connotations for people of color (Sue et al, 2007) – contribute to a negative perception of the campus climate (Solórzano, Ceja, & Yosso, 2000), which can in turn contribute to feelings of greater isolation, discontent, and lower levels of engagement (Hurtado & Carter, 1997; Nora & Cabrera, 1996). Unfortunately, minority students often confront micro-aggressions from both peers and faculty (Solórzano, Ceja, & Yosso, 2000), which make the learning environment feel hostile or chilly (Maple & Stage, 1991; Sondgeroth & Stough, 1992) wherein students feel unsupported and discouraged from continuing the pursuit of their STEM aspirations (Perna et al., 2010). Alternatively positive cross-racial interactions between Black students and others lead to a strong sense of support, engagement and sense of belonging to the department and institution, and the enhancement of the students' overall college experience (Davis, & Finelli, 2007; Hrabowski & Maton, 2009; Johnson, 2007).

In addition to positive cross-racial interactions, a strong sense of self-efficacy helps Black STEM aspirants better cope with subtle forms of discrimination and a chilly learning environments (McGee & Martin, 2011**).** Black students often confront inequality, marginalization and oppression in the educational setting (Ortiz & Santos, 2009), and are aware of the negative racial stereotypes of Black students. These experiences and awareness can impact both how students perceive their own knowledge and abilities (i.e. self-efficacy), and their perception of how others view them (Okech, & Harrington, 2002; Steele & Aronson, 1995). Self-efficacy is a contributing factor to how engaged URMs students are socially and academically while in college (Bandura, 1986; Dembo & Seli, 2007; Schunk, 2004; Zimbaro & Gerrig, 1996), and whether Black students persist in STEM majors (Perna et al,, (2010). Applied to this study, critical perspectives demonstrate that Black students in higher education are likely to have racialized experiences in the college context that have the potential to impact how confident they are in their abilities, both of which are expected to influence the extent to which students participate in campus activities.

Social Factors: The role of Faculty and Peers

Research has emphasized the importance of faculty interactions in supporting the academic attainment of URMs in STEM, which is inclusive of Black students (Carlone & Johnson, 2007; Carrel, Page, & West, 2009; Hoffman & Oreopoulos, 2007). Such interactions can positively or adversely affect students' experiences and persistence within STEM majors (Ceja & Rhodes, 2004; Palmer & Gasman, 2008). Faculty are known as institutional agents when they use the status and authority associated with their university positions to advocate for historically disenfranchised students by expanding students' educational opportunities and exposing them to much needed resources, networks, and knowledge bases (Stanton-Salazar, 2010). In this way, institutional agents play a large role in helping students interpret and navigate the educational environment (Stanton-Salazar, 2010) and empowering them in ways that help them achieve success (Dowd, Sawatzky, Rall, & Bensimon, 2013). Mentors are also known to provide students with opportunities to participate in meaningful ways in the academic community like engagement in undergraduate research (Kuh & Love, 2000). Thus interactions with faculty or institutional agents have the potential to induce participation in other activities that are supportive of students' success while in college. With the preceding in mind, mentor functions are especially crucial to the success of students who do not come from families with long histories of educational attainment and may need additional guidance (Carlone & Johnson, 2007).

Relationships with peers are also important to the success of college students broadly (Astin, 1993; Pascarella & Terenzini, 2005), and in STEM specifically (Hurtado, Cabrera, Lin, Arellano and Espinosa , 2009; Murphey & Arao, 2001). Like relationships with faculty, supportive relationships with peers have an impact on students' self-efficacy in STEM disciplines (Zeldin and Pajares, 2000), provide key sources of support and information (Harper & Quaye, 2007; Museus, 2008), and can shape the experiences and motivations of African American students in STEM (Cole & Barber, 2003; Hurtado et al., 2010; Johnson, 2007).

The Role of the Institutional Context

Institutional context matters when it comes to the participation in the opportunity structure, because the availability of engagement opportunities varies by institution, with some institutions offering opportunities that others do not due to varying institutional resources (Porter, 2006). It may also be the case that access to some engagement opportunities is restricted to a targeted group of students, such as those who are the highest achieving (Ampaw & Partlo, 2013).

The emphasis institutions place on engagement is also important to participation in co-curricular activities. For example, Hurtado, Eagan, Cabrera, Lin, Park, and Lopez (2008) found that Black students enrolled at colleges providing research opportunities to students in their first-year were four times more likely to immerse themselves in research than their counterparts at non-research inclined institutions. The same might be the case for other engagement opportunities. Further Black students at Historically Black Colleges and Universities (HBCUs) have higher levels of involvement and more quality interactions with faculty than Black students at PWIs (Nelson Laird, Bridges, Morelon-Quainoo, Williams, & Salinas Holmes, 2007; Perna et al., 2010). This is likely due to the fact that HBCUs intentionally build an atmosphere conducive to the success of African-African students (Nelson Laird et al., 2007). Further, PWIs tend to be more dismissive of the cultural needs and interests of its URM students especially in relation to co-curricular activities (Cheng, 2004; Harper et al., 2005; Hernandez, 2002; Smedley et al., 1993) Finally the selectivity of the institutional plays role in the retention of URM students in the sciences, with URMs being more likely to withdraw from highly selective institutions (Chang et al, 2008), suggesting that institutional selectivity may also have an influence on the engagement of URM students. Clearly, a consideration of the institutional environment is critical to understanding the participation of Black STEM students in the opportunity structure.

Methods

Data and Sample

The data for this sample is drawn from the Cooperative Institutional Research Program (CIRP) 2004 Freshman Survey and follow-up 2008 College Senior Survey. The Freshman Survey (TFS) is administered to first-time freshmen students during freshman orientation or during their first term in college and collects demographic information and information about students' precollege experiences, attitudes, values, goals, self-perceptions, and expectations for college. College seniors complete the College Senior Survey (CSS) in the spring of their fourth year, and this instrument collects information about the experiences students had while in college as well as their self-perceptions, values, attitudes, career aspirations, and post-graduation plans. The intentional sampling of underrepresented students (i.e. Black, Native American, and Latino) was made possible by grants from the National Institutes of Health (NIH) and National Science Foundation (NSF). The longitudinal response rate for the 2004 TFS and 2008 CSS was approximately 23%. Response weights were calculated to adjust for potential non-response bias. The full longitudinal dataset includes information from 6,224 students at 238 institutions. Institutional data for the 2006-2007 academic school year was taken from the Integrated Postsecondary Education Data System (IPEDS) and merged into the longitudinal data set. Eagan, Hurtado, Chang, Garcia, Herrera,, and Garibay (2013) provide more information on the sampling and weighting strategies applied to this dataset. The final analytic sample included 792 Black students, and an equal number of randomly selected White students, attending 175 and 91 institutions respectively who indicated that they aspired to a STEM major at the start of their undergraduate studies.

Variables

This study analyzes two dependent variables: 1) frequency of instruction that supplemented coursework; and 2) frequency student received faculty mentorship and support. For the first dependent variable, students marked how often they had instruction that supplemented coursework (not at all, occasionally, or frequently). The faculty mentorship and support construct measured the extent to which students and faculty interacted in ways that fostered mentorship, support, and guidance, in both academic and personal domains. This score was determined by CIRP using item response theory, and items include the frequency with which faculty provided nine support activities as reported by students (see Appendix B for a list of these items). Responses for each support activity were on a three-point scale: not at all, occasionally, and frequently. A higher score on faculty mentorship therefore indicated that the student received more frequent mentorship from faculty on a variety of activities. (See Sharkness, DeAngelo, and Pryor, 2010, or CIRP Construct Technical Report, 2010, for more information on the creation of the various constructs used in this paper.)

To analyze each of the outcomes described above, we relied on a common set of predictor variables. Prior literature on student engagement and our conceptual frameworks derived from literature related to critical perspectives, engagement, interactions with peers and faculty, and the institutional context guided selection of the variables used in the models. In our analyses, we added variables in conceptually related, temporally sequenced blocks. First, we included student demographic characteristics (e.g., sex and income level) in the models (Model1). Next, we added several pre-college measures (e.g., prior academic preparation, high school activities, and degree aspirations) to the models to see if any observed differences between students could be accounted for by differences in these areas (Model 2). Third, because of our interest in the association between campus climate and Black students' propensity to be engaged in the opportunity structure, we included measures that are indicative of how students' experience the campus climate (i.e. felt intimidated by professors, positive cross racial interactions, and sense of belonging) (Model 3). Negative perceptions of the campus climate are expected to be associated with a lower probability of participating in different components of the opportunity structure. Next, we controlled for students' college experiences, which includes both behaviors (e.g., participated in a program to prepare for graduate school, and hours per week talking with faculty outside of class or office hours) (Model 4) and student attitudes about others and themselves (e.g. faculty here are interested in students' academic problems, and academic self-concept) (Model 5) measured on the CSS. We then added other indicators of students' college experiences such as the STEM area of study the student pursued (Model 6). Finally institution-level variables were added in the last model, and these measures included structural characteristics of the institution such as size, selectivity, and control (Model 7). The percentage of students who are White is also included in this block because the researchers were interested in assessing whether less institutional diversity affects involvement in the opportunity structure. We ran identical models for each dependent variable, with two exceptions: One we used each dependent variable as an independent predictor in the models for the other outcome. Two, the HBCU variable is not included in the models containing White students since there were too few White students attending an HBCU. Appendix A contains a complete list of variables in the analysis and their corresponding coding schemes, and Appendix B provides the individual items for each variable construct included in the model.

Analysis

Missing data. In order to maximize the sample available for analysis, missing data were replaced for the larger dataset, wherever appropriate, in a multi-step process. First, we removed from our samples all students who had missing data on one of the dependent variables and students who were missing information on key demographic characteristics such as gender or mother's education. In total, only 10 Blacks students and 8 White students were missing information in one or more of these areas (2%). For the remaining variables of interest, we analyzed the extent to which missing data occurred. Overall, there was very little missing data; only one variable had more than 2% of its cases missing; the variable for SAT composite score had 9.7% of its data missing for Black students and 4.4% missing for White students. Given the relatively few instances of missing data across the variables used in the analysis, we imputed missing data using the expectation-maximization (EM) algorithm in SPSS. The EM algorithm employs maximum likelihood estimation techniques to impute values for cases with missing data. Because EM uses most of the information available in the dataset to produce the imputed values, it is a more robust method of dealing with missing data than listwise deletion or mean replacement (Allison, 2002; Dempster, Laird, & Rubin, 1997; McLachlan & Krishnan, 1997). Distributions of variables were compared before and after missing values were imputed, and were found to be virtually identical. Next we filtered out all the students who self-identified as Black and randomly selected an equal number of White students. These students comprised the final dataset used in this study.

Hierarchical linear modeling. First**,** descriptive statistics of the means were ran. (See Tables 1 & 2 for a full list of the descriptive statistics for each variable). Second**,** hierarchical linear modeling was performed on the models. Performing single-level analyses with multi-level data can underestimate the standard errors of model parameters, increasing the likelihood of committing Type-I statistical errors (de Leeuw & Meijer, 2008; Raudenbush & Bryk, 2002). Since the sample only included students who intended to major in a STEM discipline in their freshman year, a positive answer indicated that the student more frequently participated in a given activity and a negative answer implied that the student less frequently participated. Finally, to allow for comparisons of the effect of independent variables on the outcomes of interest, we used the equation offered by Paternoster and colleagues (1998) for independent sample to statistically test for the equality of regression coefficients to draw systematic comparisons of the predictors of academic adjustment in graduate school between the Black student group and the White student groups. (See Tables 3 and 4 for z-scores from the equality of regression coefficient test for each dependent variable).

Limitations

One of the primary limitations with this data set is that it only includes the responses of Black students who persisted to the fourth year of college. The students in this dataset, who successfully managed to stay in college until their senior year, were probably very different from the students who aspired to major in STEM during their freshman year of college but transferred to another university or dropped out of school completely. Regrettably, no data is available on these students. There is a possibility that student dropouts or transfers had differential patterns of participation in the various activities in the opportunity structure and had different college experiences than those who persisted at the same institution after four years.

A related limitation of our study is that the CSS had a relatively low longitudinal response rate (23%), and thus the extent to which our results can be generalized to a larger group of students may be limited. Although we attempted to correct for non-response bias that may have been introduced by the low response rate, our correction was necessarily limited to the information we had available, and we may not have taken all of the important factors into consideration. Also, a number of the independent variables in this study are self-reported (i.e. GPA, SAT composite scores) and it is possible that students' answers do not accurately reflect what actually occurred. Previous research however demonstrates high overall validity of self-reported scores on academic performance (Cole & Gonyea, 2010).

Finally, as our dependent variables were taken from the 2008 CSS, our dependent variables were measured at the same point in time as many of our independent variables. Therefore we cannot assume a causal relationship between the dependent variables and those independent variables measured in 2008. Our purpose is to identify the experiences that are associated with a greater or lesser frequency of participating in the STEM opportunity structure; thus the establishment of causation is not necessary to address the focus of our study.

Findings

Descriptive Statistics

Each student sample was comprised of 792 students pursuing STEM degrees at four-year institutions around the United States. Independent sample t-test were used to compared the means for White students to the means of Black students on each of the dependent variables; results showed no significant differences in the way students responded between the two student groups.

Black student sample. Approximately 68% of the sample identified as female. Roughly 11.6% of students had never utilized SI by their fourth year of college and the mean faculty mentorship score for STEM aspirants was 49.11. The 175 institutions represented in the Black student sample were fairly selective with average institutional selectivity (defined as the combined verbal and math SAT scores) being 1133. Thirty percent of the institutions in this sample were masters granting institutions, and the other 60% were doctoral granting institutions. Roughly 54% of the institutions were privately controlled. Twelve percent were designated as HBCUs. On average White students represented 54.75% of the student population at the institutions included in this study, although this figure ranged from a low of 0% at HBCU institutions to a high of 93% at PWIs. Likewise the proportion of the overall student body that majored in a STEM discipline at various institutions averaged at 12%, although this value ranged widely. (See Table 1 for descriptive statistics on all of variables in the models for Black students).

White student sample. Approximately 48% of the sample identified as female. Roughly 14.8% of students had never utilized SI by their fourth year of college and the mean faculty mentorship score for STEM aspirants was 48.92. The 91 institutions represented in the White student sample were fairly selective with average institutional selectivity (defined as the combined verbal and math SAT scores) being 1162. Twentyseven percent of the institutions in this sample were masters granting institutions, and the other 63% were doctoral granting institutions. Roughly 49% of the institutions were privately controlled. On average White students represented 64.47 % of the student population at the institutions included in this study, although this figure ranged from a low of 18% to a high of 93%. Likewise the proportion of the overall student body that majored in a STEM discipline at various institutions averaged at 14%, although this value ranged widely. (See Table 2 for descriptive statistics on all of variables in the models for White students).

HLM Models

The results from the HLM analyses for supplemental instruction and faculty mentorship/support are presented with respect to the Black student sample first and then for the White student sample. Detailed results can be found in Tables 5 through 8. These tables also contain the R^2 values for each block of variables as they are entered into the model and the final unstandardized regression coefficients for each variable.

Black student sample.

Supplemental instruction (SI). Demographic characteristics such as, gender, income level and mother's education explain a small percentage (1.09%) of the variance in the frequency with which Black students participated in SI courses. It is notable that none of the demographic variables reaches significance in the final model meaning differences in the probabilities of participating in supplemental instruction are not explained by differences in demographic characteristics. (Refer to Table 5 to see the coefficients for the various variables examined.) After adding the precollege preparation, achievement and experience variables, the amount of variance the model explains jumps to roughly 7.66%. This second block of variables explains the most variance of all the blocks ultimately entered into the model. The total variance explained by our model increases slightly to 12% and later to 16.66%, with the addition of campus climate and colleges behaviors respectively. The variance explained increased a miniscule amount after perceptions and attitudes were added to the model 17.15%, and increased again slightly to 20.35% with the addition of the STEM environment variables. After all seven blocks were added, the model accounted for 22.85% of the student-level variance. Below is a discussion of the best-fit model (Model 7).

Although there were no significant demographic variables, two pre-college experiences are predictive of Black students' participation in SI courses. First, Black students who take fewer years of biological sciences in high school more frequently utilize supplemental instruction. It is possible that students who enroll in SI are talented students who recognize that they need additional assistance in understanding content presented in their STEM-related courses, since they did not receive the level of exposure in high school to already be familiar with complex concepts. Also, students who spent more hours per week talking to high school teachers outside of class more frequently utilized SI once in college. It is likely that students continue to use help-seeking behaviors while in college and therefore use SI to complement their in-class experiences. None of the campus climate variables significantly affect the frequency with which students participate in SI. Further, with respect to college behaviors, students who participate in clubs or organizations related to their major tend to engage in supplemental instruction more frequently than their peers who are not involved in such clubs. Similarly higher scores on the faculty mentorship construct (indicative of more frequent receipt of faculty mentoring and support) are associated with more frequent use of supplemental instruction. This finding is understandable given that faculty often refer students to resources that can bolster their academic success.

When institutional characteristics are added to the model we find several contextual factors that significantly predict the frequency with which Black STEM aspirants utilized SI courses. First, students attending colleges and universities with a larger student bodies (as measured by the undergraduate full-time enrollment) tend to participate in SI course more frequently. Further students enrolled at doctoral-granting institutions tend to engage more frequently in supplemental instruction than students at masters comprehensive institutions. Lastly, the percentage of STEM students on campus is negatively associated with the frequency SI is used. It may be that institutions with a large proportion of STEM majors have a culture around achievement in STEM, wherein students can find academic help via other avenues other than SI. (See Table 5 for coefficients associated with each variable and changes in R^2).

Faculty mentoring and support. Similar to supplemental instruction, demographic variables account for a very small percentage (0.34%) of the variation in the frequency which Black students receive faculty mentorship and support. The total student-level variation increases to 7.20% once precollege preparation, experiences, and achievement variables are entered into the model. The variance explained jumps to 24.57% and 38.30% with the addition of campus climate and college behaviors respectively. There is a modest increase in variance (44.50%) explained after the addition of the perceptions/attitudes students had while in college are added to the model, and a very slight increase with the addition of the STEM environment variables (44.69%). The final model, which includes institutional characteristics, explains for 44.89% of the variance between students.

Family income was the only demographic variable that significantly predicted receipt of faculty mentoring and support. Black students who come from families with high-middle incomes ($100K-

$199,999) tend to receive greater levels of support and mentoring from faculty than their peers whose family's annual income falls in what we define as the 'middle-income' bracket ($50K-$99,999). In addition, two pre-college preparation, achievement and experiences variables influenced faculty mentoring and support for Black students. Specifically, high school GPA and participation in a summer research program are negative and positive predictors respectively of receipt of faculty mentoring and support.

Interestingly the block of variables that address the campus climate were the largest contributors to the variance explained in the frequency with which students received faculty mentorship and support. Black students who have a higher sense of belonging at their institution and experience more frequent positive cross-racial interactions, tended to receive more frequent mentoring and support from faculty. Previous research shows that students who have close relationships with faculty and feel validated within the context of those relationships, often have higher levels of success in STEM (Palmer & Gasman, 2008; Toldson, 2013). STEM students who feel a higher sense of belonging also tend to do better academically (Strayhorn, 2013). Not surprisingly, students who more often felt intimidated by faculty tended to receive less frequent faculty support. This may be because as a result of the intimidation, students are too afraid to approach faculty and are unsure of how they can best develop meaningful relationships with professors.

The block of variables that includes multiple students behaviors related to the college experience represents the next largest contributor to the variance explained by our model. Specifically students who participate more frequently in supplemental instruction, internships, and programs that prepare students for graduate school tend to receive more mentoring and support from faculty. Additionally, college GPA and more frequently consulting with an advisor or counselor about career plans all positively predict the extent to which Black STEM aspirants receive faculty mentorship. Student behaviors, in which student work with a faculty or staff member in an intimate setting, expose students to other opportunities for development and career reflection that they would not otherwise have (Ceja & Rhodes, 2004). Further students who more strongly agree that faculty are interested their academic problems tend to receive more frequent support and mentorship from faculty. Often-times students initially interact with faculty due to academic concerns (DeFreitas & Bravo, 2012); when faculty take students' concerns seriously and genuinely try to address them, students are likely to feel that faculty care about their academic welfare (Eagan et al., 2012). These findings indicate that the major environment is associated with the extent to which Black students are mentored.

Lastly, two institutional variables significantly predict the frequency with which Black STEM aspirants received faculty mentoring and support. Particularly, students who attend HBCUs compare to non HBCUs more frequently receive mentoring from faculty. Please note that roughly 33% of the Black students in our sample attended an HBCU although HBCUs only accounted for 10.2% of the institutions in our sample. The findings about students attending HBCU's and faculty mentoring aligns with previous studies demonstrating that Blacks attending HBCUs are more likely to have quality interactions and relationships with faculty (Perna et al., 2010; Toldson, 2013). Since HBCUs have a reputation for promoting academic excellence and supporting Black STEM aspirants, it is no surprise that many students attending those schools receive frequent mentorship. It seems to be counterintuitive then to find that Black students attending institutions with a higher proportion of White students in the student body, tend to receive faculty support and mentoring more often. (See Table 6 for coefficients associated with each variable and changes in R^2).

White student sample.

Supplemental instruction (SI). Demographic characteristics account for 0.50% of the student-level variance in the frequency of participation in SI. This proportion rises to 1.28% after accounting for precollege preparation, achievement, and experiences in the model and jumps to 8.38% once aspects of the campus climate are accounted for. The variance increases to 11.40%, then to 13.12%, and once more to 14.76% after adding college experience variables such as behaviors, perceptions/attitudes, and the STEM environment respectively. The level-one variance bumps up slightly 16.81% once institutional-level variables are added to the model. Only one of the institutional variables reaches significance in the final model, meaning differences in the probabilities of participating in supplemental instruction is somewhat explained by the size of the undergraduate student body of the institution of attendance. Below is a discussion of this final model.

White students who come from high income households (i.e. students' parents make $200 thousand or more annually) utilize supplemental instruction less frequently than students who are from middle income families (i.e. families that make between $50 thousand and $199,999 annually); no other demographic characteristics are significant. It's possible that students from the highest income bracket simply pay for private tutoring when they struggle in classes. When looking at the importance of pre-college preparation, achievement, and experiences the only variable that mattered was the number of years students took biological science in high school; White students who took fewer years of biological science courses in high school are less likely to participate in SI during college. Moving onto the campus climate, White students who have more frequent cross-racial interactions that are of a positive nature tend to more frequently engage in supplemental instruction. When considering college experiences, students who more often study with other students more frequently used SI. With respect to student attitudes and perceptions, students who more strongly agree that faculty at their institution are interested in students' academic problems tend to use SI more often. Finally a higher score on the construct measuring receipt of faculty mentorship is associated with more frequent use of SI. (See Table 7 for coefficients associated with each variable and changes in R^2).

Faculty mentoring and support. Demographic variables explain a very small percentage (0.93%) of the student-level variation in the frequency with which White students receive faculty mentorship, which increases slightly to 4.99% with the addition of precollege preparation, achievement, and experiences into the model. The variance jumps to an impressive 18.85% after controlling for campus climates, increases to 33.32% after adding college behaviors, and rests at 42.36% after adding students' perceptions/attitudes while in college. Including STEM environment variables, as measured by students' majors, to the model slightly increases the proportion of level-1 variance explained by the model to 43.09%, which then drops to 42.62% when institutional variables are added indicating a poorer fit model. Interestingly, none of the institutional variables reaches significance in the final model, meaning differences in the probabilities of participating in supplemental instruction are not explained by institutional characteristics. Although we do not discuss the results from the model containing institutional variables, we include the results from this model in Table 8 so that readers can see the coefficients for the various institutional variables that we examined. Below is a discussion of the best-fit model (Model 6), which only had student level variables.

Although there are no significant differences by gender in the best-fit model, we did detect significant differences by income with regard to the frequency with which students receive faculty mentorship and support. High income students (i.e. students who come from families that make $200 thousand a year or more) appear to have more frequent mentorship activity from faculty than their middle income peers who come from families making between $50 thousand and $199,999 thousand annually. When considering precollege preparation, achievement, and experiences, the regression reveals that higher high school GPAs and higher SAT composite scores each are predictive of a tendency to receive less frequent mentorship from faculty. Students who spent more hours per week talking to teachers outside of class in high school have more frequent mentorship from faculty in college, likely because they continue this behavior in college. Two aspects pertaining to the climate of the campus also matter: White students who have more frequent cross racial interactions that are of a positive nature and who score higher on the construct measuring sense of belonging tend to have more frequent mentoring and support from faculty. Furthermore, there are several activities in which more frequent participation in the respective activity is associated with more often receiving faculty support and mentorship and include meeting with an advisor/counselor about career plans, studying with other students, and having instruction to supplement coursework. Students who at some point in their college career participate in a program to prepare for graduate school or join a club or organization related to one’s major tend to be the recipients of more frequent faculty mentorship and support. Finally students who have a higher overall college GPA tend to have higher scores on receipt of support and mentoring from faculty. With respect to students’ attitudes and perceptions, students who more strongly agree that faculty at their institution are interested in students’ academic problems and who score higher on the construct measuring academic self-concept are more likely to have more frequent mentorship from faculty. Finally considering the STEM environment, students pursuing an engineering or a professional health major have less frequent mentoring and support from faculty than their peers in the biological sciences — a finding with important implications for retention in these majors. (See Table 8 for coefficients associated with each variable and changes in R^2).

Discussion and Conclusion

Participation in educationally enriching co-activities tends to enhance the self-efficacy, sense of belonging, and overall persistence of students in general (Astin, 1993, Barlow & Villarejo, 2004). Since co-curricular activities enhance students' experiences in STEM and support academic success, they comprise what we term "the STEM opportunity structure" as they support students' engagement in STEM. Taking this into consideration, there are several findings from our study that are worthy of further discussion.

First, as predicted, certain institutional contexts seem to better promote participation in the opportunity structure for Black student intending to major in STEM. For example, Black students attending doctoral granting institutions, tend to more frequently use SI than their Black peers at masters comprehensive institutions. The size of the student body also seems to be an important aspect of the institutional context when it comes to the extent students, both Black and White, participate in co-curricular activities. Black students attending larger colleges and universities (in terms of the undergraduate full time equivalent enrollment) tend to less frequently participate in SI. A possible explanation is that Black students have a more difficult time navigating institutional structures at larger institutions due to lack of savvy. Indeed many Black students are the first is their families to attend a 4-year university and therefore do not have older family members who have undergraduate degrees and who can use that history and accumulated knowledge to guide students' experiences (Palmer & Gasman, 2008). Further smaller institutions may do a better job at targeting academic support services to Black students due to the more intimate learning environment. Curiously, the reverse is true for White students who more frequently use SI when attending larger institutions; further the effect of institutional size is more pronounced for White students. Interestingly, institutional size is the only institutional characteristic that is a significant predictor of the frequency with which White students are involved in any of the two dependent variables we investigated, suggesting perhaps that institutional context is less salient for White students, but remains strongly associated with how frequently Black students are involved in the opportunity structure. The structural composition of the student body also influences Black students' participation in both components of the opportunity structure – namely Black students tend to receive more frequent mentoring and guidance from faculty at institutions with a greater proportion of White students in the student body. This may indicate that very White institutions are aware of the vulnerable position Black students are in with respect to retention and degree completion due to their severe under representation within the institution broadly, but also within STEM majors specifically. These institutions may therefore be more intentional about providing faculty mentorship to the Black students they have, which are likely to be few in number. It seems counter intuitive then to also find that Black students at HBCUs tend to receive more frequent mentoring and guidance from faculty than students at non-HBCUs. The latter finding aligns with existing research though, which indicates that students enrolled at HBCUs report having more fruitful relationships with faculty and staff, compared to African American students attending PWIs (Toldson, 2013). Further other research shows that STEM students at HBCUs commonly refer to administrators and faculty as "family," which is demonstrative of the personal and supportive relationships students cultivate with faculty at HBCUs (Strayhorn, 2013). This may be because STEM faculty at HBCUs tend to demonstrate an authentic concern and appreciation for the academic and cultural dimensions of students' identity (Toldson, 2013).

A second important finding is that campus climate matters for both White and Black students in explaining how frequent a student is engaged in the opportunity structure, with positive cross racial interactions consistently being a positive predictor of frequency of involvement. In other words, students who more frequently have interactions with others racially unlike themselves are the same students who tend to more frequently be involved in SI and who tend to receive more frequent mentoring and guidance from faculty. Sense of belonging also is a strong positive predictor of the frequency with which both Black and White students receive mentoring and support from faculty, with the variable having a similar effect for both groups. Taken together, these results challenge the notion that campus climate is only important for the academic engagement of students of color. In fact campus climate, is consistently one of the top contributors to the proportion of variance explained between students in our models.

Third, it is interesting that the block of variables representing students' pre-college preparation, achievement, and experiences is most predictive of the frequency with which Black students participate in SI (as measured by the change in variance explained by the model), whereas the block of variables representing campus climate is the strongest predictor of the frequency with which Black students receive faculty mentoring and support. A related point is that there are no overlapping predictor variables between the likelihood that Black students participate in SI and the frequency with which Black students receive faculty mentorship and support. As a whole, the aforementioned suggests that the frequency with which Black students participate in the opportunity structure depends on the nature of the activity in question, with different activities then being predicted by different dimensions of the campus environment and different student behaviors. This suggests that if institutions want to get Black students more engaged in co-curricular activities known to enhance academic performance and strengthen students' commitment to STEM majors, a one-size-fits-all solution will not work and does not exist. Institutions will have to engage in a multifaceted approach to improving student involvement and which will require that institutions examine multiple areas of practice. Improving engagement will not be a simple task, but is worth the expense of exploring the factors that contribute to or hinder it.

Fourth, with respect to faculty mentorship and support, it seems that Black and White students who are more involved in other campus activities (whether it is participating in a graduate school program versus not, more frequently talking to an advisor about career plans, or having more frequent instruction that supplements course work), are the very same students who tend to receive the most frequent mentorship. This finding has two implications: one, faculty and other STEM practitioners are often involved in co-curricular activities that grants Black students unique access to institutional agents who can provide additional socialization in STEM (Stanton-Salazar, 1997; 2001; 2010). Thus it is possible that participation in various activities makes it more likely that students will have exposure to faculty and because this exposure occurs within a smaller and more informal setting (compared to the formality within a large lecture class for example), students feel more comfortable approaching faculty and therefore have more opportunities to benefit from the mentoring that may occur within these more intimate interactions. Institutions may therefore want to better incentivize faculty sponsorship of/involvement in student co-curricular activities. Two, engagement in other campus activities may inform and direct students to resources on campus that can assist them in navigating the institutional environment, as is the case with talking to an advisor. This finding also provides further supporting evidence for the rising star hypothesis (Ragins, 1999) wherein students who take advantage of one engagement opportunity, also are more likely to take advantage of a number of other opportunities (Merton, 1988). Previous research shows that involvement in one co-curricular activity likely places the participating student in a favorable position and this position likely produces further relative academic and social gains (Merton, 1988), which can help students thrive in STEM.

Fifth, a unique finding for Black students is that prior preparation and behaviors predict the most variance for the frequency with which Black student utilize SI, with years of biological science also being a significant predictor for White students and affecting the two groups similarly. Specifically it is encouraging to find that Black and White students who do not receive a great deal of STEM related academic training at the secondary level more often participate in SI, since they likely will benefit from it the most. Numerous studies also demonstrate the importance of taking a greater number of years of biological science in high school to a number of college outcomes (Maltese & Tai, 2011; Robinson, 2003; Subotnik, Tai, Rickoff, & Almarode, 2009). Because of this finding, it is recommended that academic advisors look at the transcripts of entering freshmen before helping them to select classes for their very first college term. Transcripts can reveal which students aspiring to major in STEM are less prepared. These students should therefore be directed to enroll in SI if they wish to enroll in a traditionally difficult introductory STEM course so that they can get the additional support needed to strengthen their foundational knowledge. Anecdotally, we know that students, especially students who are the firsts in their families to attend college, typically do not know about SI or its benefits unless someone who is knowledgeable about it tells them. Enrolling in SI at some institutions therefore requires a particular amount of savvy on students' part for sure. Further since institutions, due to limited resources, typically only have a certain capacity to offer SI, the concern is whether students who do not, for whatever reason, participate in SI are getting the additional cognitive development, support, training, and information they need to be successful in STEM. Institutions should therefore practice the intentional channeling of students who are less prepared, as indicate by high school transcripts, to SI before they even step foot on campus. Identifying students who likely need SI and informing them of the benefits of voluntary participation would be a relatively easy thing to do.

Sixth, it is particularly interesting that participation in an academic programs for URM students does not significantly predict frequency of participation in either two of the opportunity structures we investigated. Since one of the many purposes of these programs is commonly to serve as a "bridge" to other opportunities that can support students in their academic endeavors, this may indicate that there is a missed opportunity occurring. Namely, it may be that these programs operate in isolation of other campus structures and are not imbedded in the fabric of academic life at the institution. Therefore although these program may be doing great things for Black students, they may not be connecting students to other opportunities as well as they can.

Seventh students, both Black and White, who believe that faculty are interested in students' academic problems, tend to be the same students who more frequently are engaged in different components of the opportunity structure. For example students who feel more strongly that faculty are interested about students' academic problems are tend to more likely to receive mentorship and guidance from faculty. The effect of this variable is the same for both groups. These findings are not surprising seeing as students who work closely with faculty are likely to believe that faculty care about them. Thus, promoting faculty mentoring among Black students can be used as an institutional strategy to make students feel like they matter on campus and to better incorporate them into their field of practice, which may mitigate the negative effects of competitive learning environments typical of STEM classrooms. Finally, the extent to which Black students participate in the opportunity structure seems to not vary by major. Whether students are satisfied with the opportunities they have available to them and whether satisfaction varies by student major is another matter and may be an area for future research.

This study contributes to existing research on STEM persistence by identifying the academic experiences and institutional characteristics that contribute to Black and White students' participation in the opportunity structure. Policy makers and educational leaders should invest more heavily in programs and activities that merge the academic and social spheres of student life, such as the ones examined in this study, to bolster Black students' success in STEM. STEM student associations that are connected to national professional associations are a great starting point as they can help students develop networks of like-minded peers and distinguished professionals from the STEM community who are gatekeepers to additional resources or experiences. Further institutional quality relies on the efforts colleges and university make to address the educational and social needs of their students; students should not be expected to simply engage themselves (Kuh, 2001). Thus institutions should be tasked with providing resources to support a variety of engagement opportunities, especially for Black students who are often categorized as an "at-risk" population within the educational system. Although Black students are not naturally predisposed to not succeed, they do need resources and services to be tailored to their unique cultural needs. Educators should also create environmental conditions that will aid in their successful academic and social integration within institutions of higher education (Harper and Quaye, 2009). Culturally inclusive institutions adapt and change the learning environment as needed so that it is best conducive to student engagement (Harper and Quaye, 2009). Indeed more institutions need to take an approach to education that recognizes the importance of culturally inclusive practices and acknowledges that the learning experiences of Black students are racialized in STEM disciplines given their normative and everyday encounters with race and racism (Terry, 2010).

Additionally, it is critical for educators and institutional agents to continuously engage in dialogue with Black students in order to recognize their changing needs (Harper & Quaye, 2009). Indeed the most effective discourses about student engagement often include the diverse perspectives from various stakeholders—namely the students themselves. Thus, students should be provided with plentiful opportunities to be involved in shaping the appropriate methods for enhancing their college experience (Harper & Quaye, 2009). Allowing students —especially those who have already become disengaged—into the discussions that inform institutional strategies for bolstering student engagement can help institutions more effectively enhance students' academic experiences (Harper, 2007).

Further, first-year URM students are often unfamiliar with the available resources on campus that will help them thrive in college (Kenny & Stryker, 1996; Roe Clark, 2005). Without additional support and guidance, these students are most vulnerable to non-involvement in the face of challenges or a negative institutional climate (Harper and Quaye, 2009). Institutional agents—namely faculty and other educational leaders—are best positioned to socialize students in their STEM-related discipline and disseminate information to students regarding the experiences that will support their success. Hopefully, informal student/faculty interactions develop into a mentoring relationship, which existing literature has already established is critical to the success of Black students in STEM (Strayhorn & Terrell, 2007; Cole, 2007).

Future research should investigate whether Black STEM aspirants, especially females since they are doubly underrepresented in STEM disciplines, have disparate rates of participation in SI and a range of other co-curricular activities that existing research demonstrates supports their success in STEM and propels them into STEM careers. In other words, is access to SI equitably distributed across different racial/ethnic groups and across gender? Qualitative research can better disentangle why some Black students do not participate in various co-curricular activities and to articulate the conditions that must be in place for increasing student participation (Harper & Quaye, 2009). It is possible that non-participating students do not know about the opportunities available to them (which is indicative of an information problem), are not aware of the benefits associated with participation so they do not feel compelled to do so (indicative of both a motivational and informational problem), or there is not enough available opportunities for participation and so existing ones go to students with the most impressive academic profiles (indicative of an access/ resource problem). Further it would be interesting for future research to determine if there is a disparate impact of SI and faculty mentoring and support across racial groups, and if so, uncover reasons why. Finally researchers might want to untangle why and how certain institutions better position Black students for participation in the opportunity structure and if those efforts can be replicated at other institutions.

Given the national concern to increase the proportion of individuals from diverse backgrounds in the STEM workforce (Olson & Riordan, 2012), this research can help institutions better clarify a plan for providing effective outreach to Black students pursuing STEM majors—especially those at PWIs (Harper & Quaye, 2009). As previously noted, a one-size-fits-all approach likely will not work, so future research should also investigate Black student participation within the STEM opportunity structure at Hispanic serving institutions to determine if these students have unique needs that are different from their counterparts attending PWIs. Irrespective of institutional designation, all institutions must make an intentional commitment to diversity, multiculturalism, and/or access to make sure Black students in STEM feel comfortable participating in the co-curricular activities available to them.

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Table 1

Descriptive Statistics for Black Student Sample n= 792 students, 175 institutions

Variable	Mean	S.D.	Min.	Max
Institutional Variables				
Historically Black College/University (vs. non-HBCU)	0.12	0.33	0.00	1.00
Institution offers a medical degree (vs. not)	1.78	0.42	1.00	2.00
Percentage of STEM undergraduates	0.12	0.14	0.00	0.83
Percent White undergraduates	54.75	25.69	0.00	93.00
Undergraduate full-time enrollment (proxy for institutional size)	8424.09	7523.26	246.00	39105.00
Institutional control: Private (vs. public)	1.54	0.50	1.00	2.00
Bachelor granting institution/ Liberal arts institutions	0.10	0.30	0.00	1.00
Masters comprehensive institution	0.30	0.46	0.00	1.00
Doctoral granting institution/Research institutions	0.60	0.49	0.00	1.00
Selectivity (100-point increments)	11.33	1.60	7.95	14.70
Student peer mean: Faculty here are interested in students' academic problems	2.99	0.16	2.38	4.00
Instructional expenditures per FTE	11994.98	10108.89	1793.00	73119.00
Dependent Variables				
Had instruction that supplemented course work	2.16	0.60	1.00	3.00
Faculty mentoring and support	49.11	9.96	27.33	66.99
Demographic Characteristics				
Gender: Female	1.68	0.47	1.00	2.00
Low income (Under $25K)	0.21	0.41	0.00	1.00
Low-middle income ($25K to $49,999)	0.26	0.44	0.00	1.00
Middle income ($50K to $99,999)	0.29	0.45	0.00	1.00
High middle income ($100K-$199,999)	0.03	0.16	0.00	1.00
High income ($200K+)	0.13	0.33	0.00	1.00
Mother's education	5.23	1.89	1.00	8.00
Pre-college preparation, achievement and experiences (Responses taken from TFS)				
High school GPA	6.04	1.52	2.00	8.00
Years of mathematics in H.S.	5.89	0.66	2.00	7.00
Years of biological science in H.S.	3.69	1.14	1.00	7.00
Participated in a summer research program	1.17	0.38	1.00	2.00
Hours per week: Talking with high school teachers outside class	2.71	1.09	1.00	7.00
Parent occupation in STEM	0.24	0.43	0.00	1.00
SAT composite score	10.58	1.71	6.10	16.00
2004 Degree aspiration: (Ref bachelors degree or Less)	0.89	0.31	0.00	1.00
Campus Climate				
Felt intimidated by your professors	1.56	0.64	1.00	3.00
There is strong competition among most students for high grades	2.84	0.81	1.00	4.00
Positive cross-racial interactions	53.75	9.02	29.06	68.39
Sense of belonging	49.75	8.72	25.97	62.22
College Experiences (Responses taken from the CSS)				
Behaviors				
Participated in a program to prepare for graduate school	1.21	0.41	1.00	2.00
Participated in an academic program for racial/ethnic minorities	1.34	0.47	1.00	2.00
Hours per Week: Working for pay off campus	3.80	2.99	1.00	8.00
Overall college GPA	4.82	1.60	1.00	8.00
Met with an advisor/counselor about your career plans	2.08	0.65	1.00	3.00
Studied with other students	2.45	0.58	1.00	3.00
Participated in an internship program	1.44	0.50	1.00	2.00

Descriptive Statistics for Black Student Sample n= 792 students, 175 institutions

Variable	Mean	S.D.	Min.	Max
Participated in an undergraduate research program (e.g. MARC, MBRS, REU)	1.20	0.40	1.00	2.00
Joined a club or organization related to major	1.62	0.48	1.00	2.00
Perceptions/Attitudes				
Faculty here are interested in students' academic problems	2.94	0.67	1.00	4.00
Academic self-concept	50.26	8.22	25.48	66.92
Social self-concept	52.00	8.32	23.79	67.26
STEM Environment				
Biological sciences major	0.25	0.43	0.00	1.00
Engineering major	0.21	0.41	0.00	1.00
Professional health major	0.39	0.49	0.00	1.00
Math/statistics major	0.01	0.10	0.00	1.00
Physical science major	0.06	0.24	0.00	1.00
Other STEM major	0.08	0.27	0.00	1.00

Note: Biological Science Majors = (General Biology, Biochemistry/Biophysics, Botany, Environmental Science, Marine (Life) Science, Microbiology/Bacterial Biology, Zoology, Other Biological Science);
Engineering Majors = (Aeronautical/Astronautical Engineering, Civil Engineering, Chemical Engineering, Computer Engineering, Electrical Engineering, Industrial Engineering, Mechanical Engineering, Other Engineering); Physical Science Majors = (Astronomy, Atmospheric Science, Chemistry, Earth Science, Marine Science, Physics, Other Physical Science); Math or Statistics; Professional Health Majors = (Health Technology, Medicine/Dentistry/Veterinary Medicine, Nursing, Pharmacy); Other STEM Majors = (Agriculture, Computer Science, Technical and non-technical STEM)

Table 2

Descriptive Statistics for White Student Sample n= 792 students, 91 institutions

Variable	Mean	S.D.	Min.	Max
Institutional Variables				
Historically Black College/University (vs. non-HBCU)	0.01	0.10	0.00	1.00
Institution offers a medical degree (vs. not)	1.74	0.44	1.00	2.00
Percentage of STEM undergraduates	0.14	0.17	0.00	0.83
Percent White undergraduates	64.47	16.83	18.00	93.00
Undergraduate full-time enrollment (proxy for institutional size)	9136.01	7553.77	869.00	31515.00
Institutional control: Private (vs. public)	1.49	0.50	1.00	2.00
Bachelor granting institution/ Liberal arts institutions	0.10	0.30	0.00	1.00
Masters comprehensive institution	0.27	0.45	0.00	1.00
Doctoral granting institution/Research institutions	0.63	0.49	0.00	1.00
Selectivity (100-point increments)	11.62	1.47	8.80	15.20
Student peer mean: Faculty here are interested in students' academic problems	2.97	0.12	2.48	3.44
Instructional Expenditures per FTE	13273.33	13284.53	3020.00	74084.00
Dependent Variables				
Had instruction that supplemented course work	2.14	0.64	1.00	3.00
Faculty mentoring and support	48.92	9.26	27.33	66.99
Demographic Characteristics				
Gender (Female)	1.48	0.50	1.00	2.00
Low Income (Under $25K)	0.08	0.27	0.00	1.00
Low-middle income ($25K to $49,999)	0.13	0.34	0.00	1.00
Middle Income ($50K to $99,999)	0.36	0.48	0.00	1.00
High Middle Income ($100K-$199,999)	0.10	0.30	0.00	1.00
High Income ($200K+)	0.24	0.43	0.00	1.00
Mother's Education	5.66	1.73	1.00	8.00
Pre-college preparation, achievement and experiences (Responses taken from TFS)				
High School GPA	6.96	1.17	2.00	8.00
Years of Mathematics in H.S.	5.99	0.49	3.00	7.00
Years of Biological Science in H.S.	3.76	1.01	1.00	7.00
Participated in a summer research program	1.08	0.27	1.00	2.00
Hours per week: Talking with high school teachers outside class	2.51	0.95	1.00	8.00
Parent Occupation In STEM	0.34	0.47	0.00	1.00
SAT composite score	12.25	1.71	5.00	16.00
2004 Degree aspiration: (Ref bachelors degree or Less)	0.85	0.35	0.00	1.00
Campus Climate				
Felt intimidated by your professors	1.61	0.58	1.00	3.00
There is strong competition among most students for high grades	2.75	0.75	1.00	4.00
Positive Cross-Racial Interactions	51.48	8.62	29.06	68.39
Sense of Belonging	49.93	8.21	25.97	62.22
College Experiences (Responses taken from the CSS)				
Behaviors				
Participated in a program to prepare for graduate school	1.15	0.36	1.00	2.00
Participated in an academic program for racial/ethnic minorities	1.03	0.17	1.00	2.00
Hours per Week: Working for pay off campus	3.39	2.84	1.00	8.00
Overall College GPA	5.94	1.55	1.00	8.00
Met with an advisor/counselor about your career plans	1.91	0.58	1.00	3.00

Descriptive Statistics for White Student Sample n= 792 students, 91 institutions

Variable	Mean	S.D.	Min.	Max
Studied with other students	2.44	0.58	1.00	3.00
Participated in an internship program	1.44	0.50	1.00	2.00
Participated in an undergraduate research program (e.g. MARC, MBRS, REU)	1.15	0.36	1.00	2.00
Joined a club or organization related to major	1.60	0.49	1.00	2.00
Perceptions/Attitudes				
Faculty here are interested in students' academic problems	3.01	0.65	1.00	4.00
Academic Self-Concept	52.55	8.39	23.86	66.92
Social Self-Concept	50.35	8.50	23.92	67.26
STEM Environment				
Biological Sciences Major	0.26	0.44	0.00	1.00
Engineering Major	0.31	0.46	0.00	1.00
Professional Health Major	0.30	0.46	0.00	1.00
Math/Statistics Major	0.02	0.14	0.00	1.00
Physical Science Major	0.07	0.26	0.00	1.00
Other Stem Major	0.03	0.18	0.00	1.00

Note: Biological Science Majors = (General Biology, Biochemistry/Biophysics, Botany, Environmental Science, Marine (Life) Science, Microbiology/Bacterial Biology, Zoology, Other Biological Science); Engineering Majors = (Aeronautical/Astronautical Engineering, Civil Engineering, Chemical Engineering, Computer Engineering, Electrical Engineering, Industrial Engineering, Mechanical Engineering, Other Engineering); Physical Science Majors = (Astronomy, Atmospheric Science, Chemistry, Earth Science, Marine Science, Physics, Other Physical Science); Math or Statistics; Professional Health Majors = (Health Technology, Medicine/Dentistry/Veterinary Medicine, Nursing, Pharmacy); Other STEM Majors = (Agriculture, Computer Science, Technical and non-technical STEM)

Table 3

Comparing Significant Coefficients from the Black STEM Model 7 to the Coefficients from the White STEM Model 7 for Supplemental Instruction

	Black STEM students			White STEM				
Variables	**B**		**S.E.**	**B**		**S.E.**	**Z-Score**	**Meaning**
Institutional Variables								
Undergraduate full-time enrollment (10,000)	-0.11	*	0.00	0.14	*	0.00	***	Affect is more pronounced for White students
Research/Doctoral granting institution (vs. master comprehe	0.26	***	0.07	0.05		0.07	//	Only affects Black students
Proportion of STEM undergraduate majors	-0.46	*	0.19	0.13		0.16	//	Only affects Black students
Pre-college preparation, achievement and experiences (Responses taken from TFS)								
Years of biological science in H.S.	-0.05	*	0.02	-0.05	*	0.02	n.s.	Similar effect
Hours per week: Talking with high school teachers outside c	0.06	**	0.02	-0.01		0.03	//	Only affects Black students
College Behaviors (Responses taken from the CSS)								
Joined a club or organization related to major	0.11	*	0.05	-0.01		0.05	//	Only affects Black students
STEM Environment								
Receipt of faculty mentorship	0.01	***	0.00	0.01	**	0.00	n.s.	Similar effect

Notes. ***p<.001, **p<.01, *p.05. Z scores that fall outside the range of -1.96 and +1.96, indicate a p-value of less than .05, and demonstrate that the beta coefficients between Black STEM students and White STEM students are statistically different. See article by Paternoster and colleagues (1998) for equation to test for the equality of regression coefficients. A Z-test was only performed if beta coefficients for a given variable were significant for both groups.; otherwise you see a "//" symbol.

Table 4

Comparing Significant Coefficients from the Black STEM Model 6 to the Coefficients from the White STEM Model 6 for Faculty Mentoring and Support

	Black STEM students			White STEM students				
Variables	**B**		**S.E.**	**B**		**S.E.**	**Z-Score**	**Meaning**
Demographic Characteristics								
High middle income ($100K-$199,999)	2.22	*	0.95	-0.90		0.69	//	Only affects Black students
Campus Climate (responses take from the CSS)								
Felt intimidated by your professors	-1.33	**	0.49	-0.19		0.49	//	Only affects Black students
Positive cross-racial interactions	0.10	*	0.04	0.05		0.03	//	Only affects Black students
Sense of belonging	0.16	***	0.04	0.14	**	0.04	n.s.	Similar effect
College Experiences (responses taken from the CSS)								
Behaviors								
Participated in a program to prepare for graduate school	2.89	***	0.87	2.07	**	0.76	n.s.	Similar effect
Overall college GPA	0.60	**	0.23	0.73	**	0.22	n.s.	Similar effect
Met with an advisor/counselor about your career plans	2.70	***	0.51	2.97	***	0.51	n.s.	Similar effect
Participated in an internship program	1.87	**	0.66	-0.36		0.59	//	Only affects Black students
Had instruction that supplemented course work	2.52	***	0.53	1.41	**	0.44	n.s.	Similar effect
Perceptions/Attitudes								
Faculty here are interested in students' academic problems	3.98	***	0.48	4.56	***	0.46	n.s.	Similar effect

Notes. ***p<.001, **p<.01, *p.05. Z scores that fall outside the range of -1.96 and +1.96, indicate a p-value of less than .05, and demonstrate that the beta coefficients between Black STEM students and White STEM students are statistically different. See article by Paternoster and colleagues (1998) for equation to test for the equality of regression coefficients. A Z-test was only performed if beta coefficients for a given variable were significant for both groups.; otherwise you see a "//" symbol. Also please note that we are comparing Model 6 for both Black and White students, because Model 7 was not the best fit model for White students.

Table 5

Results of Hierarchical Models Predicting Black Students' Participation in SI

Variables	Model 1				Model 2				Model 3				Model 4				Model 5				Model 6				Model 7			
Level 2	**β**	**SE**	**T-ratio**	**Sig**	**β**	**SE**	**T-ratio**	**Sig**	**β**	**SE**	**T-ratio**	**Sig**	**β**	**SE**	**T-ratio**	**Sig**	**β**	**SE**	**T-ratio**	**Sig**	**β**	**SE**	**T-ratio**	**Sig**	**β**	**SE**	**T-ratio**	**Sig**
7. Institutional Variables																												
Intercept	2.26	0.11	20.64	***	42.05	2.42	17.36	*** 0.00	1.99	0.15	13.47	***	1.70	0.18	9.22	***	1.70	0.18	9.21	***	1.85	0.20	9.34	***	1.88	0.25	7.41	***
Institutional control: Private (vs. public)																									-0.08	0.07		
HBCU (vs. non-HBCU)																									-0.09	0.12		
Institution offers a medical degree (vs. not)																									-0.06	0.06		
Undergraduate full-time enrollment (10,000)																									-0.11	0.00	-2.45	*
Proportion of undergraduate White students																									0.00	0.00		
Instructional expenditures per FTE																									0.00	0.00		
Research/Doctoral granting institution (vs. master comprehensive)																									0.26	0.07	3.61	***
Liberal Arts institution (vs. master comprehensive)																									0.16	0.11		
Selectivity (100-point increments)																									-0.01	0.03		
Student peer mean: Faculty here are interested in students' academic problems																									-0.22	0.13		
Proportion of STEM undergraduate majors																									-0.46	0.19	-2.45	*
Level 1																												
1. Demographic Characteristics																												
Gender (Female)	-0.10	0.06			-0.07	0.06			-0.07	0.06			-0.08	0.06			-0.06	0.06			-0.05	0.06			-0.06	0.06		
Low income (Under $25K)	0.06	0.07			0.11	0.07			0.10	0.07			0.09	0.07			0.09	0.07			0.07	0.07			0.07	0.07		
Low-middle income ($25K to $49,999)	0.09	0.07			0.11	0.07			0.10	0.06			0.10	0.06			0.10	0.06			0.07	0.06			0.06	0.06		
High middle income ($100K-$199,999)	0.15	0.08			0.12	0.08			0.12	0.08			0.11	0.07			0.11	0.07			0.07	0.07			0.06	0.07		
High income ($200K+)	0.17	0.14			0.13	0.14			0.10	0.14			0.12	0.13			0.12	0.13			0.14	0.13			0.12	0.13		
Mother's education	0.02	0.01			0.01	0.01			0.01	0.01			0.00	0.01			0.00	0.01			0.00	0.01			0.01	0.01		
2. Pre-college preparation, achievement and experiences (Responses taken from TFS)																												
High school GPA					0.01	0.02			0.00	0.02			-0.01	0.02			-0.01	0.02			0.00	0.02			0.00	0.02		
Years of mathematics in H.S.					-0.07	0.05			-0.07	0.05			-0.07	0.05			-0.08	0.05			-0.08	0.04			-0.08	0.04		
Years of biological science in H.S.					-0.05	0.02	-2.39	*	-0.06	0.02	-2.48	*	-0.06	0.02	-2.56	*	-0.06	0.02	-2.66	**	-0.05	0.02	-2.35	*	-0.05	0.02	-2.15	*
Participated in a summer research program					0.13	0.07	2.01	*	0.13	0.06	1.99	*	0.10	0.06			0.10	0.06			0.08	0.06			0.10	0.06		
Hours per week: Talking with high school teachers outside class					0.10	0.02	4.09	***	0.08	0.02	3.37	**	0.06	0.02	2.75	**	0.07	0.02	2.90	**	0.06	0.02	2.45	*	0.06	0.02	2.62	**
Parent occupation in STEM					0.13	0.06	2.12	*	0.10	0.06			0.08	0.06			0.08	0.06			0.09	0.06			0.07	0.06		
SAT composite score					0.03	0.02			0.03	0.02			0.03	0.02			0.02	0.02			0.03	0.02			0.03	0.02		
2004 Degree aspiration: (Ref bachelors degree or less)					0.06	0.09			0.04	0.09			0.01	0.09			0.01	0.09			0.00	0.08			0.00	0.08		
3. *Campus Climate (Responses take from the CSS)*																												
Felt intimidated by your professors									-0.03	0.04			-0.03	0.04			-0.03	0.04			0.00	0.04			0.01	0.04		
There is strong competition among most students for high grades									0.06	0.03			0.06	0.03			0.06	0.03			0.06	0.03	2.08	*	0.06	0.03		
Positive cross-racial Interactions									0.01	0.00			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00		
Sense of belonging									0.01	0.00	3.28	**	0.01	0.00	1.99	*	0.01	0.00	1.99	*	0.00	0.00			0.00	0.00		
College Experiences (Responses taken from the CSS)																												
4. Behaviors																												
Participated in a program to prepare for graduate school													0.03	0.07			0.02	0.07			-0.03	0.07			0.10	0.07		
Participated in an academic program for racial/ethnic minorities													0.04	0.05			0.04	0.05			0.05	0.05			-0.03	0.07		
Hours per Week: Working for pay off campus													0.00	0.01			0.00	0.01			0.00	0.01			0.00	0.01		
Overall college GPA													0.03	0.02			0.02	0.02			0.01	0.02			0.01	0.02		
Met with an advisor/counselor about your career plans													0.10	0.04	2.64	**	0.10	0.04	2.61	**	0.06	0.04			0.06	0.04		
Studied with other students													0.07	0.04			0.06	0.04			0.07	0.04			0.07	0.04		
Participated in an internship program													0.00	0.05			0.00	0.05			-0.04	0.05			-0.01	0.05		
Participated in an undergraduate research program (e.g. MARC, MBRS, REU)													0.11	0.07			0.11	0.07			0.09	0.07			0.03	0.05		
Joined a club or organization related to major													0.10	0.05			0.10	0.05			0.09	0.05			0.11	0.05	2.14	*
5. Perceptions/Attitudes																												
Faculty here are interested in students' academic problems																	-0.03	0.04			-0.09	0.04	-2.33	*	-0.06	0.04		
Academic self-concept																	0.01	0.00			0.01	0.00			0.01	0.00		
Social self-concept																	0.00	0.00			0.00	0.00			0.00	0.00		
6. STEM Environment																												
Receipt of faculty mentorship																					0.01	0.00	4.69	***	0.01	0.00	4.60	***
Engineering major																					0.00	0.07			-0.03	0.07		
Professional health major																					-0.03	0.06			-0.05	0.06		
Math/statistics major																					0.04	0.24			0.07	0.23		
Physical science major																					0.11	0.11			0.11	0.11		
Other STEM major																					0.13	0.11			0.04	0.11		
%Level-1 variance explained	1.09%				7.66%				11.97%				16.66%				17.15%				20.35%				22.85%			
% Level-2 variance explained	--				--				--				--				--				--				98.77%			

Note: *Indicates p-value less than .05; ** Indicates p-value less than .01; *** Indicates p-value less than .001.

Biological Science Majors = (General Biology, Biochemistry/Biophysics, Botany, Environmental Science, Marine (Life) Science, Microbiology/Bacterial Biology, Zoology, Other Biological Science);

Engineering Majors = (Aeronautical/Astronautical Engineering, Civil Engineering, Chemical Engineering, Computer Engineering, Electrical Engineering, Industrial Engineering, Mechanical Engineering, Other Engineering); Physical Science Majors = (Astronomy, Atmospheric Science, Chemistry, Earth Science, Marine Science, Physics, Other Physical Science); Math or Statistics; Professional Health Majors = (Health Technology, Medicine/Dentistry/Veterinary Medicine, Nursing, Pharmacy); Other STEM Majors =

Table 6

Results of Hierarchical Models Predicting Black Students' Receipt of Faculty Mentoring and Support

Variables	Model 1				Model 2				Model 3				Model 4				Model 5				Model 6				Model 7			
Level 2	**β**	**SE**	**T-ratio**	**Sig**	**β**	**SE**	**T-ratio**	**Sig**	**β**	**SE**	**T-ratio**	**Sig**	**β**	**SE**	**T-ratio**	**Sig**	**β**	**SE**	**T-ratio**	**Sig**	**β**	**SE**	**T-ratio**	**Sig**	**β**	**SE**	**T-ratio**	**Sig**
7. Institutional Variables																												
Intercept	46.81	1.81	25.91	***	42.05	2.42	17.36	***	43.00	2.20	19.58	***	43.00	2.20	19.58	***	37.70	2.39	15.77	***	36.36	2.55	14.27	***	33.41	3.41	9.80	***
Institutional control: Private (vs. public)																									1.05	0.96		
HBCU (vs. non-HBCU)																									3.32	1.64	2.03	*
Institution offers a medical degree (vs. not)																									0.70	0.94		
Undergraduate full-time enrollment (10,000)																									-0.83	0.00		
Proportion of undergraduate White students																									0.04	0.02	2.02	*
Instructional expenditures per FTE																									0.00	0.00		
Research/Doctoral granting institution (vs. master comprehensive)																									1.13	1.02		
Liberal Arts institution (vs. master comprehensive)																									-0.14	1.51		
Selectivity (100-point increments)																									-0.66	0.42		
Student peer mean: Faculty here are interested in students' academic problems																									-0.13	1.81		
Proportion of STEM undergraduate majors																									2.70	2.63		
Level 1																												
1. Demographic Characteristics																												
Gender (Female)	0.81	0.96			0.53	0.97			0.63	0.88			0.63	0.88			0.47	0.76			0.57	0.80			0.45	0.80		
Low income (Under $25K)	1.30	1.17			1.10	1.15			0.98	1.04			0.98	1.04			1.01	0.90			1.03	0.90			0.99	0.90		
Low-middle income ($25K to $49,999)	1.46	1.07			1.32	1.04			0.93	0.94			0.93	0.94			1.38	0.79			1.40	0.79			1.23	0.78		
High middle income ($100K-$199,999	2.50	1.26	1.98	*	2.86	1.23	2.33	*	2.62	1.11	2.36	*	2.62	1.11	2.36	0.02	2.22	0.95	2.33	*	2.22	0.95	2.34	*	2.20	0.94	2.33	*
High income ($200K+)	-0.35	2.30			-0.72	2.22			-2.03	2.02			-2.03	2.02			-1.77	1.72			-1.61	1.73			-1.50	1.70		
Mother's education	0.06	0.24			0.02	0.23			-0.11	0.21			-0.11	0.21			-0.13	0.18			-0.10	0.18			-0.13	0.18		
2. Pre-college preparation, achievement and experiences (Responses taken f																												
High school GPA					-0.28	0.32			-0.41	0.29			-0.41	0.29			-0.70	0.26	-2.73	**	-0.69	0.26	-2.70	**	-0.47	0.26		
Years of mathematics in H.S.					0.35	0.76			0.49	0.70			0.49	0.70			0.77	0.59			0.79	0.59			0.82	0.58		
Years of biological science in H.S.					-0.42	0.36			-0.47	0.32			-0.47	0.32			-0.34	0.28			-0.35	0.28			-0.32	0.28		
Participated in a summer research program					1.65	1.04			1.44	0.94			1.44	0.94			1.08	0.81			1.15	0.81			0.86	0.81		
Hours per week: Talking with high school teachers outside class					1.72	0.38	4.57	***	1.18	0.34	3.44	***	1.18	0.34	3.44	0.00	0.53	0.30			0.52	0.30			0.54	0.30		
Parent occupation in STEM					1.03	0.95			0.41	0.86			0.41	0.86			-0.32	0.74			-0.36	0.74			-0.37	0.74		
SAT composite score					-0.50	0.29			-0.70	0.27	-2.58	**	-0.70	0.27	-2.58	0.01	-0.68	0.23	-2.89	**	-0.65	0.24	-2.73	**	-0.46	0.25		
2004 Degree aspiration: (Ref bachelors degree or less)					3.08	1.42	2.17	*	2.42	1.29			2.42	1.29			1.39	1.10			1.60	1.11			1.55	1.10		
3. *Campus Climate (Responses take from the CSS)*																												
Felt intimidated by your professors									-1.61	0.56	-2.90	**	-1.61	0.56	-2.90	0.00	-1.31	0.49	-2.70	**	-1.33	0.49	-2.74	**	-1.18	0.48	-2.46	*
There is strong competition among most students for high grades									-0.13	0.46			-0.13	0.46			-0.23	0.40			-0.20	0.40			-0.06	0.40		
Positive cross-racial interactions									0.21	0.04	4.67	***	0.21	0.04	4.67	0.00	0.10	0.04	2.59	**	0.10	0.04	2.54	*	0.15	0.04	3.65	***
Sense of belonging									0.36	0.04	8.19	***	0.36	0.04	8.19	0.00	0.15	0.04	3.87	***	0.16	0.04	3.89	***	0.15	0.04	3.70	***
College Experiences (Responses taken from the CSS)																												
4. Behaviors																												
Participated in a program to prepare for graduate school																	2.74	0.87	3.14	**	2.89	0.87	3.30	***	2.86	0.87	3.30	***
Participated in an academic program for racial/ethnic minorities																	-0.36	0.68			-0.39	0.68			-0.31	0.68		
Hours per Week: Working for pay off campus																	-0.06	0.11			-0.07	0.11			-0.09	0.11		
Overall college GPA																	0.61	0.23	2.72	**	0.60	0.23	2.63	**	0.51	0.23	2.23	*
Met with an advisor/counselor about your career plans																	2.75	0.52	5.32	***	2.70	0.51	5.27	***	2.58	0.51	5.07	***
Studied with other students																	0.00	0.57			0.00	0.57			-0.26	0.57		
Participated in an internship program																	1.78	0.66	2.71	**	1.87	0.66	2.86	**	1.82	0.66	2.74	**
Participated in an undergraduate research program (e.g. MARC, MBRS, REU)																	0.51	0.87			0.53	0.88			0.57	0.88		
Joined a club or organization related to major																	0.60	0.67			0.59	0.66			0.32	0.66		
Had instruction that supplemented course work																	2.51	0.54	4.69	***	2.52	0.53	4.74	***	2.48	0.53	4.68	***
5. Perceptions/Attitudes																												
Faculty here are interested in students' academic problems																	4.00	0.48	8.32	***	3.98	0.48	8.27	***	3.71	0.48	7.71	***
Academic self-concept																	-0.01	0.05			-0.01	0.05			-0.02	0.05		
Social self-concept																	0.04	0.05			0.05	0.05			0.06	0.05		
6. STEM Environment																												
Engineering major																					0.73	0.97			0.96	0.97		
Professional health major																					0.96	0.76			1.04	0.76		
Math/statistics major																					1.48	3.10			1.78	3.09		
Physical science major																					-0.19	1.46			-0.18	1.45		
Other STEM major																					1.43	1.43			1.30	1.42		
%Level-1 variance explained	0.34%				7.20%				24.47%				38.30%				44.50%				44.69%				44.89%			
% Level-2 variance explained	--				--				--				--				--				--				89.02%			

Note: *Indicates p-value less than .05; ** Indicates p-value less than .01; *** Indicates p-value less than .001.

Biological Science Majors = (General Biology, Biochemistry/Biophysics, Botany, Environmental Science, Marine (Life) Science, Microbiology/Bacterial Biology, Zoology, Other Biological Science);

Engineering Majors = (Aeronautical/Astronautical Engineering, Civil Engineering, Chemical Engineering, Computer Engineering, Electrical Engineering, Industrial Engineering, Mechanical Engineering, Other Engineering); Physical Science Majors = (Astronomy, Atmospheric Science, Chemistry, Earth Science, Marine Science, Physics, Other Physical Science); Math or Statistics; Professional Health Majors = (Health Technology, Medicine/Dentistry/Veterinary Medicine, Nursing, Pharmacy); Other STEM Majors =

Table 7

Results of Hierarchical Models Predicting White Students Participation in SI

Variables	Model 1				Model 2				Model 3				Model 4				Model 5				Model 6				Model 7			
Level 2	**β**	**SE**	**T-ratio**	**Sig**	**β**	**SE**	**T-ratio**	**Sig**	**β**	**SE**	**T-ratio**	**Sig**	**β**	**SE**	**T-ratio**	**Sig**	**β**	**SE**	**T-ratio**	**Sig**	**β**	**SE**	**T-ratio**	**Sig**	**β**	**SE**	**T-ratio**	**Sig**
7. Institutional Variables																												
Intercept	2.11	0.09	23.15	***	2.12	0.15	14.63	***	2.20	0.14	15.69	***	2.13	0.23	9.35	***	2.15	0.23	9.48	***	2.17	0.23	9.26	***	1.94	0.30	6.57	***
Institutional control: Private (vs. public)																									0.09	0.08		
HBCU (vs. non-HBCU)																									NA	NA	NA	NA
Institution offers a medical degree (vs. not)																									0.02	0.07		
Undergraduate full-time enrollment (10,000)																									0.14	0.00	2.59	*
Proportion of undergraduate White students																									0.00	0.00		
Instructional expenditures per FTE																									0.00	0.00		
Research/Doctoral granting institution (vs. master comprehensive)																									0.05	0.07		
Liberal Arts institution (vs. master comprehensive)																									0.16	0.12		
Selectivity (100-point increments)																									0.03	0.03		
Student peer mean: Faculty here are interested in students' academic problems																									0.14	0.25		
Proportion of STEM undergraduate majors																									0.13	0.16		
Level 1																												
1.Demographic Characteristics																												
Gender (Female)	0.02	0.05			0.04	0.05			0.02	0.05			0.00	0.05			0.02	0.05			0.02	0.05			0.02	0.05		
Low income (Under $25K)	-0.07	0.10			-0.06	0.10			-0.10	0.10			-0.10	0.10			-0.10	0.10			-0.12	0.10			-0.11	0.10		
Low-middle income ($25K to $49,999)	-0.04	0.08			-0.02	0.08			0.00	0.08			0.01	0.08			0.01	0.08			0.01	0.08			0.00	0.08		
High middle Income ($100K-$199,999)	0.02	0.06			0.02	0.06			0.01	0.06			0.00	0.06			-0.01	0.06			0.00	0.06			-0.03	0.06		
High income ($200K+)	-0.11	0.08			-0.13	0.08			-0.15	0.08			-0.13	0.08			-0.12	0.08			-0.15	0.08			-0.17	0.08	-2.07	*
Mother's education	0.03	0.02			0.02	0.02			0.01	0.02			0.01	0.02			0.01	0.02			0.01	0.02			0.01	0.02		
2. Pre-college preparation, achievement and experiences (Responses taken from TFS)																												
High school GPA					0.04	0.03			0.02	0.03			-0.01	0.03			-0.01	0.03			0.00	0.03			-0.01	0.03		
Years of mathematics in H.S.					0.09	0.06			0.09	0.05			0.09	0.05			0.09	0.05			0.10	0.05			0.10	0.05		
Years of biological science in H.S.					-0.05	0.03			-0.05	0.02	-2.10	*	-0.06	0.02	-2.45	*	-0.06	0.02	-2.50	*	-0.06	0.02	-2.30	*	-0.05	0.02	-2.23	*
Participated in a summer research program					-0.12	0.09			-0.11	0.09			-0.11	0.09			-0.11	0.09			-0.11	0.09			-0.10	0.08		
Hours per week: Talking with high school teachers outside class					0.01	0.03			0.01	0.03			0.00	0.03			0.00	0.03			-0.01	0.03			-0.01	0.03		
Parent occupation In STEM					0.01	0.06			0.00	0.05			0.01	0.05			0.01	0.05			0.01	0.05			0.01	0.05		
SAT composite score					0.01	0.02			0.00	0.02			-0.01	0.02			-0.01	0.02			0.00	0.02			-0.01	0.02		
2004 Degree aspiration: (Ref bachelors degree or less)					0.12	0.08			0.06	0.07			0.02	0.07			0.02	0.07			0.02	0.07			0.03	0.07		
3. *Campus Climate (Responses take from the CSS)*																												
Felt intimidated by your professors									-0.01	0.04			-0.01	0.04			0.01	0.04			0.01	0.04			0.01	0.04		
There is strong competition among most students for high grades									0.08	0.03	2.62	**	0.08	0.03	2.54	*	0.08	0.03	2.44	*	0.08	0.03	2.42	*	0.06	0.03		
Positive cross-racial interactions									0.01	0.00	3.41	**	0.01	0.00	3.00	**	0.01	0.00	2.69	**	0.01	0.00	2.62	**	0.01	0.00	2.72	**
Sense of belonging									0.01	0.00	4.42	***	0.01	0.00	3.52	***	0.01	0.00	2.07	*	0.01	0.00			0.01	0.00		
College Experiences (Responses taken from the CSS)																												
4. Behaviors																												
Participated in a program to prepare for graduate school													0.09	0.07			0.09	0.07			0.07	0.07			0.07	0.07		
Participated in an academic program for racial/ethnic minorities													-0.13	0.13			-0.14	0.13			-0.13	0.13			-0.13	0.13		
Hours per Week: Working for pay off campus													0.01	0.01			0.01	0.01			0.01	0.01			0.01	0.01		
Overall college GPA													0.03	0.02			0.02	0.02			0.02	0.02			0.02	0.02		
Met with an advisor/counselor about your career plans													0.03	0.04			0.01	0.04			-0.02	0.04			-0.01	0.04		
Studied with other students													0.13	0.04	3.07	**	0.13	0.04	2.91	**	0.11	0.04	2.59	*	0.12	0.04	2.79	**
Participated in an internship program													0.04	0.05			0.04	0.05			0.04	0.05			0.03	0.05		
Participated in an undergraduate research program (e.g. MARC, MBRS, REU)													0.07	0.07			0.05	0.07			0.04	0.07			0.04	0.07		
Joined a club or organization related to major													0.01	0.05			0.01	0.05			-0.01	0.05			-0.01	0.05		
5. Perceptions/Attitudes																												
Faculty here are interested in students' academic problems																	0.13	0.04	3.35	**	0.09	0.04			0.09	0.04	2.07	*
Academic self-concept																	0.00	0.00			0.00	0.00			0.00	0.00		
Social self-concept																	0.00	0.00			0.00	0.00			0.00	0.00		
6. STEM Environment																												
Receipt of faculty mentorship																					0.01	0.00	2.95	0.003**	0.01	0.00	3.15	**
Engineering major																					0.03	0.07			0.00	0.07		
Professional health major																					0.03	0.06			0.03	0.06		
Math/statistics major																					0.23	0.16			0.21	0.16		
Physical science major																					-0.04	0.09			-0.03	0.09		
Other STEM major																					0.16	0.15			0.16	0.15		
%Level-1 variance explained	0.50%				1.28%				8.38%				11.40%				13.12%				14.76%				16.81%			
% Level-2 variance explained	--				--				--				--				--				--				99.37%			

Note: *Indicates p-value less than .05; ** Indicates p-value less than .01; *** Indicates p-value less than .001.

Biological Science Majors = (General Biology, Biochemistry/Biophysics, Botany, Environmental Science, Marine (Life) Science, Microbiology/Bacterial Biology, Zoology, Other Biological Science);

Engineering Majors = (Aeronautical/Astronautical Engineering, Civil Engineering, Chemical Engineering, Computer Engineering, Electrical Engineering, Industrial Engineering, Mechanical Engineering, Other Engineering); Physical Science Majors = (Astronomy, Atmospheric Science, Chemistry, Earth Science, Marine Science, Physics, Other Physical Science); Math or Statistics; Professional Health Majors = (Health Technology, Medicine/Dentistry/Veterinary Medicine, Nursing, Pharmacy); Other STEM Majors = (Agriculture, Computer Science, Technical and non-technical STEM)

Table 8

Results of Hierarchical Models Predicting White Students' Receipt of Faculty Mentoring and Support

Variables	Model 1				Model 2				Model 3				Model 4				Model 5				Model 6				Model 7			
Level 2	**β**	**SE**	**T-ratio**	**Sig**	**β**	**SE**	**T-ratio**	**Sig**	**β**	**SE**	**T-ratio**	**Sig**	**β**	**SE**	**T-ratio**	**Sig**	**β**	**SE**	**T-ratio**	**Sig**	**β**	**SE**	**T-ratio**	**Sig**	**β**	**SE**	**T-ratio**	**Sig**
7. Institutional Variables																												
Intercept	46.72	1.33	35.10	***	44.10	2.06	21.46	***	44.79	1.90	23.51	***	40.99	2.80	14.63	***	41.00	2.62	15.67	***	42.65	2.69	15.85	***	44.84	3.43	13.08	***
Institutional control: Private (vs. public)																									-1.08	0.98		
HBCU (vs. non-HBCU)																									NA	NA	NA	
Institution offers a medical degree (vs. not)																									-0.04	0.80		
Undergraduate full-time enrollment (10,000)																									-0.85	0.00		
Proportion of undergraduate White students																									0.03	0.02		
Instructional expenditures per FTE																									0.00	0.00		
Research/Doctoral granting institution (vs. master comprehensive)																									-0.38	0.82		
Liberal Arts institution (vs. master comprehensive)																									1.19	1.37		
Selectivity (100-point increments)																									-0.10	0.39		
Student peer mean: Faculty here are interested in students' academic problems																									0.23	2.96		
Proportion of STEM undergraduate majors																									-3.14	1.92		
Level 1																												
1. Demographic Characteristics																												
Gender (Female)	1.48	0.73	2.03	*	1.10	0.74			1.03	0.69			0.36	0.62			0.63	0.59			0.22	0.62			0.20	0.62		
Low income (Under $25K)	2.40	1.44			1.63	1.45			0.77	1.34			0.57	1.22			0.31	1.13			0.36	1.13			0.30	1.13		
Low-middle income ($25K to $49,999)	-0.87	1.13			-0.69	1.12			-0.17	1.03			-0.13	0.93			0.03	0.87			-0.15	0.87			-0.19	0.87		
High middle income ($100K-$199,999)	0.19	0.90			-0.12	0.89			-0.27	0.82			-0.60	0.75			-0.74	0.69			-0.90	0.69			-0.83	0.70		
High income ($200K+)	0.96	1.20			0.77	1.18			0.63	1.09			1.46	0.99			1.83	0.92	1.99	*	1.72	0.93			1.98	0.93	2.12	*
Mother's education	0.29	0.22			0.26	0.22			0.14	0.21			0.11	0.19			0.05	0.18			0.05	0.18			0.05	0.17		
2. Pre-college preparation, achievement and experiences (Responses taken from TFS)																												
High school GPA					0.46	0.41			0.11	0.38			-0.66	0.35			-0.73	0.33	-2.25	*	-0.70	0.32	-2.16	*	-0.73	0.33	-2.22	*
Years of mathematics in H.S.					-0.70	0.77			-0.82	0.71			-1.06	0.64			-0.82	0.59			-0.84	0.59			-0.86	0.59		
Years of biological science in H.S.					-0.09	0.36			-0.07	0.33			-0.14	0.30			-0.19	0.28			-0.28	0.28			-0.25	0.28		
Participated in a summer research program					0.72	1.25			1.12	1.15			1.10	1.05			1.36	0.98			1.37	0.98			1.43	0.98		
Hours per week: Talking with high school teachers outside class					1.16	0.39	2.97	**	1.10	0.36	3.05	**	0.80	0.33	2.44	*	0.94	0.31	3.05	**	0.88	0.31	2.84	**	0.93	0.31	3.00	**
Parent occupation in STEM					0.50	0.78			0.34	0.72			0.47	0.66			0.42	0.61			0.53	0.61			0.66	0.62		
SAT composite score					-0.18	0.27			-0.37	0.25			-0.79	0.24	-3.35	**	-0.98	0.23	-4.26	***	-0.98	0.23	-4.20	***	-0.89	0.26	-3.44	**
2004 Degree aspiration: (Ref bachelors degree or less)					2.79	1.05	2.65	**	1.79	0.98			0.26	0.89			0.35	0.83			0.20	0.83			0.18	0.83		
3. *Campus Climate (Responses take from the CSS)*																												
Felt intimidated by your professors									-0.79	0.58			-0.73	0.53			-0.21	0.50			-0.19	0.49			-0.20	0.50		
There is strong competition among most students for high grades									1.03	0.43	2.37	*	0.30	0.39			0.23	0.36			0.19	0.36			0.22	0.37		
Positive cross-racial interactions									0.12	0.04	3.05	**	0.08	0.04	2.06	*	0.14	0.04	3.45	**	0.05	0.03			0.07	0.04	2.01	*
Sense of belonging									0.37	0.04	8.55	***	0.26	0.04	6.40	***	-0.02	0.04			0.14	0.04	3.42	**	0.13	0.04	3.24	**
College Experiences (Responses taken from the CSS)																												
4. Behaviors																												
Participated in a program to prepare for graduate school													1.96	0.82	2.38	*	2.01	0.77	2.63	**	2.07	0.76	2.70	**	1.98	0.76	2.59	*
Participated in an academic program for racial/ethnic minorities													-0.19	1.60			-0.44	1.49			-0.32	1.49			-0.59	1.49		
Hours per Week: Working for pay off campus													-0.02	0.12			0.02	0.11			0.04	0.11			0.02	0.12		
Overall college GPA													1.09	0.22	4.88	***	0.78	0.22	3.57	***	0.73	0.22	3.30	**	0.67	0.23	2.96	**
Met with an advisor/counselor about your career plans													3.35	0.54	6.16	***	3.03	0.51	5.96	***	2.97	0.51	5.86	***	2.89	0.51	5.72	***
Studied with other students													1.54	0.54	2.87	**	1.45	0.50	2.91	**	1.55	0.50	3.10	**	1.45	0.50	2.91	**
Participated in an internship program													-0.58	0.62			-0.41	0.58			-0.36	0.59			-0.25	0.59		
Participated in an undergraduate research program (e.g. MARC, MBRS, REU)													1.77	0.81	2.18	*	1.00	0.76			0.80	0.76			0.83	0.76		
Joined a club or organization related to major													1.68	0.65	2.60	**	1.70	0.60	2.83	**	1.72	0.60	2.87	**	1.71	0.60	2.85	**
Had instruction that supplemented course work													2.00	0.47	4.26	***	1.40	0.44	3.17	**	1.41	0.44	3.21	**	1.45	0.44	3.29	**
5. Perceptions/Attitudes																												
Faculty here are interested in students' academic problems																	4.53	0.46	9.79	***	4.56	0.46	9.93	***	4.39	0.46	9.46	***
Academic self-concept																	0.13	0.05	2.80	**	0.14	0.05	3.04	**	0.15	0.05	3.22	**
Social self-concept																	0.06	0.03			-0.02	0.04			-0.02	0.04		
6. STEM Environment																												
Engineering major																					-1.84	0.83	-2.21	*	-1.85	0.84	-2.20	*
Professional health major																					-1.23	0.73			-1.49	0.73	-2.03	*
Math/statistics major																					0.69	1.87			0.86	1.85		
Physical science major																					0.12	1.05			0.12	1.06		
Other STEM major																					-1.75	1.72			-1.92	1.73		
%Level-1 variance explained	0.93%				4.99%				18.85%				33.32%				42.36%				43.09%				42.62%			
% Level-2 variance explained	--				--				--				--				--				--				97.06%			

Note: *Indicates p-value less than .05; ** Indicates p-value less than .01; *** Indicates p-value less than .001.

Biological Science Majors = (General Biology, Biochemistry/Biophysics, Botany, Environmental Science, Marine (Life) Science, Microbiology/Bacterial Biology, Zoology, Other Biological Science);

Engineering Majors = (Aeronautical/Astronautical Engineering, Civil Engineering, Chemical Engineering, Computer Engineering, Electrical Engineering, Industrial Engineering, Mechanical Engineering, Other Engineering); Physical Science Majors = (Astronomy, Atmospheric Science, Chemistry, Earth Science, Marine Science, Physics, Other Physical Science); Math or Statistics; Professional Health Majors = (Health Technology, Medicine/Dentistry/Veterinary Medicine, Nursing, Pharmacy); Other STEM Majors = (Agriculture, Computer Science, Technical and non-technical STEM)

Appendix A
Variables and Coding

Variable	Coding Scheme
Dependent Variables	
Had instruction that supplemented course work	1= not at all; 2=occasionally; 3= frequently
Faculty mentorship	Continuous; Nine-item factor (see Appendix B)
Demographic Characteristics	
Gender (Female)	1=male, 2=female
Low income (Under $25K)	0=no; 1=yes
Low-middle income ($25K to $49,999)	0=no; 1=yes
Middle income ($50K to $99,999)	0=no; 1=yes
High middle income ($100K-$199,999)	0=no; 1=yes
High income ($200K+)	0=no; 1=yes
Mother's education	1=grammar school or less; to 8=graduate degree
Pre-college preparation, achievement and experiences (Responses taken from TFS)	
High school GPA	1=D to 8=A or A+
Years of mathematics in H.S.	1=none to 7=5 or more years
Years of biological science H.S.	1=none to 7=5 or more years
Participated in a summer research program	1=no; 2=yes
Hours per week: Talking with high school teachers outside class	1=none to 8=Over 20 hours
Parent occupation in STEM	0=no; 1=yes
SAT composite score	Continuous; range 400-1600, rescaled to 4-16
2004 Degree aspiration: (Ref bachelors degree or Less)	0=bachelor degree or less; 1= Higher than a bachelors degree (i.e. Masters, Ph.D. or Ed.D., MD, other professional degree like law, divinity)
Campus Climate	
Felt intimidated by your professors	1= not at all; 2=occasionally; 3= frequently
There is strong competition among most students for high grades	1= strongly disagree; 2= disagree; 3=agree; 4= Strongly agree
Positive cross-racial interactions	Continuous; Six-item factor (see Appendix B)
Sense of belonging	Continuous; Four-item factor (see Appendix B)
College Experiences (Responses taken from the CSS)	
Behaviors	
Participated in a program to prepare for graduate school	1=no; 2=yes
Participated in an academic program for racial/ethnic minorities	1=no; 2=yes
Hours per Week: Working for pay off campus	1=none to 8=Over 20 hours
Overall college GPA	1=D to 8=A or A+
Met with an advisor/counselor about your career plans	1= not at all; 2=occasionally; 3= frequently
Studied with other students	1= not at all; 2=occasionally; 3= frequently
Participated in an internship program	1=no; 2=yes
Participated in an undergraduate research program (e.g. MARC, MBRS, REU)	1=no; 2=yes
Joined a club or organization related to major	1=no; 2=yes
Perceptions/Attitudes	
Faculty here are interested in students' academic problems	1= strongly disagree; 2= disagree; 3=agree; 4= Strongly agree

Appendix A
Variables and Coding

Variable	Coding Scheme
Academic self-concept	Continuous; Five-item factor (see Appendix B)
Social self-concept	Continuous; Three-item factor (see Appendix B)

Appendix A
Variables and Coding

Variable	Coding Scheme
STEM Environment	
Biological sciences major	0=no; 1=yes
Engineering major	0=no; 1=yes
Professional health major	0=no; 1=yes
Math major	0=no; 1=yes
Physical science major	0=no; 1=yes
Other STEM major	0=no; 1=yes
Institutional Variables	
Intercept	
Historically Black College/University (vs. non-HBCU)	0=non-HBCU, 1=HBCU
Institution offers a medical degree (vs. not)	1=no; 2=yes
Percentage of STEM undergraduates	Continuous
Percent White undergraduates	Continuous
Undergraduate full-time enrollment (proxy for institutional size) (in increments of 10,000)	Continuous
Institutional control: Private (vs. public)	0=Public 1=Private
Masters granting institution (vs. liberal arts)	0=no; 1=yes
Doctoral granting institution (vs. liberal arts)	0=no; 1=yes
Selectivity (100-point increments)	Continuous
Student peer mean: Faculty here are interested in students' academic problems	Continuous
Instructional expenditures per FTE	Continuous

Appendix A
Variables and Coding

Variable	Coding Scheme

Appendix B
Factor Items and Loadings

Factor	Item
Faculty Mentorship (CSS) - Measures the extent to which students and faculty interact in relationships that foster mentorship, support, and guidance, with respect to both academic and personal domains.	
	Faculty Provide: Help in achieving your professional goals
	Faculty Provide: Advice and guidance about your educational program
	Faculty Provide: Feedback about your academic work (outside of grades)
	Faculty Provide: Emotional support and encouragement
	Faculty Provide: An opportunity to discuss coursework outside of class
	Faculty Provide: Encouragement to pursue graduate/professional study
	Faculty Provide: Help to improve your study skills
	Faculty Provide: A letter of recommendation
	Faculty Provide: An opportunity to work on a research project
Academic Self-Concept (CSS) - A unified measure of students' beliefs about their abilities and confidence in academic environments.	
	Academic ability
	Self-confidence (intellectual)
	Mathematical Ability
	Writing ability
Positive Cross-Racial Interaction - A unified measure of students' level of positive interactions with diverse peers.	
	Dined or shared a meal
	Had meaningful and honest discussions about race/ethnic relations outside of class
	Shared personal feelings and problems
	Had intellectual discussions outside of class
	Studied or prepared for class
	Socialized or partied
Sense of Belonging (CSS) - Measures the extent to which students feel a sense of academic	
	I feel I have a sense of belonging to this campus
	I feel I am a member of this college
	I see myself as part of the campus community
Social Self-Concept (CSS) - A unified measure of students' beliefs about their abilities and	
	Self-Confidence (social)
	Leadership ability
	Understanding of others

Appendix C
List of Majors Defined as STEM

Biological Science Majors

1. General Biology
2. Biochemistry/Biophysics
3. Botany
4. Environmental Science
5. Marine (Life) Science
6. Microbiology/Bacterial Biology
7. Zoology
8. Other Biological Science

Engineering Majors

9. Aeronautical/Astronautical Engineering
10. Civil Engineering
11. Chemical Engineering
12. Computer Engineering
13. Electrical Engineering
14. Industrial Engineering
15. Mechanical Engineering
16. Other Engineering

Physical Science Majors

17\. Astronomy
18\. Atmospheric Science
19\. Chemistry
20\. Earth Science
21\. Marine Science
23\. Physics
25\. Other Physical Science

Math or Statistics

22\. Mathematics
24\. Statistics

Professional Health Majors

26\. Health Technology
27\. Medicine/Dentistry/Veterinary Medicine
28\. Nursing
29\. Pharmacy

Other STEM Majors

30\. Agriculture
31\. Computer Science
32\. Technical and non-technical STEM