Running Head: Academic Engagement

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Academic Engagement of Undergraduate Students Majoring in STEM

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ABSTRACT

Research on the educational outcomes of students in Science, Technology, Engineering, and Math (STEM) continues to be needed given the persistent underrepresentation of women and minorities in STEM fields. Prior research has determined that academic engagement is a predictor of student academic success and persistence within higher education. However, little research has been conducted on underrepresented students' academic engagement within STEM. Using the results of surveys administered at ten large, public, research universities, the authors examine the relationships between academic engagement, gender, race/ethnicity, and students' major, with specific attention given to underrepresented students in STEM. The findings suggest that women and students of color in STEM fields have similar levels of academic engagement and, for some measures, have higher levels of academic engagement than that of majority students in STEM fields. The findings provide a basis for understanding academic engagement patterns of underrepresented students in STEM, while also informing programmatic interventions that seek to serve women and students of color in STEM.

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INTRODUCTION

Research on factors that impact students' educational outcomes in Science, Technology, Engineering, and Mathematics (STEM) fields remains important, particularly given the continued underrepresentation of women and students of color in the sciences. The national imperative to expand the educated STEM workforce relies on diversifying the talent pool and identifying factors that impact students' entrance into and success in the STEM fields (Committee on Underrepresented Groups and the Expansion of the Science and Engineering Workforce Pipeline, 2011). While research on STEM education has shifted from focusing solely on the individual to now include contextual factors (George-Jackson, 2009), individual factors, such as students' academic engagement, may still shed light on outcomes in STEM, as well as inform program interventions.

The purpose of this study is to investigate the levels of academic engagement of undergraduate students by type of major (STEM vs. non-STEM), as well as differences in engagement by gender and race/ethnicity. The study is part of a larger research effort, funded by the National Science Foundation, which investigates factors that impact undergraduate students' pursuit of and success in STEM fields. Past studies have established that engagement positively impacts likelihood of persistence (or students' persistence) but less is known about how engagement may impact student's persistence *within* their major. This study seeks to investigate students' engagement by major, to detect possible differences in engagement levels, and to create a baseline from which to study how engagement might change over time.

Project STEP-UP

The study presented here is part of a larger study, funded by the National Science Foundation. Project STEP-UP (STEM Trends in Enrollment and Persistence for Underrepresented Populations) is located at the University of Illinois at Urbana-Champaign.[1] The project utilizes three different data components to investigate individual, institutional, and contextual factors that impact underrepresented students in the STEM fields at large, public, research universities. Underrepresented groups of focus for the overall project include women, students of color, low-income students, and first-generation students. The first component of the project draws on semester-by-semester institutional data of undergraduate students who entered college in Fall 1999. The second component uses qualitative data gathered through interviews with directors and administrators of recruitment and retention programs in the STEM fields. The third component of the project, featured in the study presented here, uses online survey data of undergraduate students. The details of the survey data, and its use in this particular study, are outlined below.

LITERATURE REVIEW

The role of engagement in understanding students' educational trajectories and outcomes emerged as a topic of interest and importance in recent decades. Much of the theoretical and empirical work that currently exists stems from Alexander Astin (1984). According to Astin (1984), "student involvement refers to the quantity and quality of the physical and psychological energy that students invest in the college experience" (p. 307). His student involvement theory focuses solely on the motivation and behavior of the students at a university. As students become more engaged, academically and socially, students feel a greater attachment to the institution and become satisfied with their experiences.

[1] More information about Project STEP-UP can be found at http://stepup.education.illinois.edu/.

Academic engagement can also be understood as "a measure of student involvement with university studies" (Horstmanshoff & Zimitat, 2007, p. 705), which encourages students to develop "a deeper understanding of their university work" (Horstmanshoff & Zimitat, 2007, p. 705). Another perspective indicates that engagement occurs when "students take advantage of the range of learning opportunities their institutions provide outside the classroom" (Reason, Terenzini & Domingo, 2006, p. 155). Furthermore, Kuh, Cruce, Shoup, and Kinzie (2008) define academic engagement as "the time and energy students invest in educationally purposeful activities" (p. 542). The benefits of students' engagement, as well as factors that impact engagement, are now highlighted to provide an overview of the engagement literature.

Benefits of Student Engagement

Nearly thirty years after Astin's article, we have a more complex but still evolving understanding of the college students' academic engagement. The level, type, and frequency of engagement has been shown to impact several educational outcomes, including retention and persistence (Pascarella & Terenzini, 2005; Horstmanshof & Zimitat, 2007), as well as "growth in academic competence" (Reason, Terenzini & Domingto, 2006, p. 171). Horstmanshof & Zimitat (2007) found that students oriented towards future goals, such as careers after college, resulted in "an increase in the level of students' engagement with their studies, and potentially, an increased likelihood that they would continue with their studies long-term" (p. 715). In this sense, engagement is a critical component to students' persistence in college. Using data from the National Survey of Student Engagement, Kuh and his colleagues (2008) identified further positive outcomes of engagement "represented by first year student grades and by persistence between the first and second year of college" (p. 555). In addition, "Black students benefited more than White students from increasing their engagement in educationally effective activities"

(Kuh, Cruce, Shoup & Kinzie, 2008, p. 551).These results suggest important racial and ethnic differences, as well as how engagement—and opportunities to increase engagement—can impact students at specific time points within college.

Factors that Affect Student Engagement

Factors that impact students' academic engagement, and by extension, their learning and persistence in college, include contact with people different than themselves (Pascarella & Terenzini, 2005; Reason, Terenzini & Domingo, 2006); being oriented towards the future (Horstmanshof & Zimitat, 2007); faculty (Umbach & Wawrzynski, 2005); and race/ethnicity (Johnson, Crosnoe & Elder, 2001). Pike & Kuh (2005) also found that academic engagement was influenced by being female, having graduate or professional-school aspirations, and residing on the college campus. More specific to students in STEM, a study of eighth graders in math and science classes revealed that academic engagement was a significant factor in students' academic performance (Singh, Granville & Dika, 2002). Investigating the impact of engagement on students in STEM at the postsecondary level is important, particularly if programmatic and curricular changes can be made to strengthen students' level of engagement with math and science.

DATA AND METHODOLOGY

This study uses data from two surveys data gathered in 2010 and 2011 from a total of 4,561 undergraduates enrolled at ten large, public, research universities. In terms of the racial and ethnic composition of the student bodies on each campus, these universities can be classified as Predominantly White Institutions (PWI). The survey asked questions about students' socio-demographic background, pre-college experiences, college experiences, majors, and post-college plans. Questions pertaining to students' academic engagement are used for the basis of analysis

(see Appendix A for a list of the specific questions). These measures of engagement were adopted from the Gates Millennium Scholars survey, which allows for additional comparisons to be made in future research. This study is part of an on-going research effort funded by the National Science Foundation on undergraduate students in STEM fields at large, public, research universities.

In order to recruit participants to the study, the researchers contacted three specific groups. These points of contact distributed the survey to undergraduate students on behalf of the researchers. The first group was comprised of academic advisors and others administrators who have access to and work with undergraduate students. The second group was comprised of directors and administrators of recruitment and retention programs in STEM fields, which often serve underrepresented students in these fields. The final groups contacted were local chapters of national student organizations in STEM (e.g., the National Society of Black Engineers (NSBE), the Society for Women Engineers (SWE), etc.). The second and third groups contacted were done so in an effort to oversample underrepresented students in the STEM fields—specifically women, Blacks, Latinos, and Native Americans. Despite the concerted efforts to oversample underrepresented undergraduates in the STEM fields, the percent of underrepresented students of color included in the final dataset was still limited.

Profile of Participants

In terms of the profile of survey respondents, 58.5 percent were female and 40.6 percent were male. The racial composition of respondents was as follows: 72.8 percent white, 12.3 percent Asian American, 4.3 percent Latino/a, 3.9 percent Black, and 0.5 percent Native American. (See Appendix B) As stated above, the racial and ethnic composition of the students who participated

in the study is majority-white due to the fact that the universities featured in the study are PWIs. In terms of students' current major, students were classified as either STEM students (89.1 percent) or non-STEM students (10.9 percent). STEM majors included physical science, computer science, engineering, mathematics, agricultural science, biological, health science, and psychology majors. Non-STEM majors include all other majors, and students who have not yet formally declared a major.

Research Objectives

The specific research questions that this study investigates are:

1. How are students engaged academically at their university?
2. How does academic engagement differ by type of major? By gender? By race/ethnicity?

Basic descriptive statistics and cross-tabulations are used to answer these questions, with statistically significant differences identified by chi-square analysis. For some analyses, responses were collapsed into dichotomous variables. An academic engagement index was created based on the mean response of the respective questions. Investigations of the intersection of gender and race/ethnicity were somewhat limited due to the small numbers of Black, Latino, and Native American respondents.

RESULTS AND DISCUSSION

The results are organized according to each measure of academic engagement featured in the survey. Only results that were found to be statistically significant are discussed below, and the chi-square statistics are provided for each finding that is discussed. There were no statistically significant results among all cross-tabulations for the variable that measures students discussing ideas with students outside of class.

Working with Other Students Outside of Class

The first measure of students' academic engagement investigates the extent to which students work with other students outside of class. The results show that a greater percent of students majoring in STEM work with others outside of class, as compared to non-STEM majors (55 percent versus 40.5 percent, respectively) ($x^2(1, N = 4{,}514) = 39.770, p < .001$)). This finding suggests that student in STEM may be asked to do more group-based work, or are more inclined to work in groups to complete homework, study for exams, and complete projects. In examining differences between racial and ethnic groups by gender for all students (regardless of major), 72 percent of Black males reported working with other students outside of the classroom twice a week or more, compared to 58.6 percent of Asian males, 52.4 percent of white males, and 48.9 percent of Latino males ($x^2(1, N = 1{,}717) = 14.801, p < .05$). The results were very similar for males within STEM fields, with 71.9 percent of Black males majoring within STEM reported working with other students outside of the classroom twice a week or more. In comparison, 60.4 percent of Asian males, 53.2 percent of white males, and 52.4 percent of Latino males who majored in STEM also working with other students outside of class at least twice a week ($x^2(1, N = 1{,}522) = 13.292, p < .05$). From these results, differences in males' engagement with other students outside of class by racial and ethnic group are similar for students regardless of whether or not they major in STEM.

For female students, 64.4 percent of Latino female students reported working with other students outside of the classroom twice a week or more compared to 57 percent of Asian females, 54.0 percent of Black females, and 52.9 percent of white females ($x^2(1, N = 2{,}491) = 12.703, p < .05$). Differences between females from different racial and ethnic groups with STEM fields were not statistically significant.

Discussing Ideas with Students within Major

Another measure of student academic engagement is a measure of how often a student discusses ideas with other students within their major. The percentage difference between STEM students and non-STEM students is not large but the difference is significant. The results show that a higher percentage of students majoring in STEM reported discussing ideas with students within their major twice a week or more compared to students majoring in non-STEM fields (49.5 percent versus 44.0 percent, respectively) ($x^2(1, N = 4,464) = 9.150$, $p < .05$). Students in STEM fields may find it more important to exchange ideas with other students in their major. Students in STEM fields may also feel more comfortable talking to other students within their major because of the relative proximity in which the students work during the progression through the major.

Across both STEM and non-STEM majors, a significant percent of female students engaged with other students within their major much less frequently: 29.6 percent of Black females, 20 percent of Asian females, 16.3 percent of white females, and 15.4 percent of Latinos students reported discussing ideas with other students once a month or less ($x^2(1, N = 2,462) = 14.925$, $p < .05$). Black female students may find discomfort in discussing ideas with other students within their major. The cause of this discomfort may be due to a lack of other Black females within their specific majors. Also, the Black female students may feel isolated within their majors. Although the statistic was not significant, similar results were found for female students in STEM. A higher percentage of Black female students (26.4 percent) reported discussing ideas with other students in their major once a month or less compared to Asian, white, and Latina female students in STEM, (17.9 percent, 16.1 percent, and 14.6 percent, respectively). A low number of Black female students within STEM may cause these results.

Discussing Ideas with Faculty Outside of Class

Another way that student can be academically engaged is to discuss ideas with faculty members outside of class. Slightly more men discussed ideas with faculty outside of class twice a week or more as compared to women (14.8 percent versus 10.7 percent, respectively) ($x^2(1, N = 4{,}380) = 17.395$, $p < .001$). Also, 12.5 percent of white male students in STEM reported discussing ideas with faculty outside of the classroom twice a week or more compared to 9.3 percent of white female students in STEM. ($x^2(1, N = 2{,}902) = 9.769$, $p < .01$). Approximately 20 percent of Black students, 18.1 percent of Latino students, and 16.9 percent of Asian students discuss ideas from class or readings with faculty outside of the classroom twice a week or more, as compared to 10.7 percent of white students. ($x^2(1, N = 4{,}122) = 37.691$, $p < .001$). Within males, 22.7 percent of Latinos, 20.7 percent of Black males, 19.4 percent of Asian males, and 12.8 percent of white males discussed ideas with faculty outside of class at least twice a week ($x^2(1, N = 1{,}678) = 17.454$, $p < .01$). By comparison, Black women were most likely to discuss ideas with faculty outside of class at least twice a week, as compared to other women. Specifically, 19.6 percent of Black females, 14.1 percent of Asian females, 14 percent of Latino females, and 9.2 percent of white females discussed ideas with faculty outside of the classroom twice a week or more compared to 9.2 percent of white females. ($x^2(1, N = 2{,}436) = 22.550$, $p < .005$).

For students majoring in STEM, 19 percent of Black students, 18.9 percent of Latino students, and 15.8 percent of Asian students in STEM discuss ideas with faculty outside of the classroom twice a week or more compared to 10.6 percent of white students in STEM. ($x^2(1, N = 3{,}679) = 29.508$, $p < .001$). A greater percentage of males in Non-STEM fields discussed ideas with faculty at least twice a week than their counterparts in STEM majors (20.5 percent versus 14.1 percent, respectively) ($x^2(1, N = 3{,}914) = 11.798$, $p < .005$). In comparison, approximately

the same percentage of women spoke with faculty outside of class at least twice a week, regardless of their type of major (10.7 percent in STEM and 10.9 percent in Non-STEM ($x^2(1, N = 466) = 8.453, p < .05$).

Within STEM majors, 23.1 percent of Latino males and 19.6 percent of Black males discuss ideas with faculty outside of the classroom twice a week or more compared to 16.8 percent of Asian males and 12.5 percent of white males. ($x^2(1, N = 1,491) = 13.154, p < .05$). For females majoring in STEM, 17.8 percent of Black females, 15.1 percent of Latino females, and 14.5 percent of Asian females discuss ideas with faculty outside of the classroom twice a week or more compared to 9.3 percent of white females. ($x^2(1, N = 2,181) = 18.741, p < .01$). In this sense, despite being underrepresented in many STEM fields, Black and Latino males and females are more academically engaged with faculty members outside of class, as compared to students from other racial and ethnic backgrounds. These results may reflect student behavior at the particular set of institution in this study, may not be generalizable to other settings, and may also reflect underrepresented students' having to work harder to persist in STEM fields. If the results reflect the latter, underrepresented minority students may feel that they have to prove themselves to faculty members, and will subsequently seek out faculty during office hours and other times outside of class in order to counteract their group's underrepresentation. Additional light may be shed on this theory by investigating the results of the next survey question, which asked students how often they had to work harder than they thought they could in order to meet instructor's expectations.

Working Harder to Meet Instructor's Expectations

Across all majors, more women (46.1 percent) than men (35.1) worked harder to meet teacher expectations twice a week or more ($x^2(1, N = 4,339) = 51.149, p < .001$). Furthermore, a greater

percentage of Black (52.4 percent) and Latino (49.2 percent) students worked harder to meet teacher expectations twice a week or more compared to Asian (45.9 percent) and white (38.6 percent) students ($x^2(1, N = 4{,}090) = 30.167$, $p < .001$). Similar results were found for students in STEM majors. A higher percentage of women in STEM majors reported working harder to meet teacher expectations twice a week or more compared to men in STEM majors, (45.0 percent versus 34.8 percent) ($x^2(1, N = 3{,}871) = 52.130$, $p < .001$). In terms of race/ethnicity, 51.1 percent of Black students and 50.3 percent of Latino students in STEM worked harder to meet teacher expectations twice a week or more compared to 45.4 percent of Asian students and 39.0 percent of white students ($x^2(1, N = 3{,}644) = 23.319$, $p < .005$). In general, these results may reflect the overall negative perception of respect and inclusion that women and students of color have within STEM fields. It suggests that female students and students of color may find the need to overcompensate in order to obtain acceptance from their teachers.

When disaggregated by race/ethnicity and gender, 50 percent of Black males, 40.9 percent of Latino males, and 43.8 percent of Asian males worked harder to meet teacher expectations twice a week or more compared to 32.0 percent of white males ($x^2(1, N = 1{,}662) = 23.255$, $p < .005$). Similarly, a slightly higher percentage of Latino females (56.6 percent) and Black females (53.2 percent) worked harder to meet teacher expectations twice a week or more compared to 47.6 percent of Asian females and 43.0 percent of white females ($x^2(1, N = 2{,}420) = 14.156$, $p < .05$). For males majoring in STEM fields, 48.1 percent of Black males, 42.3 percent of Latino males, and 41.0 percent of Asian males worked harder to meet teacher expectations twice a week or more compared to 32.1 percent of white males ($x^2(1, N = 1{,}472) = 16.259$, $p < .05$). Likewise, for females majoring in STEM fields, a higher percentage of Latino, Black, and Asian females (57.6 percent, 52.3 percent, and 49.6 percent) worked harder to meet teacher

expectations twice a week or more compared to 43.5 percent of white females ($x^2(1, N = 2,165) = 13.154, p < .05$).

When comparing STEM students by race/ethnicity and gender, some notable results emerged. There were no statistically significant differences of academic engagement between male and female students in STEM that reported their race or ethnicity as Black, Latino/a, or Asian. However, more white female students in STEM reported working harder to meet teacher expectations twice a week or more that white male students, 43.5 percent compared to 32.1 percent ($x^2(1, N = 2,875) = 28.630, p < .001$). Although the within race/ethnicity comparisons by gender for Black, Latino/a, and Asian students were not found to be statistically significant, the results continue to suggest that women worked harder to meet their teacher expectations compared to men. If the sample size was larger for Black, Latino, and Asian students, the differences between women and men within race/ethnicity groups may be statistically significant. These results reflect that gender differences within STEM fields do cross racial and ethnic groups.

Expressing Creativity through Involvement in Projects

The last measure that was used to gauge academic engagement was how often students worked on creative projects. In general, a higher percentage of Latino/a (34.2 percent) and Black (30.1 percent) students reported working on creative projects twice a week or more than Asian (26.7 percent) and white (19.4 percent) students ($x^2(1, N = 4,111) = 42.433, p < .001$). Similar results were found for students majoring in STEM fields: 34.4 percent of Latino students, 28.8 percent of Black students, 28.0 percent of Asian students in STEM reported working on creative projects twice a week or more compared to 19.6 percent of white students in STEM ($x^2(1, N = 3,669) = 38.481, p < .005$). These results may reflect how underrepresented students seek out

opportunities to be involved in projects that promote their creativity. The students may identify such projects as a way to become more included and recognized in their programs.

When disaggregated by race/ethnicity and gender, a much higher percentage of Black and a slightly larger percentage of Latino males reported working on creative projects twice week compared to Asian and white males, (40.0 percent and 30.7 percent versus 25.6 percent and 18.9 percent) ($x^2(1, N = 1,666) = 24.0238, p < .005$). For female students, 37.4 percent of Latino females and 27.6 percent of Asian females worked on creative projects at least twice a week or more compared to 24.3 percent of Black females and 19.7 percent of white females ($x^2(1, N = 2,437) = 26.013, p < .001$). For male students in STEM fields, 37.7 percent of Black males and 32.1 percent of Latino males reported working on creative projects twice a week or more compared to 25.9 percent of Asian males and 18.7 percent of white males ($x^2(1, N = 1,478) = 23.284, p < .005$). For students in STEM fields, 36.5 percent of Latino females and 29.7 percent of Asian females reported working on creative projects twice a week or more compared to 22.4 percent of Black females and 20.0 percent of white females ($x^2(1, N = 2,184) = 23.194, p < .005$). This result is concerning because of the low levels of participation in creative projects of Black females who major in STEM fields. Black female students may not feel comfortable with other students in their major and may not seek out opportunities to work in group activities. If this is the case, academic programs may want to increase efforts to supply projects that promote inclusiveness while also allowing students to express their creativity.

Total Academic Engagement

A composite index of academic engagement was computed based on students' average responses to the six measures of academic engagement. Twenty-eight percent of Black students and 27.6 percent of Latino students were academically engaged twice a week or more compared to 18.8

percent of white students and 20.7 percent of Asian students ($x^2(1, N = 4,514) = 18.946, p < .005$). Overall, 30.8 percent of Latino females and 28.1 percent of Black females were academically engaged twice a week or more compared to 21.4 percent of Asian females and 19.2 percent of white females ($x^2(1, N = 2,500) = 12.703, p < .005$). For female students in STEM fields, 31.5 percent of Latino females and 26.4 percent of Black females reported being academically engaged at least twice a week or more compared to 22.7 percent of Asian females and 19.9 percent of white females ($x^2(1, N = 2,237) = 13.446, p < .05$).

These findings are positive signs of heightened levels of academic engagement for Latino and Black students. For underrepresented women in STEM fields, a dual degree of resistance may be a factor in their increased levels of academic engagement. Specifically, underrepresented women in STEM are likely to have to counteract the perceived biases of being both a student of color and a woman. The results suggest a positive direction for engagement for underrepresented women in STEM fields.

LIMITATIONS

Several limitations exist for the current study; some of which may be addressed by future research, which is discussed in further detail below. In relation to the profile of the respondents, the sample size for each racial and ethnic category was small in comparison to white students, which again is reflective of these institutions being PWIs. This still occurred despite efforts to oversample underrepresented students of color. In addition, the gender differences within the white student population are not generalizable across all other races. Finally, the number of responses varied across the ten campuses, and varied between the two data collection years. Variability in the response rate may have been due to timing of when the surveys were launched, as well as the method by which the survey was advertised to students.

Regarding the survey instrument itself, the survey was long and not all students who started the survey completed it. A $10 Amazon gift card was offered to students who completed the survey as a way to incentivize students to complete the survey, yet not all students responded to all of the questions featured in the survey. Academic engagement was just one of many topics covered in the survey. In this sense, the set of questions regarding academic engagement could have included other measures, such as how often students spend studying, how often they use library services, or if they participate in online learning modules. Future studies on the academic engagement of underrepresented students in STEM may wish to include other indicators of academic engagement.

FUTURE RESEARCH

Based on the findings of this study and the acknowledged limitations, future research may examine the relationship between academic engagement and persistence within STEM fields. During the administration of the first year survey, students were asked if they were willing to participate in a follow-up survey. Of the approximately 1,300 students who agreed to be contacted again, just over 700 completed the follow up survey. Analysis of the follow-up survey will allow for an examination of how academic engagement may change over time, as well as how academic engagement may impact underrepresented students' persistence in STEM.

Future studies may also examine differences of academic engagement by class standing (i.e., freshman, sophomores, juniors, and seniors). Further research could also disaggregate the STEM fields and identify the engagement patterns of students in different majors. Given the small sample of students of color, the same group comparison may not be able to be made if looking at groups differences within specific types of STEM fields. However, gender differences could be studied to help answer if students who are majoring in engineering, physical sciences,

biological sciences, computer sciences, and mathematics, engage differently than students in other STEM and non-STEM fields. Finally, future studies could also combine analysis of students' social and academic engagement (see George-Jackson, Harwell, and Houston (2011)). Doing so could create an overall understanding of students' multiple types of engagement on the surveyed campuses, and how engagement levels might differ by gender, race/ethnicity, and major.

CONCLUSION

This study allows for the investigation of differences in academic engagement by gender, race, ethnicity, and type of college major. The findings shed light on differences in students' academic engagement levels as it relates to STEM participation. The results show that both women and underrepresented students in STEM are working harder to achieve acceptance than their white male counterparts. Although positive, these results reinforce the need for culturally conscious professors in STEM fields. Rincon and George-Jackson (2011) suggest that departments should provide a sense of belonging for all of its students and, in particular, women and underrepresented students. Doing so could enhance the academic engagement levels of students and lead to higher levels of persistence for women and underrepresented students majoring in STEM fields. Furthermore, the findings inform recommendations for designing programs, services, or field-specific interventions to increase engagement levels for students, which may in turn improve the likelihood of persisting in STEM to graduation. As the nation's universities and colleges seek to increase the number of students and underrepresented students in STEM, learning how students engage can increase the persistence within STEM fields, especially for underrepresented populations. Engagement is one of many factors effecting

student persistence within STEM fields. This study can help shape a foundation for future research on the specific effects of academic engagement on students' persistence in STEM.

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APPENDIX A: SURVEY QUESTIONS

Academic Engagement Measures:

Students were asked to rank the statements below on the following Likert Scale: 3 or more times a week; 2 or more times a week; Once a week; 2-3 times a month; Once a month; Less than once a month; Prefer Not to Answer

- How often do you work with other students on school work outside of class?
- How often do you discuss your ideas from your readings or classes with students outside of class?
- How often do you discuss ideas from your readings or classes with students within your major?
- How often do you discuss ideas from your readings or classes with faculty outside of class?
- How often do you work harder than you thought you could to meet an instructor's expectations?
- How often are you involved in projects that allow you to express your creativity (e.g. research)?

APPENDIX B: RESULTS

Table 1
Demographic and Background Information of Survey Respondents
(n=4,561)

Variables	N	%
Gender		
Male	1854	40.6%
Female	2669	58.5%
Prefer not to Answer	38	0.8%
Race and Ethnicity		
White not Hispanic	3320	72.8%
Asian or Pacific Islander	561	12.3%
Hispanic or Latino/a	197	4.3%
Black, not Hispanic	176	3.9%
Other Race/Ethnicity	154	3.4%
Prefer not to Answer	130	2.9%
Native American or Alaskan Native	23	0.5%
Major Category		
STEM	4066	89.1%
Non-STEM	495	10.9%

Source: Project STEP-UP Survey, 2011; Authors' Calculations.

Figure 1

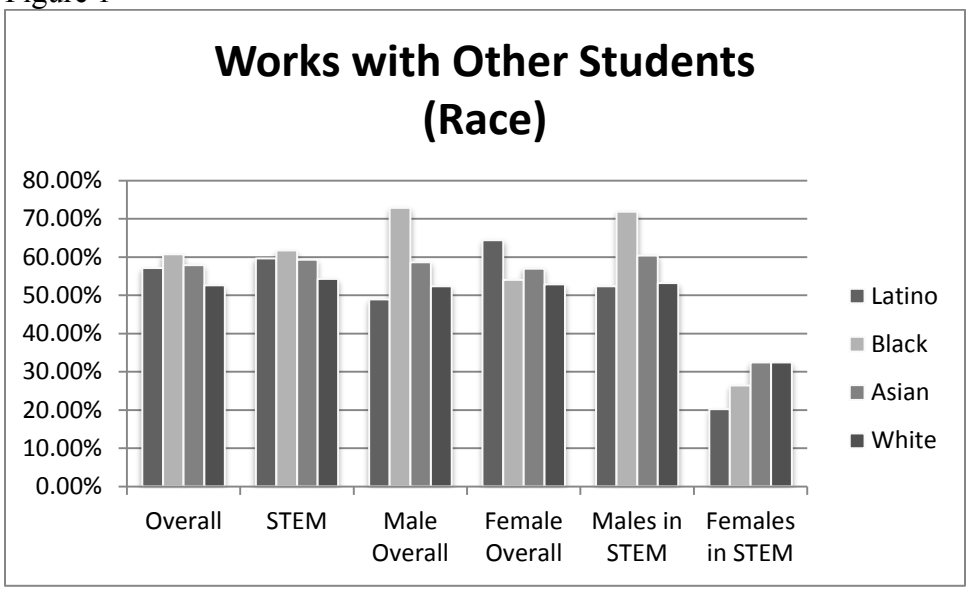

Figure 2

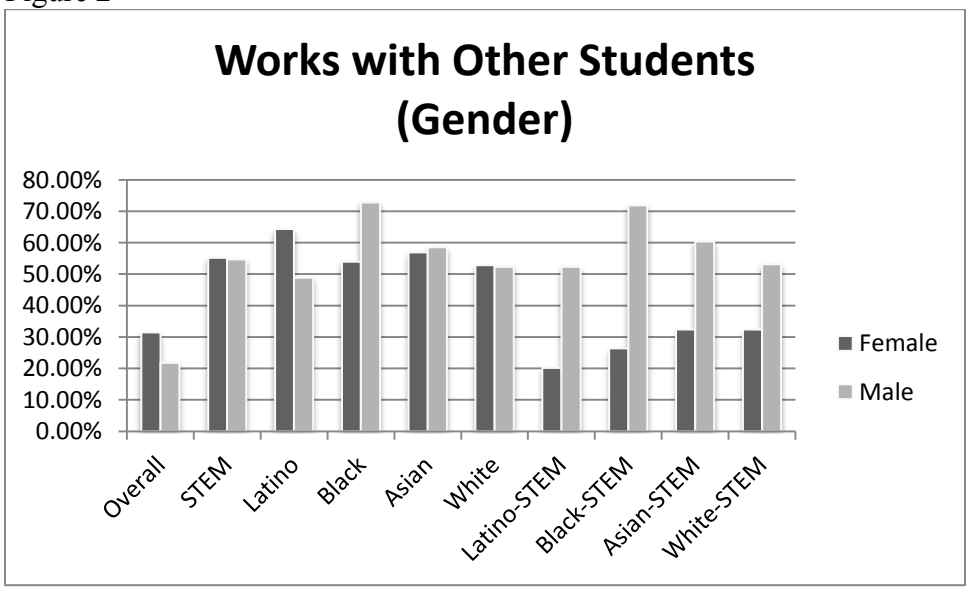

Figure 3

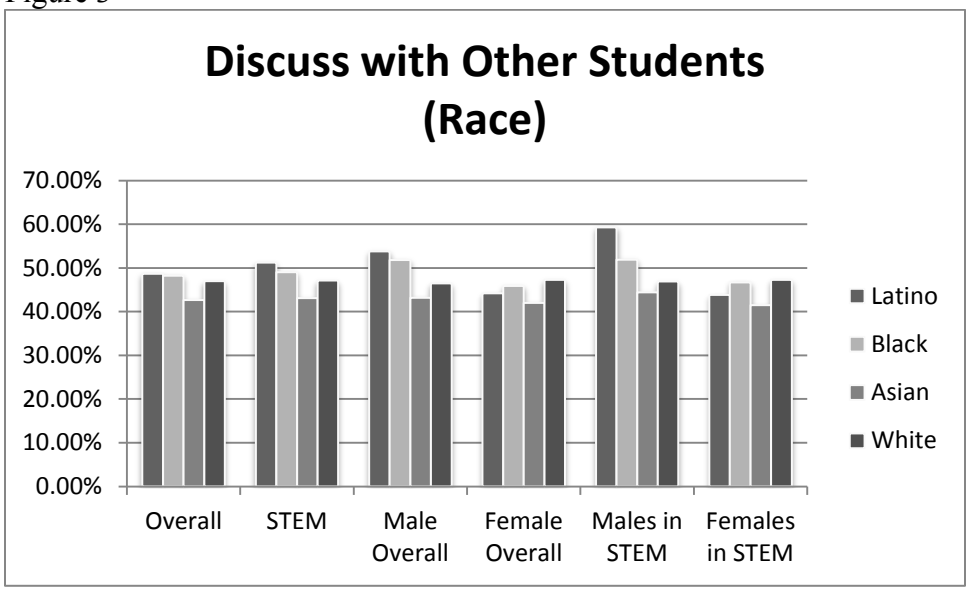

Figure 4

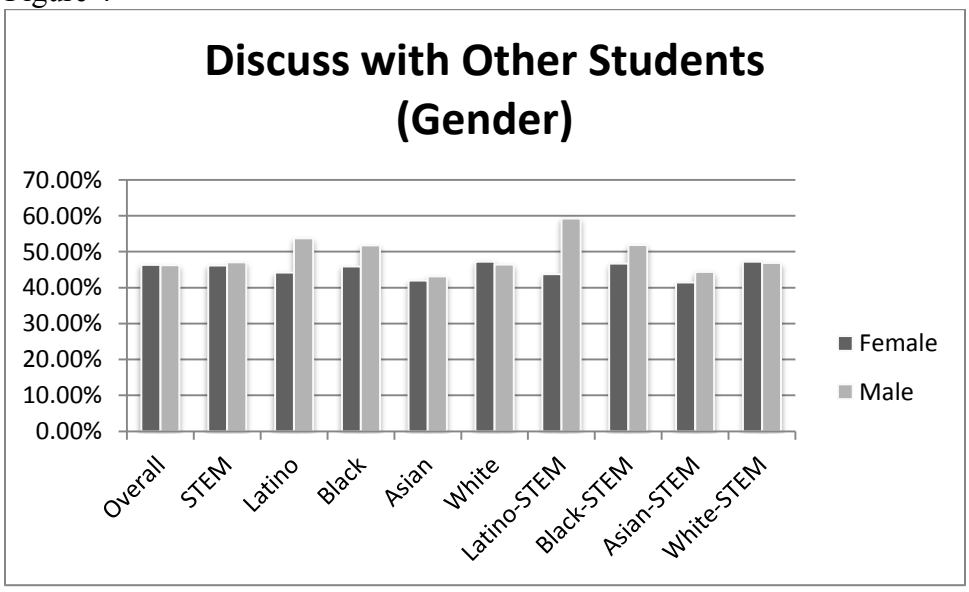

Figure 5

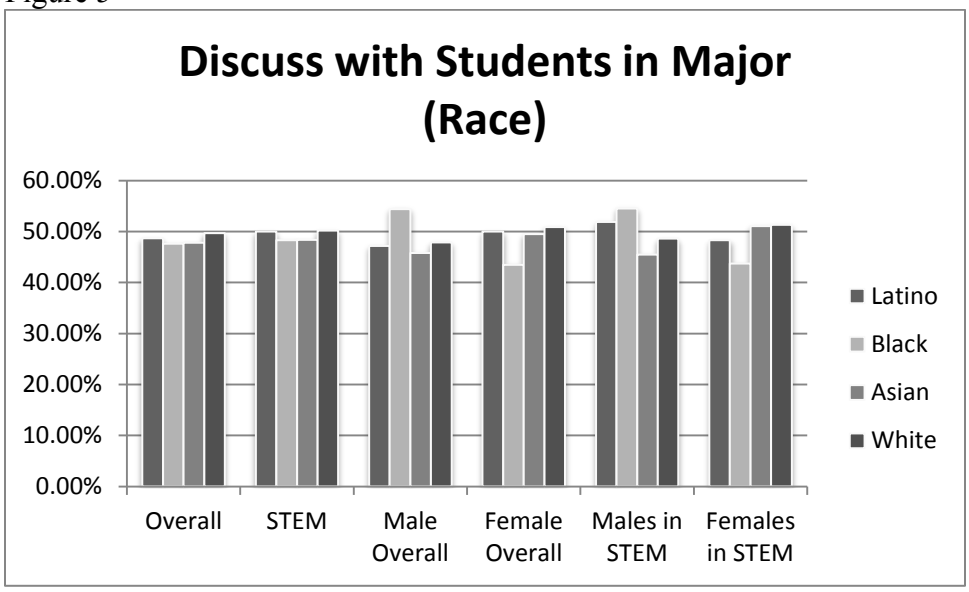

Figure 6

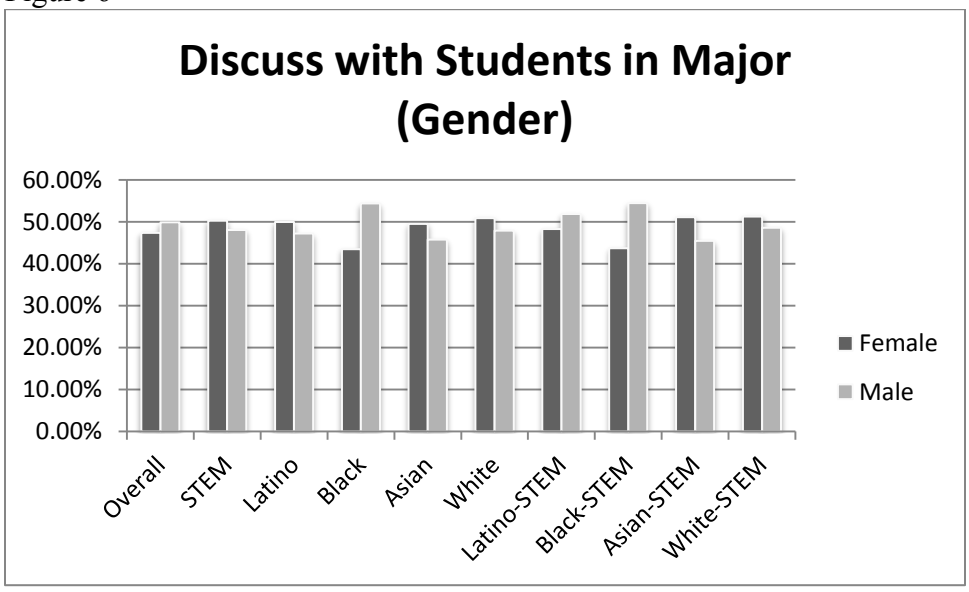

Figure 7

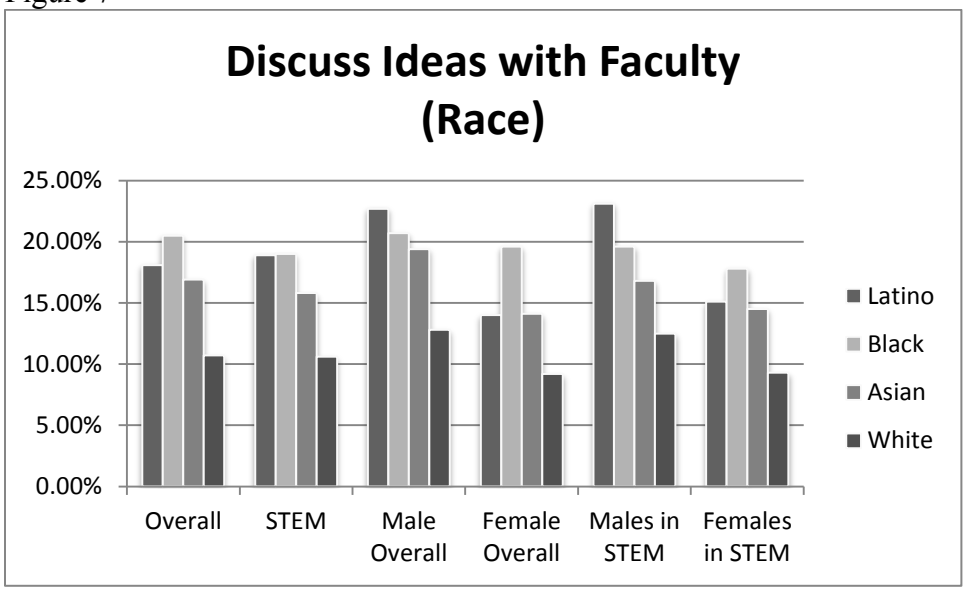

Figure 8

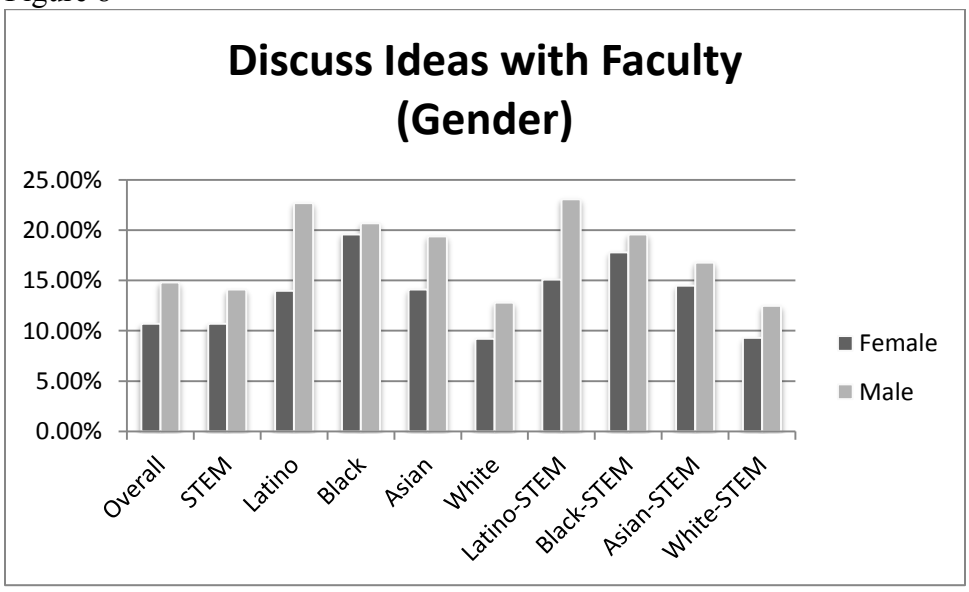

Figure 9

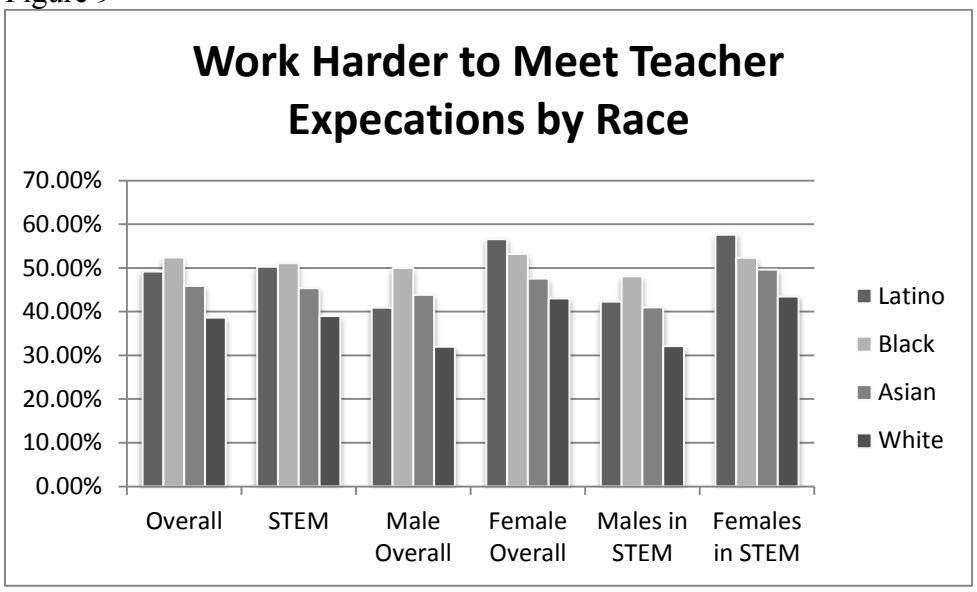

Figure 10

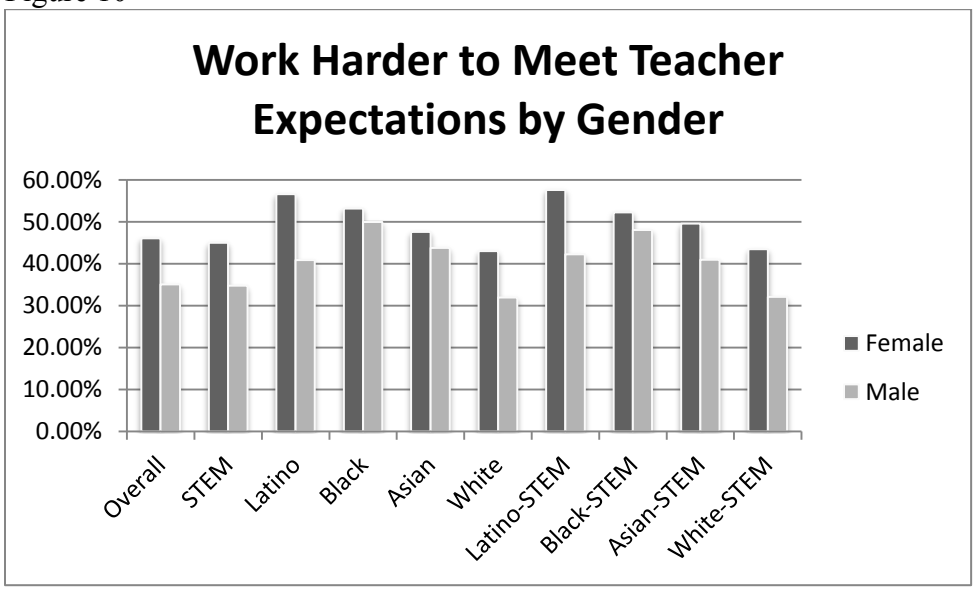

Figure 11

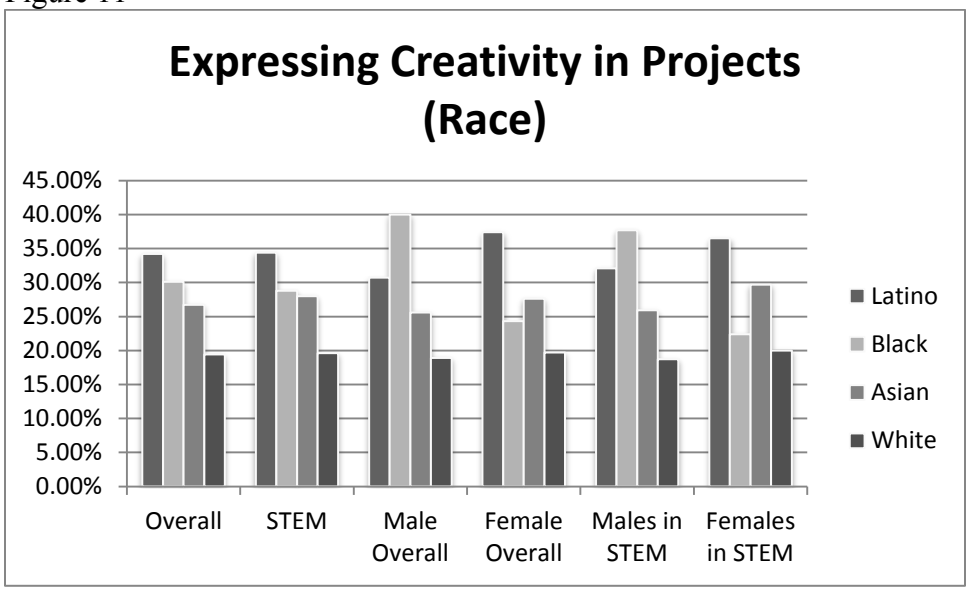

Figure 12

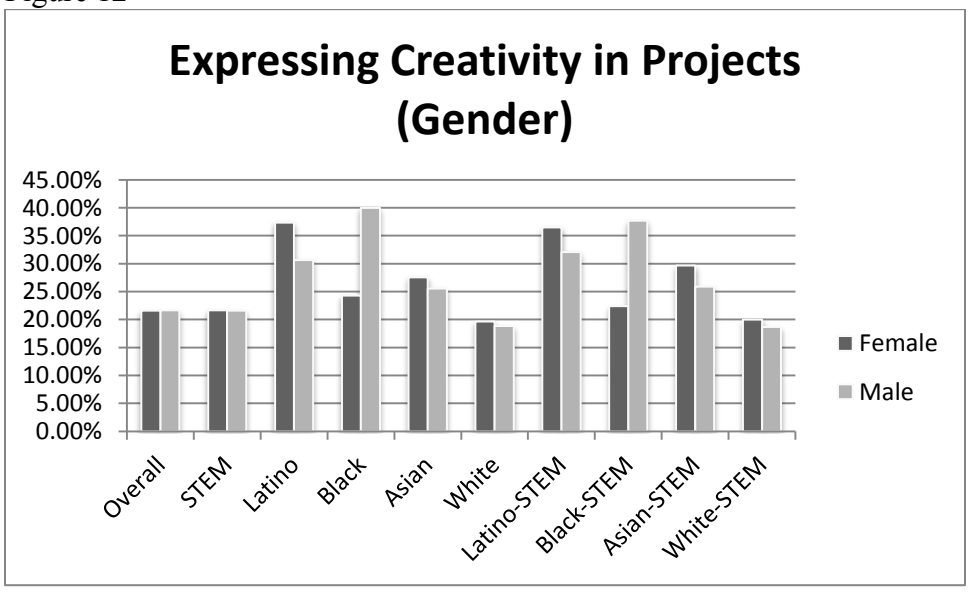

Figure 13

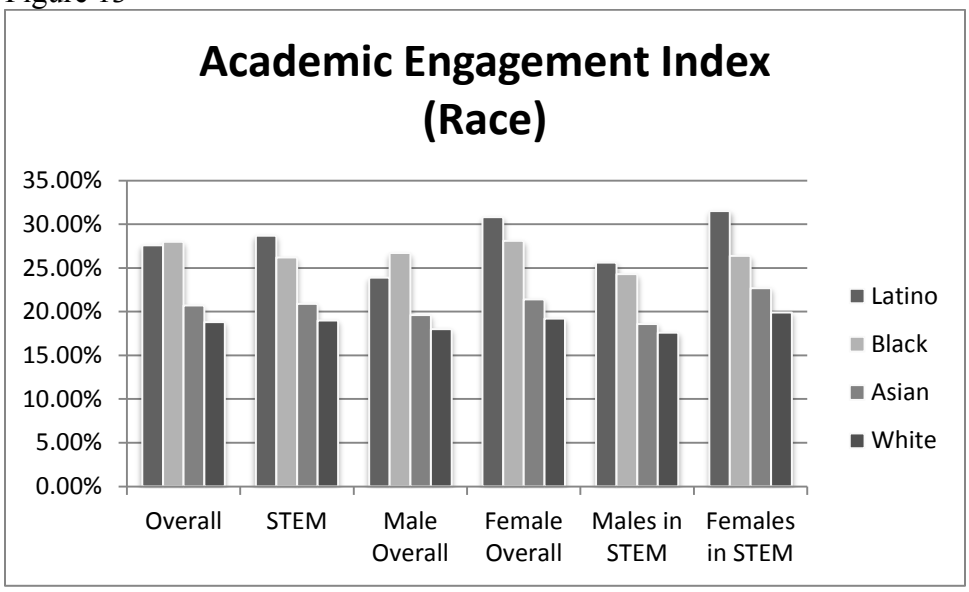

Figure 14