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African American and Hispanic STEM Students' Engagement at Predominantly White Institutions

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African American and Hispanic STEM Students' Engagement at Predominantly White Institutions

Abstract

Although research has shown that involvement is a helpful predictor of students' future success, underrepresented minorities (i.e., African Americans and Hispanics) face unique obstacles at predominantly White institutions, which limit their engagement in educationally purposeful activities. Survey data from a 2007 administration of the National Survey of Student Engagement (NSSE) were analyzed to measure African American and Hispanic students' engagement in educationally purposeful activities. Results from the present study found that student satisfaction in college is positively related to time spent preparing for class and frequency of interactions with faculty members about careers. Furthermore, African American and Hispanic science, technology, engineering, and math (STEM) students who engage peers of different opinions or spend significant amounts of time studying academic work report higher scores on personal and social gains than their same-race peers who do so less frequently.

Introduction

Empirical research has consistently shown that the time and energy students devote to educationally purposeful activities is the greatest predictor of college outcomes ranging from cognitive and intellectual development,[1,2] to moral and ethical development,[3] to persistence and degree completion.[4] While general findings typically persist across student groups, studies have shown that historically underrepresented racial/ethnic minorities (URMs [such as African Americans and Hispanics]) face several obstacles at predominantly White institutions (PWIs) that impede their engagement including negative, "chilly" campus environments,[5] unsupportive faculty members,[6] strong familial obligations,[7] and very few same-race peers upon whom they can rely for support and friendship.[8]

Having supportive faculty members, welcoming learning environments, and a critical mass of same-race peers upon whom one may lean for support can be particularly important for African American and Hispanic students in academic disciplines, such as science, technology, engineering, and math (STEM), where they are sorely underrepresented and report a low sense of belonging.[9] Often studied in a homogenous group, URMs experience academic success when they feel they belong in STEM fields.[10] From 2000-2009 the share of STEM bachelor's degrees for Hispanic students has continued to grow, albeit at a slow rate, while African American student's share has not seen any statistically significant increase or decrease.[11]

Overall, African American and Hispanic students have historically faced lower degree attainment rates at the postsecondary level no matter their selected field of study, with completion rates in STEM fields following similar patterns. These realities are seen in statistics from as early as the 1995-96 cohort of beginning students who chose to pursue a STEM degree, with one study defining success as earning a degree by 2001. African American students represented 21% of the total cohort who intended to earn a degree in a STEM discipline, however only 3% of those who entered with STEM aspirations actually earned a bachelor's degree in the field. Similarly, although Hispanics accounted for 23% of the total cohort, only 3% actually earned a bachelor's

degree in a STEM discipline. Observing the same cohort, 22% of White students enrolled in a STEM program and 6% earned a bachelor's degree, while 47% of Asian/Pacific Islander students enrolled and 15% obtained a four-year STEM degree. [9]

Despite existing research on URMs, very little work focuses on understanding and comparing African American and Hispanic STEM college students' engagement at PWIs. The present study addresses this gap in the research by beginning to disaggregate and uncover the differences in racial/ethnic identity experiences of URMs in STEM fields.

Purpose

The purpose of this study was to measure (a) differences between African American and Hispanic STEM students' engagement in educationally purposeful activities as defined by prior research,[10] (b) differences among African American and Hispanic STEM students' engagement in terms of sex/gender, and (c) the net effect of academic challenge and interaction with faculty and peers on African American and Hispanic STEM student outcomes.

Literature Review

College students' learning, development, and postsecondary success have been studied by numerous researchers using a variety of perspectives and approaches. To improve undergraduates' learning and development, researchers have stressed the importance of student engagement in educationally purposeful activities.[10,11,12,13] Students' social and academic engagement takes on many forms depending on one's academic ability, social identity, and areas of interest. Student variability is compounded when institutional type, population, and financial resources are also considered. However, scholars have identified "high-impact" practices that promote student success. Indeed, the Association for American Colleges and Universities (AACU) and America's Promise Alliance highlight college interventions that assist with student achievement. One such idea is a learning community. These formal programs require cohorts of students to take multiple classes together. This high-impact intervention combines multiple areas of engagement in that students are able to build a social community while working toward a shared academic passion, typically under the advisement of a highly involved faculty member.

Although engagement is critically important to URMs, it is a significant factor across all student populations. Prior research by Umbach and Wawrzynski [12] found that postsecondary institutions where faculty utilize collaborative and active learning techniques have higher levels of student engagement. For instance, students' in-class learning is enhanced when faculty value co-curricular activities. In addition, student-centered environments highlight important aspects of engagement that support elements of student success such as student-faculty interaction, academic challenges, and developmental gains.

Research by Kuh[11] found that students who are engaged in the campus community are significantly more likely to remain in school, even when controlling for background characteristics and previous performance. Also, underrepresented students experience greater benefits from higher levels of engagement than their peers. Additionally, campus engagement enables students to develop a sense of belonging, which is also directly tied to student success.[10]

Sense of belong is important because it represents a fundamental, "basic human need and motivation, sufficient to influence behavior...consist[ing] of cognitive and affective elements." [9] Sense of belonging also takes on heightened importance in certain context (e.g., college campuses) and among specific populations (e.g., URMs). So, engagement and sense of belonging are especially important for Hispanic and African American student's retention and satisfaction in STEM fields.

Theoretical Framework

Since college students benefit from the time and energy they devote to college activities, we found Astin's theory of student involvement a useful framework for conducting our study. Therefore, Astin's widely used input-environment-outcome (I-E-O) model of change was employed. Based on the model, two factors, 1) inputs (e.g., demographic traits, time, energy) and 2) environment (e.g., experiences in college) influence student outcomes (e.g., learning gains).[14,15]

Astin's I-E-O college impact model focuses on the origins of change and serves as a guiding framework for assessment in higher education.[14, 15] His model controls for inputs such as students' background characteristics (i.e., the personal characteristics that a student brings to an educational setting) in order to better predict expected outcomes. In addition, the model takes collegiate environments (i.e., educational experiences, practices, programs, interventions) into account. The last part of the model, outputs, refers to the skills or abilities that college educators desire for students. Using this framework, the present study seeks to measure differences between African American and Hispanic STEM students' engagement.

Method

This study is part of a larger, longitudinal study titled, *Investigating the Critical Junctures: Strategies that Broaden Minority Participation in STEM Fields* funded by the National Science Foundation (NSF). As such, the study focused on African American and Hispanic students majoring in STEM fields. While the larger study consists of both quantitative and qualitative components, this report is based on multivariate analysis of the quantitative survey data only.

Data Source. Data were drawn from a 2007 administration of the *National Survey of Student Engagement* (NSSE). The NSSE is a survey instrument designed to measure the quality and quantity of students' engagement in educationally purposeful college activities.[11,16] Items relate to participation in various curricular/co-curricular programs and activities. In addition, a set of questions designed to elicit information about student perceptions of the overall educational environment are included. NSSE is generally sent to random samples of undergraduates, primarily freshmen and seniors, at participating institutions. To date, more than 600 colleges and universities have participated in the national survey.[11,16]

Sample. The sample for this study was restricted to include students who were STEM majors. Appropriate STEM majors were defined based on NSF's broad categorization of the following fields: 1) biological and agricultural sciences, 2) earth, atmospheric, and ocean sciences, 3) mathematics and computer sciences, 4) physical sciences, 5) psychology, 6) social sciences and

7) engineering. Health fields such as nursing, pre-medicine, pre-dentistry, pharmacy, and nutrition were not included. In addition, neither architecture nor graphic design was included. This created a sample of 698 undergraduate college students majoring in STEM fields who responded to a 2007 administration of the NSSE. Sixty-two percent of the students in our sample were women and 38% were male. Eighty-eight percent were Caucasians, 5.9% were Blacks and only 1.1% were Hispanics. Most participants were seniors (55%) and freshmen (36%), 5% were sophomore and the rest (3%) were juniors. Additionally, 38% were 19 years or younger, 43% were 20-23 years old, whereas the rest (19%) were older than 23 years. Eighteen percent of the participants achieved average grades of "B- or below" at their college, while 57% earned average grades of "B+ or above". Table 1 presents a summary of information describing this study's sample of STEM students.

Table 1: Description of sample (N=698)

Variables	%
Academic	
College classification	
Freshman, first-year	35.5
Sophomore	5.3
Junior	2.9
Senior	55.0
Missing	1.2
Enter college here or transfer	
Started here	71.9
Transferred	28.1
Grades at this college	
C, C-, or lower	5.6
B-, C+	12.2
B	24.5
A-, B+	30.8
A	26.9
Fraternity or sorority	
Yes	18.3
No	81.7
Demographic	
Sex of student	
Male	37.7
Female	62.3
Missing	3.5
Ethnicity	
African American/Black	5.9
American Indian/Alaska Native	0.7
Asian/Pacific Islander	2.9
Caucasian/White	88.4
Hispanic	1.1
Missing	1.0

Age of student	
19 or younger	38.3
20-23	43.1
24-29	11.1
30-39	4.2
40-55	2.1
Missing	2.7

Measures. One of the dependent variables—global gains—is based on students' perceived gains in college. Specifically, we operationalized global gains using 15 items from the NSSE. The precursors to global gains are the students' average responses to the 15 items within the group, after all items have been placed on a 4-point Likert-type scale that ranges from 1 *("very little"*) to 4 (*"very much"*). Results of a principal components factor analysis with varimax rotation revealed that these items, loaded on a single factor, accounted for approximately 68% of inter-item variance. As a result, we calculated a single composite variable using all fifteen items (α = 0.91). An example of this scale is, "To what extent has your experience at this institution contributed to your knowledge, skills, and personal development in analyzing quantitative problems?" Original responses to each item were placed on a 4-point scale ranging from 1 (*"very little"*) to 4 (*"very much"*). Thus, the mean scores for the composite summated variable, which combined all 15 items, still ranged from 1 to 4 with higher scores indicating greater levels of global gains.

Satisfaction is another important dependent variable, which is based on the concept of students' entire educational experience. Students indicated their level of satisfaction using a 4-point Likert-type scale that ranges from 1 (*"poor"*) to 4 (*"excellent").* Similarly, the NSSE elicits information about students' grades in college. Students reported their GPA based on an 8-point scale ranging from 1 (*"C- or lower"*) to 8 (*"A"*).

The primary independent variables assessed the frequency and nature of African American and Hispanic STEM students' engagement with faculty members and peers. This included engagement inside classes (e.g., worked with other students on projects during class) and outside classes (e.g., talked about career plans with a faculty member). Specifically, five items measured the frequency with which students worked on a research project, discussed personal problems, or discussed career goals with a faculty member. Similarly, three items measured the extent of working collaboratively with other students inside and outside of class (e.g., had serious conversations with students who are very different from you in terms of their religious beliefs, political opinions, or personal values). Response options for the two variables both ranged from 1 (*"never"*) to 4 (*"very often"*).

Lastly, academic challenge is an important predictor variable in our study. Specifically, 11 items measured students' time spent preparing for class, amount of reading and writing, deep learning, and institutional expectations for academic performance. It is important to note that 10 out of 11 items emphasized positive outcomes. That is to say, the academic challenges were viewed as "growth producing," and only one item talked about students' enduring difficulties and frustrations.[17] An example of this scale is, "applying theories or concepts to practical problems or in new situations." Responses to each item were placed on a 4-point scale ranging from 1 (*"very*

little") to 4 (*"very much"*).

Data Analysis. Data analysis proceeded in four stages. First, descriptive statistics were calculated to describe the analytic sample and to determine any existing patterns among data points. Second, correlation analyses were conducted to estimate the magnitude and direction of statistical relationships among independent and dependent variables used in this analysis. Third, independent *t*-tests were employed to measure differences between African American and Hispanic STEM students' engagement in college activities. Two-way analyses of variance (ANOVA) were conducted to not only determine sex differences among subgroups, but also to identify whether a significant interaction effect between sex and African American or Hispanic subgroups exists. Lastly, hierarchical linear regression tests were used to identify predictors of African American STEM students' satisfaction with their educational experience, personal and social gains, and grades in college. To intensify the rigor of this analysis, a set of statistical controls were employed to account for potentially confounding influences such as background (e.g., sex, age) and academic factors (e.g., year in school, transfer status). Several of these factors have been shown to be important when estimating the "net effect" of college on students.[11] The study was designed to account for such differences.

Results

The mean grade for the sample was 4.53 (*SD*=1.91), which is between a B- and B. Using a Likert-type scale that ranges from 1 (*"not at all" / "very little"*) to 4 (*"very satisfied" / "very much"*), mean satisfaction of the entire educational experience for African American and Hispanic STEM students in our sample was 3.12 (*SD* = 0.73), while the mean global gains for our sample was 2.84 (*SD* = 0.61). Table 2 presents means and standard deviations for the main independent and dependent variables included in this analysis.

Table 2: Descriptive statistics for satisfaction, outside school activities, and gains

	M	SD
Satisfaction		
Satisfaction of entire educational experience	3.10	0.72
Outside school activities		
Prepared two or more drafts of a paper or assignment before turning it in	2.34	0.95
Worked with classmates outside of class to prepare class assignments	2.67	0.87
Tutored or taught other students (paid or voluntary)	1.69	0.81
Discussed ideas from your readings or classes with faculty members outside of class	1.89	0.84
Attended an art exhibit, play, dance, music, theater, or other performance	1.98	0.84
Worked with faculty members on activities other than coursework	1.60	0.85
Exercised or participated in physical fitness activities	2.72	0.99
Participated in activities to enhance your spirituality (worship, meditation, etc.)	2.29	1.13
Preparing for class (studying, reading, writing, doing homework or lab work)	3.96	1.60
Working for pay on campus	1.96	1.58
Working for pay off campus	2.70	2.33
Student-Faculty interaction		
Discussed grades or assignments with an instructor	2.63	0.97
Talked about career plans with a faculty member or advisor	2.22	0.87

Discussed ideas from your readings or classes with faculty members outside of class	1.78	0.80
Received prompt feedback from faculty on your academic performance	2.41	0.79
Worked with faculty members on activities other than coursework	1.69	0.94
Gains		
Global gains	2.84	0.61
Acquiring a broad general education	3.15	0.76
Acquiring job or work-related knowledge and skills	2.78	0.92
Writing clearly and effectively	2.90	0.88
Speaking clearly and effectively	2.74	0.91
Thinking critically and analytically	3.20	0.77
Analyzing quantitative problems	2.98	0.94
Using computing and information technology	3.18	0.84
Working effectively with others	2.97	0.88
Voting in local, state, or national elections	2.11	1.00
Learning effectively on your own	2.91	0.85
Understanding yourself	2.66	1.00
Understanding people of other racial and ethnic backgrounds	2.43	0.92
Solving complex real-world problems	2.62	0.93
Developing a personal code of values and ethics	2.50	1.02
Contributing to the welfare of your community	2.27	0.96
Academic challenges		
Number of assigned textbooks, books, or book-length packs of course readings	3.10	0.82
Number of written papers or reports of 20 pages or more	1.14	0.41
Number of written papers or reports between 5 and 19 pages	2.29	0.79
Number of written papers or reports of fewer than 5 pages	2.51	0.79
Analyzing the basic elements of an idea, experience, or theory	3.10	0.74
Synthesizing and organizing ideas into new, more complex interpretations	2.76	0.83
Making judgments about the value of information, arguments, or methods	2.88	0.86
Applying theories or concepts to practical problems or in new situations	3.00	0.87
Worked harder than you thought you could to meet an instructor's standards	2.57	0.84
Preparing for class (studying and other academic activities)	3.67	1.29
Spending significant amounts of time studying and on academic work	3.12	0.75

Exploratory correlation analyses revealed a number of important linkages. For instance, students' satisfaction regarding their entire educational experience is positively related to their global gains from college ($r = 0.33$, $p < 0.05$), student-faculty interactions ($r = 0.36$, $p < 0.05$), and campus environment ($r = 0.562$, $p < 0.01$). Students' global gains are positively correlated with academic challenge ($r = 0.42$, $p < 0.01$), student-faculty interaction ($r = 0.42$, $p < 0.01$), and peer interaction ($r = 0.37$, $p < 0.01$). For example, the more frequently African American and Hispanic STEM students talked with students of a different race, different personal values, or different political opinions the more they gained. Similarly, students who frequently talked with a faculty member about their career or discussed ideas from readings/classes with faculty members outside of class tended to report higher gains from college. Interestingly, no statistically significant relationships were found between grades and academic challenge or between grades and student-faculty interaction. That is to say, African American STEM students' grades are not related to (a) time spent studying and on academic work ($r = 0.14$, $p = 0.33$), (b) interactions with peers of different races ($r = 0.014$, $p = 0.93$), (c) preparing for class (i.e., studying, reading, writing, doing homework or lab work, analyzing data, rehearsing, and other academic activities ($r = 0.08$, $p = 0.57$)), or (d) discussing grades or assignments with an

instructor ($r = 0.13$, $p = 0.37$). Such estimates justified the use of regression to simultaneously measure the magnitude and direction of these associations. That is, regression analysis allows researchers "to estimate coefficients showing how changes in an independent variable affect the dependent variable." [17]

Ethnicity. Independent *t*-tests were conducted to determine the differences between African American and Hispanic STEM students' engagement in educationally purposeful activities, as defined by prior research.[10] Results suggest that African American and Hispanic STEM students differ in terms of hours working off-campus (Mean difference [*MD*] = 0.93, $p < 0.01$) and working with classmates outside of class to prepare class assignments (*MD* = 0.54, $p < 0.05$). Figure 1 shows that African American STEM students spent more time working off campus than Hispanic students. Figure 2 shows that African American STEM students are more engaged in working with classmates outside of class to prepare class assignments than their Hispanic counterparts.

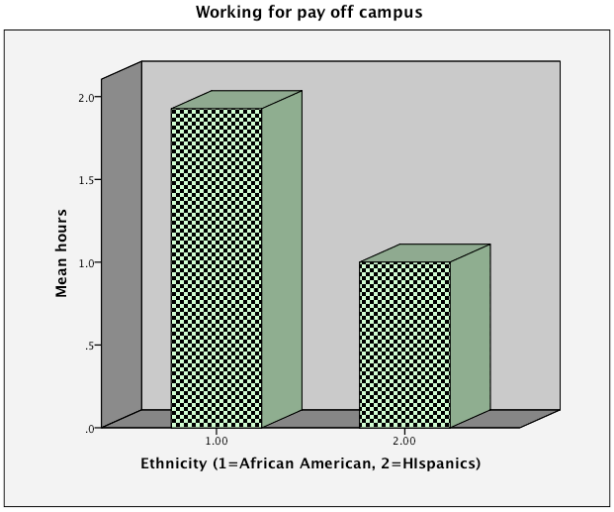

Figure 1: Differences by ethnicity in working for pay off campus

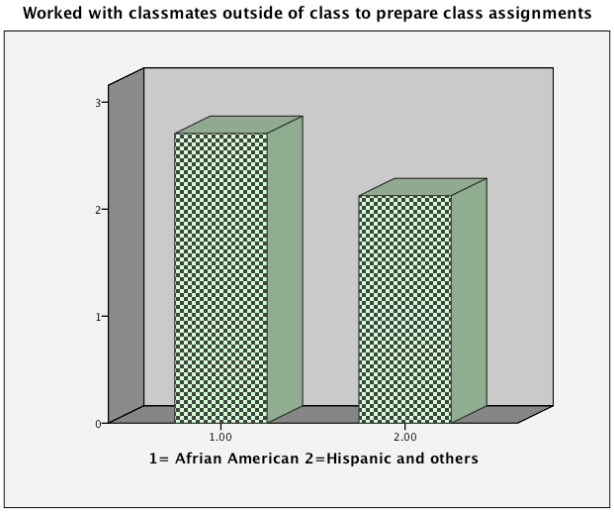

Figure 2: Differences by ethnicity in working with classmates outside class to prepare class assignments

Gender. Two-way ANOVA and independent *t*-tests were conducted to examine differences among African American and Hispanic STEM students' engagement in terms of gender. There was no significant gender*ethnicity interaction effect. Follow-up independent *t*-tests allowed us to determine gender differences among/between African American and Hispanic STEM students respectively. Specifically, for African Americans, significant gender differences were seen among STEM students who work with classmates outside of class to prepare assignments (MD = 0.78, $p < 0.05$). Female African American students tend to work less frequently with classmates outside of class to prepare class assignments than their same-race male peers (Figure 3). For Hispanic STEM students, the only significant gender difference was seen for student participation in activities to enhance spirituality (MD = 1.87, $p < 0.01$). Comparing Hispanic STEM students by gender, in order to enhance their spirituality, males tend to participate in activities such as worship, meditation, and prayer more frequently than females (Figure 3). No significant statistical differences were found when comparing respondents' sex or race with respect to the influence of participation in out-of-class academic activities.

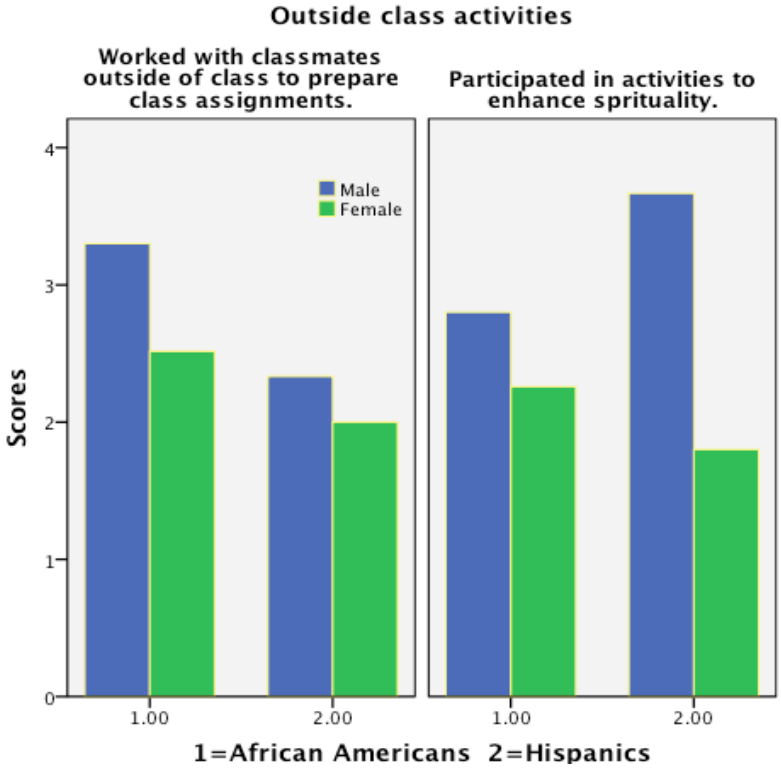

Figure 3: significant gender differences in two outside class activities

Satisfaction. Regression results suggest that the linear combination of factors had a statistically significant relationship on STEM students' satisfaction with their entire educational experience, $F_{model\ 4}$ (26, 21) = 2.17, $p < 0.05$. In the last and final model, the regression coefficient was 0.85 indicating that approximately 73% (adjusted $R2$ = 0.39) of the variance in African American and Hispanic STEM students' satisfaction can be explained by the variables in the model, which included all factors. Interestingly, background traits (i.e., Model 1) accounts for only 3% of the

variance in satisfaction, while academic challenge (i.e., Model 2) and students' interaction with diverse others (i.e., Model 3) added 27% ($\Delta R2 = 0.27$) and 34% ($\Delta R2 = 0.34$) respectively. So, students' interactions with faculty (i.e., Model 4) explains the greatest amount of variance at 39% ($\Delta R2 = 0.39$). Significant predictors of African American and Hispanic STEM students' satisfaction include: preparing for class (studying, reading, writing, doing homework or lab work, analyzing data, rehearsing, and other academic activities) ($B = 0.24$, $p < 0.05$) and talking about career plans with a faculty member or advisor ($B = 0.39$, $p < 0.05$). In other words, students in the sample who spend more time on class preparation tend to report a higher level of satisfaction in college than their same-race peers who spend less time preparing for class. Similarly, participants who frequently talk with a faculty member about their careers tend to report a higher level of satisfaction in college.

Grades. Regression results suggest that the linear combination of factors has a statistically insignificant relationship with grades, F (26, 21) = 0.52, $p > 0.5$. We further conducted independent *t*-test to examine if there were gender or ethnicity effects on African American and Hispanic STEM students' grades. Interestingly, we found that the differences in students' grades are insignificant between African American and Hispanic STEM students ($p = 0.075$). However, differences are significant among all ethnic groups including Whites, Asian/Pacific Islanders, African Americans, Hispanics, and American Indians/Alaska Natives ($F = 9.15$, $p < 0.01$). This was likely due to the fact that the sample sizes for the African American and Hispanic STEM students were relatively small. From Figure 3, we can see Hispanic STEM students tend to report higher grade point averages (GPAs) than their African American counterparts. Figure 4 shows that male Hispanic STEM students tend to report higher grades than their female counterparts, while male African American STEM students tend to report relatively lower grades than their same-race female counterparts.

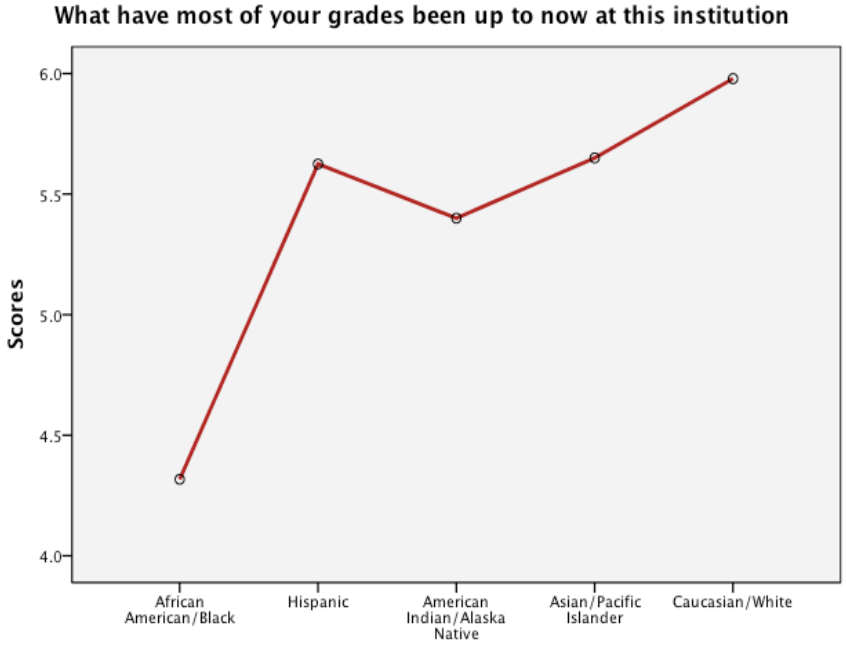

Figure 4: Ethnicity differences in grades

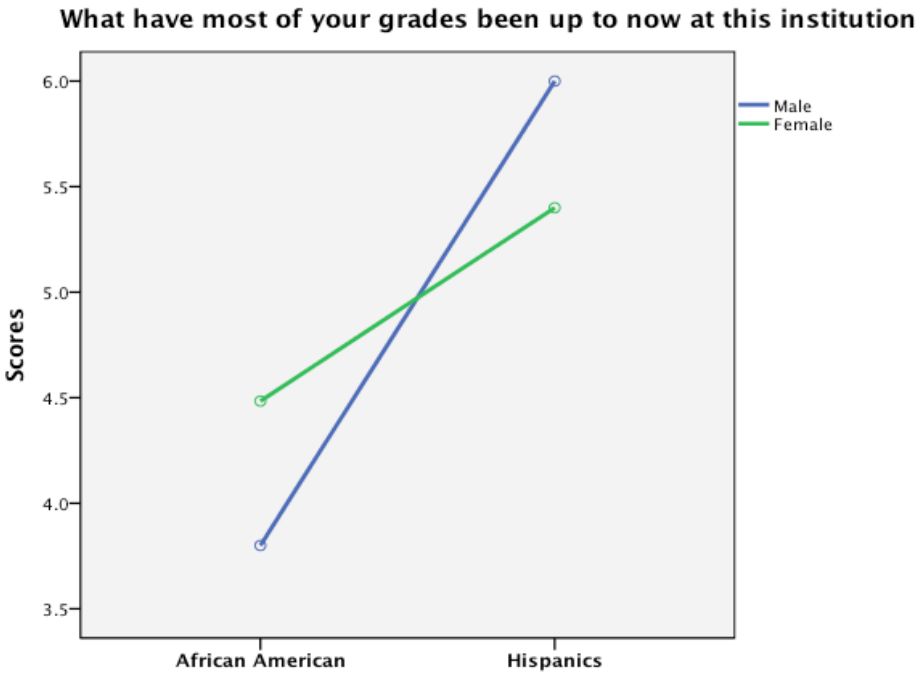

Figure 5: Gender*Ethnicity differences in grades

Personal and social gains. Regression results suggest that the linear combination of factors has a statistically significant relationship with personal and social gains ($F_{model\ 3}$ (20, 27) = 2.35, $p <$ 0.05). The regression coefficient was 0.80 indicating that approximately 64% (adjusted R^2 = 0.36) of the variance in African American and Hispanic STEM students' perceived personal and social gains in college can be explained by the variables in the model, which included all factors. Interestingly, background traits (i.e., Model 1) accounts for only 0.4 % of the variance in sampled students' personal and social gains. Academic challenge (i.e., Model 2) adds 19% (ΔR^2= 0.19). Hence, students' interactions with diverse others (i.e., Model 3) explains the greatest amount of variance (ΔR^2 = 0.36). One significant predictor of African American and Hispanic STEM students' perceived personal and social gains is spending significant amounts of time studying on academic work (B = 0.22, $p < 0.05$). Lastly, acquaintance with students of different religious beliefs, political opinions, or personal values (B = 0.013, p = 0.06) approaches statistical significance in predicting students' personal and social gains in college. In other words, African American and Hispanic STEM students who engage peers of different opinions or spend significant amounts of time studying academic work tend to report higher scores on personal and social gains than their same-race peers who do so less frequently. Table 3 shows regression results.

Table 3: Regression results

	Satisfaction (Model 4)		Gains (Model 3)	
	Unstd. β	Std. β	Unstd. β	Std. β
(Constant)	-0.697		1.920	
Age	-0.269	-0.317	-0.090	-0.130
Sex	-0.129	-0.076	0.076	0.054
Ethnicity	0.033	0.069	-0.013	-0.031
College classification	0.080	0.153	-0.027	-0.060
Enter college here or transfer	0.218	0.114	-0.151	-0.093
Member of a social fraternity or sorority	1.221	0.244	-1.056	-0.248
Number of assigned textbooks, books, or book-length packs of course readings	-0.063	-0.071	0.051	0.067
Number of written papers or reports of 20 pages or more	0.286	0.163	0.387	0.259
Number of written papers or reports between 5-19 pages	0.110	0.121	-0.009	-0.011
Number of written papers or reports of fewer than 5 pages	0.181	0.201	-0.071	-0.092
Analyzing the basic elements of an idea, experience, or theory	0.006	0.006	0.094	0.112
Synthesizing and organizing ideas, into new, more complex interpretations and relationships	0.237	0.262	-0.216	-0.280
Making judgments about the value of information, arguments, or methods	0.001	0.001	0.036	0.050
Applying theories or concepts to practical problems or in new situations	-0.128	-0.153	0.013	0.019
Worked harder than you thought you could to meet an instructor's standards or expectation	-0.069	-0.081	0.033	0.045
Preparing for class	0.237	0.423*	0.078	0.164

Spending significant amounts of time studying and on academic work	0.237	0.250	0.225	0.278*
Had serious conversations with students of a different race or ethnicity than your own	-0.249	-0.351	0.013	0.022
Had serious conversations with students who are very different from you in terms of their religious beliefs, political opinions, or personal values	-0.135	-0.183	0.235	0.374*
Participating in co-curricular activities	-0.099	-0.170	0.134	0.271
Discussed grades or assignments with an instructor	-0.012	-0.017		
Talked about career plans with a faculty member or advisor	0.394	0.481*		
Discussed ideas from your readings or classes with faculty members outside of class	0.003	0.003		
Received prompt written or oral feedback from faculty on your academic performance	0.015	0.017		
Worked with faculty members on activities other than coursework	0.103	0.135		

NOTE: $*p < 0.05$

Limitations

This study enriched our knowledge base pertaining to the effect of peer interactions, student-faculty interactions, and academic challenge on non-GPA collegian gains and satisfaction of the entire educational experience. However, this study was not without limitations. First, there was a relatively small sample size of African Americans (5.9%) and Hispanics (1.1%), although the percentage of African American STEM students was representative of the demographic characteristics of American 4-year colleges. Nonetheless, these small and unbalanced samples may reduce one's ability to correctly draw broader conclusions from the analysis. Secondly, as reported in this study, insignificant influence of student-faculty interactions on students' self-reported gains is worthy of further investigations. We intentionally only looked at non-GPA measures of student gains in college, but excluding academic measures of student gains provided an incomplete picture. Therefore, resizing the sample for a more balanced design and including more comprehensive measures of students' college gains should be investigated in future research.

Discussion

This study investigated (a) differences between African American and Hispanic STEM students' engagement in educationally purposeful activities as defined by prior research,[10] (b) differences among African American and Hispanic STEM students' engagement in terms of sex/gender, and (c) the net effect of academic challenge and interaction with faculty and peers on African American and Hispanic STEM student outcomes.

Consistent with previous research, no statistically significant differences were found when comparing respondents' sex or race with respect to the influence of participation in out-of-class academic activities.[10] This finding supports the previous notion that differences in students' out-of-class academic activities is not explained by sex or race. Therefore, we can conclude that the type of activities and amount of time students spend engaging in them is most important.

African American and Hispanic STEM students who engage peers with a very differing opinion or spend significant amounts of time studying academic work tend to report higher scores on personal and social gains than their same-race peers who do so less frequently. This finding may suggest the need for future studies that examine determinants of satisfaction or personal and social gains. Specially, future work should focus on African American and Hispanic STEM collegians who have less opportunity to engage or less frequent engagement with peers of different religious beliefs, political opinions, or personal values. This finding may also point to the significant role that peers play in socializing and educating each other in college.

It is important to note that findings pertaining to the effect of student-faculty interactions on student gains are on the contrary to results obtained from previous literature. For example, Umbach and Wawrzynski previously concluded that student-faculty interactions have a profound influence on students' gains in college, where more actively involved students report greater significant gains in their collegiate experience.[12] Saks and Harper confirmed this finding in their study on the effects of student-faculty interactions among different student groups.[13] However, they also found that the influence of student-faculty interactions might vary across different student groups in terms of gender, socio-economic status, and cultural backgrounds. Nonetheless, our preliminary analysis uncovered an insignificant influence from student-faculty interactions on students' self-reported gains. Possible reasons for this unusual finding could be related to our selection of student gain measures. We chose self-reported gains in areas of general education, work-related skills, and social personal improvements, none of which are measured by college GPA. However, in aforementioned studies, college GPA was one of the most important indicators of student gains.

Conclusion

This study used survey data from a 2007 administration of the National Survey of Student Engagement (NSSE) to measure African American and Hispanic students' engagement in educationally purposeful activities. More specifically, this present work sought to measure (a) differences between African American and Hispanic STEM students' engagement in educationally purposeful activities as defined by prior research,[10] (b) differences among African American and Hispanic STEM students' engagement in terms of sex/gender, and (c) the net

effect of academic challenge and interaction with faculty and peers on African American and Hispanic STEM student outcomes.

Results from our analysis found that students who spend more time on class preparation tend to report a higher satisfaction in college than their same-race peers who do so less often. Similarly, participants who frequently talked with a faculty member about their careers tend to report a higher satisfaction in college. In addition, we found insignificant differences in student grades when comparing African American and Hispanic STEM students. Furthermore, African American and Hispanic STEM students who engage peers of a different opinion or spend significant amounts of time studying on academic work tend to report higher scores on personal and social gains than their same-race peers who do so less frequently.

Findings from this study have implications for future educational practice and research. In terms of practice, several groups might benefit from the results of this work. For example, academic administrators, such as department heads, might use the findings to initiate important discussions with faculty about how they provide feedback and initiate/maintain mentoring relationships. Specifically, faculty members might encourage regular face-to-face meetings (e.g., formal meetings and private conversation) with their African American and Hispanic STEM students. This would give them important insight into the individual motivations and ambitions of these students while also providing a supportive forum for conversations about their academic programs. Deans or department heads should also place an emphasis on academic performance and diversity within their programs. This will offer additional opportunities for students to succeed in STEM fields and benefit from engaging with people of different backgrounds.

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