

College Social Experiences between First-Generation Students and Other Students Enrolled in a STEM Discipline at a Historically Black College and University

Terence Hicks, Samuel Heastie, Tawannah Allen, Shelton Ford, and Robert Taylor

The primary purpose of this study was to determine the differences in the levels of social engagement between first-generation and other college students enrolled in a STEM discipline at a Historically Black College and University. A two-group ex post facto research design using a single questionnaire was used for the study. A stratified sample of 90 college students participated in the study. The data for the research questions were analyzed using descriptive and inferential statistics based upon the subscales of the College Student Experiences Questionnaire.

These findings indicated that there were significant differences among first-generation and other college students who were enrolled in a STEM discipline at an HBCU. Statistically significant differences between first-generation and other college students were found for three items in the social integration category: "met other students," ($p = .017$, $\eta^2 = .063$); "used campus recreational facilities," ($p = .050$, $\eta^2 = .043$); and "became acquainted with students," ($p = .035$, $\eta^2 = .050$). Both groups felt that meeting others would happen "often." Both groups differ for using campus recreational facilities and becoming acquainted with students whose family backgrounds were different. First-generation students reported that "occasionally" and "often"; and the other college students felt "often" and "very often" that using campus recreational facilities and becoming acquainted with students whose family background was different would happen. The study documented the impact of the nurturing environment that exists at an HBCU and focused on the social engagement aspects of attending college. The study findings provide clues to ways that college administrators and researchers can assist first-generation college

Terence Hicks (tlhicks@pvamu.edu) is Interim Dean and Professor in the Whitlowe R. Green College of Education at Prairie View A&M University.

Samuel Heastie (sheastie@uncfsu.edu) is an assistant professor in the Department of Educational Leadership at Fayetteville State University.

Tawannah Allen (tallen@uncfsu.edu) is an Associate Professor and Director of the doctoral program in the Department of Educational Leadership at Fayetteville State University.

Shelton Ford (sford2@uncfsu.edu) is an Assistant Professor in the Department of Middle Grades, Secondary & Specialized Subjects at Fayetteville State University.

Robert Taylor (rtaylor@bladen.k12.nc.us) is the Superintendent for Bladen County School System in North Carolina.

students enrolled in a STEM discipline at an HBCU. Implications for future research and policymakers are discussed.

Introduction

Past studies have documented the college student social experiences of African American students at Historically Black Colleges and Universities (HBCUs). There have been relatively few studies, however, that have examined these experiences among African American first-generation college students in Science, Technology, Engineering, and Mathematics (STEM) disciplines while attending HBCUs. HBCUs are essential in providing a supporting and nurturing environment for African American students, regardless of their academic and social circumstances; furthermore, HBCUs have been known to provide the kind of academic and social environment that many African Americans need for surviving and persisting through college.

Swail et al. (2003) noted that minority serving institutions (MSIs) play a vital role in providing educational opportunities to minority students. Such institutions are reported as having environments that aid in the self-pride and confidence of African American students, thereby leading to academic and social success (Johnson, 2002; Swail et al., 2003). Given the abundance of stories in the media about the underrepresentation of minority students in STEM fields, these data are encouraging and surprising, but the trend is not especially new. The majority of those working in STEM-related fields in the United States have been White males; however, in recent decades, there have been significant efforts made to attract more women and minorities to STEM-related fields. In 2000, HBCUs awarded 40% of the baccalaureate degrees to African Americans in STEM fields (Southern Education Foundation, 2005). In fact, HBCUs outnumber Historically White Institutions (HWIs) in awarding degrees to African American students in most STEM disciplines (SEF, 2005). Educators believe that these findings can be improved and questions are beginning to be raised among educators regarding the minority students' social experiences and preparation before and during their enrollment in a STEM discipline. For example, African American students who enter engineering programs do not persist to graduation, or they switch to non-STEM fields (Lowery, 2010; Strayhorn, 2009).

Increasing the diversity of the STEM workforce has been an issue of national concern for decades. African American and Latino students from working class families are significantly underrepresented in science and technical fields, and this is especially the case for African American students who are the first in their family to attend college. Students who are the first in their families to attend college, commonly known as first-generation college students, have been receiving the attention of researchers and practitioners. For example, the difference between first generation college students and other college students is a relatively new topic being studied. These two groups are defined in different ways in the research literature; however, the dominant research available on first-generation college students would support the contention that most first-generation students are

deficient in many aspects of the college experience, from pre-college through college and after graduation, than other college students (Harper & Quaye, 2008; Hurtado, 2007; Murphy & Hicks, 2006; Hicks, 2003; Kuh, Kinzie, Schuh, Whitt, & Associates, 2005; Pascarella & Terenzini, 2005). Adjustment to college for the first-generation student has been studied in different contexts, such as academic or social, and has included a wide range of constructs including motivation, psychosocial development, and personality (Barry & Finney, 2009).

Because first-generation college students may be perceived as having different expectations, poorer academic and social preparation, greater financial constraints, lower self-esteem, and insufficient parental support, it would seem logical to suggest that they do not perform as well as non-first-generation college students (Hicks, 2002). The increased accessibility of higher education for minorities necessitates a clearer understanding of this causal relationship because their participation as first-generation students in the college or university process has dramatically grown. Additionally, because basic information about college survival and social adaptation to college success may not be readily available from first-generation families, there is a need for more extensive research to determine the nature and type of social and personal support systems needed for this population's college success.

To that effect, little is known about the college social experiences and barriers of first generation college students enrolled in a STEM discipline at an HBCU. With first-generation college students exhibiting one of the lowest retention and graduation rates among their racial counterparts, investigating their college social experiences and barriers might aid in explaining their high rates of attrition, especially in the STEM fields. As colleges and universities are welcoming more and more diverse student populations within the STEM disciplines, the number of first generation students that have access to these disciplines will continue to increase. With this in mind, college administrators, faculty, and counselors must be prepared to serve these students.

Unfortunately, there is an apparent gap in the knowledge of college administrators and faculty concerning the college social experiences and beliefs that are held by first-generation college students enrolled in the STEM disciplines and how these social experiences and barriers may relate to their persistence, or lack thereof, at post-secondary institutions. Until more accurate methods are developed to identify which type of first-generation college students are at risk of failing and leaving college, little can be done to intervene and avoid the undesired consequences of poor social performances and attrition that affect both first-generation college students enrolled in STEM disciplines and the institutions. Thus, it would be helpful to know what social challenges and barriers exist for these first-generation students upon entering a college setting and enrolling in a STEM discipline. Such information is needed to assess more fully the at-risk potential of these students for non-completion of college.

Given that a relatively large percentage of African Americans entering college are first-generation students and considering the low completion rate among this group in the STEM discipline, it is important to explore means to improve their

college completion rates; furthermore, it is imperative that first-generation college students who are enrolled in a STEM discipline receive appropriate social support in and out of the classroom in order to navigate successfully the educational pathway; therefore, the purpose of this study was to determine the differences in the levels of social engagement between first-generation and other college students enrolled in a STEM discipline at an HBCU. The study focused on the following research question: What are the differences in the levels of social engagement between first generation and other college students enrolled in a STEM discipline? The social engagement categories consisted of campus facilities, clubs and organizations, personal experiences, and student acquaintances. Example questions listed under these categories were *“used campus lounge to relax or study by yourself,” “attended a meeting of a campus club, organization, or student government group,” “meeting with other students for a discussion,” “using campus recreational facilities,” “identifying with a character in a book, movie, or television show and wondered what you might have done under similar circumstances,” and “becoming acquainted with students whose family background was different from yours.”*

Method

Research Design

A two-group ex post facto research design using a single questionnaire was used for this study. Ex post facto designs are used when the researcher is not able to randomly assign participants into experimental groups; rather, the groups are determined by a pre-existing or naturally occurring condition (Breakwell, Hammond, Fife-Schaw & Smith, 2006; Schenker & Rumrill, 2004). In this study, the predetermined group variable was parental level of education. A group of college students enrolled in a STEM discipline was gathered and divided into groups based on their parental level of education; groups were determined based on the levels of parental education revealed. The categories are “no college”; “yes, both parents”; “yes, father only”; “yes, mother only”; and “don’t know.” The researcher made an effort to recruit a sufficient number of participants to represent each group rather than simply operationalizing parental level of education as a dichotomous variable. Quantitative data was obtained from the social engagement items on the College Student Experiences Questionnaire. This study surveyed both students whose parents graduated from a four-year college (other college students) and students whose parents did not graduate from a four-year college (first-generation).

Instrumentation

College Student Experiences Questionnaire (CSEQ). Robert Pace developed the CSEQ at the University of California Los Angeles in the 1970s and introduced it as a multi-institutional survey tool in 1979. It has been revised three times since:

the second edition in 1983, the third edition in 1990, and the fourth edition in 1998. The fourth edition of the CSEQ (Pace & Kuh, 1998) is designed for students attending four-year colleges and universities and gathers information about students' backgrounds (age, major field, and so forth) and their experiences in three areas. With over 150 items, the CSEQ provides colleges and universities with a comprehensive inventory of the student experience. The first area is the amount of studying, reading, and writing students do and the time and energy (quality of effort) they devote to various activities measured by items contributing to 13 Activities Scales. One of these scales, Computer and Information Technology (C&IT), is composed of nine items describing various forms and uses of computers and information technology. The response options for all Activities items are: 4 = "very often, 3 = "often," 2 = "occasionally," and "1 = "never."

The second area includes 10 Environment items representing student perceptions of the extent to which their institution emphasizes important conditions for learning and personal development. Student responses are scored on a seven point scale ranging from "strong emphasis" = 7 to a "weak emphasis" = 1. The final set of questions asks students to estimate the extent to which they have made progress since starting college in 25 areas that represent desired outcomes of higher education. Response options for the Gains items are: 4 = "very much," 3 = "quite a bit," 2 = "some," and 1 = "very little."

Since its inception, the CSEQ has been administered to over 300,000 students attending more than 400 different colleges and universities in the United States, making it the third largest national database on college student experiences. Over 100,000 students at 200 different institutions have completed the fourth edition alone. The CSEQ data have been cited in over 250 articles, books, and dissertations and probably an equal number of institutional reports. The CSEQ remains one of the few national assessment instruments that inventories both the processes of learning (e.g., interactions with faculty, collaboration with peers, and writing experiences) and progress toward desired outcomes of college (e.g., intellectual skills, interpersonal competence, and personal values).

CSEQ items satisfy all these conditions. The questionnaire requires that students reflect on what they are putting into and getting out of their college experience. The items are clearly worded, well defined, and have high face validity. The nature of the questions refers to common experiences of students during the current school year, typically a reference period of about six months or less. The format of most response options is a simple rating scale that helps students to accurately recall and record the requested information, thereby minimizing this as a possible source of error. Based on their review of the major college student research instruments, Ewell and Jones (1996) concluded that the CSEQ has excellent psychometric properties and high to moderate potential for assessing student behavior associated with college outcomes. The validity of the CSEQ is well substantiated. It has been used extensively in college impact research studies (Pike, 1993; 2000); its self-reported "gains scales" are highly consistent with criterion-based achievement test results (Pascarella, 2001; Pike, 1995), and it has "excellent" psychometric properties (Ewell & Jones, 1996). Researchers calculated internal

consistency indices (for instance, Cronbach's alpha) to establish reliability. Kuh, Pace, and Vesper (1997) report that alpha values for the CSEQ subscales are high, ranging from .81 to .91; thus, the CSEQ is regarded as a reliability instrument as well.

Demographic Survey. This scale was created for the purposes of this study. The scale contains 12 questions that ask participants about their age, gender, race, living conditions, residency, classification at the university, parental educational achievement, source of income during the university year, and educational or employment goals. In addition, two questions ask the participant to identify a person (by relationship, not name) who either supported or did not support their educational plans. These two questions relate to parental involvement and the background contextual influences of being the first in the family to attend college.

Participant Demographics

Examining the parent college education status in this study, 52.2% of students had parents with no college degree, 24.4% had both parents that had a college degree, and 23.4% had at least one college educated parent. At all degree levels, more mothers earned degrees than did fathers. This finding is consistent with another study of African American college freshmen, in which African-American students' mothers were slightly more likely than their fathers to be college graduates (Astin, 1990). The majority of the participants (72%) were college students between the ages of 20 and 29 years, most of whom were African Americans (59%), as seen in Table 1; however, the first-generation gender and ethnicity compositions of students in this study are consistent with other studies (Tinto, 1993; Hicks, 2003). The sample was 57% female. This follows the trend for most college and universities that enroll African American students. National data demonstrates that African-American women outnumber African-American men on college campuses. In 2000 (Hoffman, Llagas, & Snyder, 2003), 63% of the African-American population on college campus was female and 37% was male. The participants in the study were comprised of 3.3% sophomores, 22.2% juniors, 72.2% seniors and 2.2% other. The majority of the participants (39%) were college students taking between 7 and 11 credit hours, 31% of the sample were taking between 15 and 16 credit hours and 20% were taking 17 or more credit hours. Of the study participants, 45% indicated that they had plans of attending a graduate school.

Procedures

Data collection. Permission to use and administer the College Student Experiences Questionnaire was obtained from the Institutional Review Board (IRB) of the participating institution. In the spring 2012 semester, a stratified random sampling process was used to survey students enrolled in a STEM course. Stratified sampling is most likely to be used when the researcher is convinced that

TABLE 1

Percentages of Race by Group

Group	Percentages
African American or Black	59%
Caucasian	20%
Asian or Pacific Islander	5%
American Indian or other Native American	2%
Mexican American	1%
Puerto Rican	1%
Other Hispanic	2%
Multiracial	9%
Other	1%

a particular variable is of such importance that the researcher wants to ensure that it is represented as it would be in the population. The strata for the sample were first-generation status: first-generation college student and other college student. A sample of students was selected from 300 and 400 level STEM courses from the following departments: biological sciences, chemistry, physics, mathematics, and computer sciences. After selecting the courses, the course professors were contacted to seek permission to administer the questionnaires and to determine the most desirable time for administering the questionnaire to the study participants. During the administering of the questionnaire, the researcher informed students that they were being asked to voluntarily participate in research that will examine their college experiences. The procedures of the study and the estimated time requirement of 30 minutes were discussed as well. Students were informed that their participation would be both anonymous and confidential, as no identifying information will be disclosed. In addition, students in attendance were given the opportunity to voluntarily participate in the research study, or they could elect to decline participation and leave the event without penalty or question. Packets containing the CSEQ were distributed to all student volunteers. After completion, each participant returned the questionnaire to the researcher. Data collection was conducted during the first four weeks of the spring 2012 semester.

Data analysis. To ensure that the sample size was big enough, a power analysis calculation was conducted to determine what size sample was needed. For any power calculation, one needs to identify the statistical test being used, the alpha value or significance level, the expected effect size, and the sample size. There were 121 students who originally completed the CSEQ, and 37% (45) of the 121 college students were classified as "other college students" and 76 of the study participants were classified as "first-generation college students." For ANOVA,

the Cohen's G power analysis concluded that using a low effect size of ($f^2 = .33$) with 80% power that the sample size required is 38 per group. To determine the low effect size of ($f^2 = .33$) for this study on STEM college students, a preliminary meta-analysis conducted on STEM subjects was reviewed. Becker and Park (2011) synthesized the findings from existing research on the effects of integrative approaches among STEM subjects on students' learning; 28 studies were selected and 33 effect sizes were calculated. With respect to grade levels, the smallest effect size was presented at the college level. As seen in Table 2, Becker and Park (2011) examined four college level studies with five different effect sizes.

TABLE 2

Major Features of Four College Level Studies

Study	N	Grade Levels	Effect Sizes
Crates (1994)	32	College	0.09 -0.58
Dantley (1999)	25	College	0.65
Elliot et al. (2001)	143	College	0.31
Su (2006)	257	College	1.18

Note: Effect size determine for this study was an average of the previous four studies/five effect sizes above = ($f^2 = .33$)

The data for the research question was analyzed using descriptive and inferential statistics based upon the subscales of the College Student Experiences Questionnaire with the sample size set at $N = 45$ for the first-generation college student group and $N = 45$ for the other college student group; therefore, the sample consisted of 90 college students enrolled in a STEM discipline at a Historically Black College and University. Data analysis was conducted on the mean scores for the first-generation and other college student groups using the Statistical Package for the Social Sciences (SPSS), Version 19.0 to determine if there were differences on each of the dependent variables. A one-way Analysis of Variance (ANOVA) was used to examine the differences between first-generation and other college students enrolled in a STEM discipline and their levels of social engagement.

Results

Quantitative Analysis

This study sought to answer one research question: What are the differences in

the levels of social engagement between first generation and other college students enrolled in a STEM discipline? With regards to the question, the between groups analysis was a comparison of the first-generation and other college students' responses to the social engagement items on the CSEQ questionnaire. This analysis helped to determine if there were any differences in the perceptions and beliefs concerning social engagement experiences between first-generation and other college students enrolled in a STEM discipline at a Historically Black College and University.

As seen in Table 3, statistically significant differences between first-generation and other college students were found for three items in the social integration category: "*met other students*," "*used campus recreational facilities*," and "*became acquainted with students*." The distribution of responses for the first-generation and other college students were very similar for item "*met with other students at some campus location (campus center, etc.) for a discussion*." A statistically significant difference ($F(1, 88) = 5.870, p = .017, \eta^2 = .063$) was found between the means of the two groups. The strength of the relationship between the dependent variable was moderate, with 6% of the variability in the dependent variable accounted for. The mean score for the first-generation college students was significantly higher ($M = 2.57, SD = .941, 95\% CI = [2.294, 2.861]$) than the mean score of the other college students ($M = 2.08, SD = .973, 95\% CI = [1.805, 2.372]$). Both first-generation and other college students felt that they "*often*" met other students at some campus location for a discussion.

For social engagement item "*used campus recreational facilities (pool, fitness equipment, courts, etc.)*," a statistically significant difference ($F(1, 88) = 3.957, p = .050, \eta^2 = .043$) was found between the mean score of the two groups. The strength of the relationship between the dependent variable was moderate, with 4% of the variability in the dependent variable accounted for. The mean score for the first-generation college students was significantly higher ($M = 3.31, SD = 1.062, 95\% CI = [2.997, 3.625]$) than the mean of the other college students ($M = 2.86, SD = 1.057; 95\% CI = [2.553, 3.181]$). First-generation college students felt that they "*occasionally*" used campus recreational facilities; whereas, other college students reported that they "*often*" used campus recreational facilities. For social engagement item "*became acquainted with students whose family background (economic, social) was different from yours*," a statistically significant difference ($F(1, 88) = 4.601, p = .035, \eta^2 = .050$) was found between the means of the two groups. The strength of the relationship between the dependent variable was moderate, with 5% of the variability in the dependent variable accounted for. The mean score for the first-generation college students was significantly higher ($M = 2.26, SD = 1.074; 95\% CI = [1.990, 2.543]$) than the mean of the other college students ($M = 1.84, SD = .767; 95\% CI = [1.568, 2.121]$). First-generation college students felt that they "*often*" became acquainted with students whose family backgrounds (economic, social) were different from theirs; whereas, other college students reported that they "*very often*" became acquainted with students whose family backgrounds were different.

TABLE 3

Means, Standard Deviations, Significant Levels and Eta Squared (η^2) for Social Engagement Items by First-generation and Other College Students Status

Group	First-generation	Other students	p value	η^2
	n = 45	n = 45		
	M/SD	M/SD		
Met other students	2.57/.941	2.08/.973	.017*	.063
Used campus recreational facilities	3.31/1.062	2.86/1.057	.050*	.043
Became acquainted with students	2.26/1.074	1.84/.767	.035*	.050

Note: *significant at .05; Eta Squared (η^2): Small = .01, Medium = .06, Large = .14

Discussion

The goal of this study was to document the differences in college student social engagement between first-generation and other college students enrolled in a STEM discipline at an HBCU. A few studies were located that focused on interventions intended to improve college social under-preparedness for STEM students enrolled at a Historically Black College and University that included first-generation status as a variable. This study attempted to add to that body of literature on STEM college students who fit that first-generation status. The findings discussed below provide support for the concept of college social interventions for first-generation college students at an HBCU.

Summary of Findings

A statistically significant difference between first-generation and other college students was found for “met other students,” ($p = .017$); “used campus recreational facilities,” ($p = .050$) and “became acquainted with student,” ($p = .035$). Both groups felt that meeting other students would happen “often.” It was interesting to note that responses for the two groups differ for using campus recreational facilities and becoming acquainted with students whose family background was different. First-generation students reported these occurrences “occasionally” and “often”; whereas, the other college students felt “often” and “very often” that using campus recreational facilities and becoming acquainted with students whose family

background was different would happen.

This finding on meeting others and becoming acquainted with students whose family background was different was not surprising. Students appeared to be aware that going to college means changes in their friendship patterns, and surely, part of the excitement of college relates to the anticipation of making new friends. For most first-time/first-year first-generation college students, the idea of making new friends is also filled with uncertainty. According to Karp and Holmstrom (1998), freshmen students are excited about new friends but worry about leaving their old friends. They know they need to make a social life for themselves in the new campus environment but worry that perhaps they will not.

In college, young people can “start over”; they can make friends, establish intimate relationships, and develop the skills and knowledge to help become self-supporting adults. “But the truth is that they are not sure they can take care of themselves or that they want to be left alone” (Bassoff, 1988, p.3). Bassoff indicated that students see college as the time for discovering who they really are and who they really can become; they anticipate finding wholly new and permanent life identities during the college years. In addition, they believe that going to college provides a unique opportunity to consciously establish some new identities.

In regards to recreational and extracurricular activities, first-generation students in this study reported these occurrences “occasionally” and “often”; whereas, the other college students felt “often” and “very often” that using campus recreational facilities and becoming acquainted with students whose family background was different would happen. Researchers have suggested that, compared to their other peers, first-generation students have lower social integration (Duggan, 2001), lower involvement in student activities, and fewer non course-related peer interactions (Pascarella, et al. 2004); however, Pascarella et al. (2004) found that first-generation college students benefited more from extracurricular activities and engagement with peers, but were less likely to participate in these beneficial activities than were those students who were not first-generation. Terenzini et al. (1994) similarly noted that first-generation students tended to delay involvement in extracurricular activities and informal peer groups during the initial transition period and were often likely to have friends who lived off-campus or who were not enrolled in college. Given the social needs of first-year, first-time college students who may be first-generation and enrolled in a STEM discipline, college personnel can play a pivotal role in expanding and providing social experience awareness at the junior and senior high school levels of the demands in postsecondary education. Innovative approaches, such as field trips to college campuses, presentations by other first-generation college students enrolled in a STEM major and collaborative planning for transition, provide valuable opportunities to better prepare first-generation students before the beginning of their college studies.

Limitations and Generalizability

As with any study, there are a few possible limitations of this research that are noteworthy. First, the data obtained for this study consisted of responses from two

groups of college students enrolled in a STEM discipline at a Historically Black College and University. One group consisted of first-generation students, and the other group was other students. First-generation status was the variable of main interest. This study was limited to a single historically Black four-year university in the United States. It is acknowledged that a large number of first-generation students are concentrated at two-year community colleges (Inman and Mayes, 1999), and a considerable body of literature on first-generation students focuses on these institutions. To that effect, it is beneficial to examine students within a state system of higher education such as North Carolina; however, given the unique characteristics of the UNC system, it may be difficult to generalize the findings of this study to other state university systems; furthermore, the limited demographic has the potential to impact the study findings as well. Although demographic variables such as age, gender, and ethnicity were comparative to the national sample of first-generation college students, college social engagement experiences may still differ based on the type of university where the student is enrolled. A public institution with a unique admission criteria and a majority first-generation student population, such as the participating university for this study, may enroll students with lower academic abilities than other universities; therefore, there is potential for differences among the student body demographics compared to other institutions with admissions criteria. College social engagement experiences and adjustment may be impacted based on these differences and, therefore, this must be considered when interpreting the findings of this study.

Second, the lack of consistency in defining the first-generation student was another limitation. Some studies define the first-generation students as those whose parents have no college or university experience (Billson & Terry, 1982; Terenzini et al., 1996), while others define the first-generation students as those whose parents have some college (Warburton, Burgarin, Nunez, & Carroll, 2001), or as the first in the family to attend college (Inman & Mayes, 1999); therefore, the complexities involved in identifying first-generation students across colleges and university campuses have created inconsistencies in the literature in terms of discussing this cohort. As a result, this study may not be generalizable to all first-generation students. Finally, the questionnaire was based on self-report and student perceptions, so no information is available from parents, school personnel, or others who may know about the social engagement experiences of these students.

Implications for Practice

There are several implications for practice that exist for this population of students. A newly developed enrichment program could consider those factors that are known to hinder a first-generation college student successfully enrolled in a STEM discipline such as addressing social engagement and motivation issues. Research has indicated that STEM enrichment programs afforded students a level of familiarity with laboratories. According to Gary (2010), many campuses have instituted programmatic interventions to supplement the mathematics and science curricula of their campuses, and many of these programs employ strategies, such

as additional class time, learning in cohorts, formalized faculty-student mentor relationships, and group study sessions, to maintain underrepresented populations within the STEM pipeline. It has become typical for institutions to increase the flow of underrepresented minorities in science and mathematics through the development of intervention programs (Hurtado et al., 2009). These programs focus on students who are academically and socially underprepared, very talented students, and students who are trying to overcome the major academic and social barriers to STEM.

Furthermore, most of the first-generation students enrolled in the STEM courses acknowledged their lack of social experiences within these surroundings, confirming their need for additional exposure beyond the offerings provided at their respective institutions. Summer research programs have proven to be effective. The summer research experience immerses students in the typical STEM environment, which also will allow them to assess their weaknesses and develop strategies to compensate for those academic and social deficiencies. In addition to the summer research programs, minority students in a STEM discipline need encouragement and support from both parents and teachers, and during the summer research experiences, it would be a great idea for those students to be exposed to scientists of color, both male and female, who can awaken their dreams and demonstrate the real-world relevance of science and engineering. According to Pizzolato (2007), this is pivotal in the construction of future possible selves and self-efficacy beliefs, particularly the segment of the process focused on students' interaction with their environment, as well as confirming appropriate adjustments to their educational plans to strengthen those areas. Likewise, these programs can continually assist the students in the socialization process. Early socialization exposure and mentoring informed students of required expertise and continued engagement in normative STEM behavior and expectations; therefore, STEM role models—K-12 teachers and administrators with STEM backgrounds—and visitations to other universities' and colleges' STEM offices and laboratories all help minority students to become socially exposed and aware of the opportunities that the science and mathematics fields have to offer.

Implications for Future Research

Suggestions for further research that might provide additional information for the development of social engagement programs for first-generation college students enrolled in a STEM discipline include the following: a) As other researchers have suggested, longitudinal research on disadvantaged groups such as the African American first-generation students enrolled in a STEM discipline also are needed. Longitudinal studies can help determine the social challenges faced by these students. Comparisons could be made between first-generation college students enrolled in a STEM discipline and their peers over time to determine the social engagement challenges that these students faced in a university setting; furthermore, long-term studies can help determine when college-going intentions change, that is, when students stop believing that college is not important. A

longitudinal study is, therefore, recommended between first-generation students over time to determine if differences grew or shrunk throughout high school. b) Learning disabilities, psychological, cognitive, or other similar factors, conditions, or limitations were also not considered in this study. Any of these factors may have been operative in the present study and should be studied in the future. c) To more fully understand the phenomenon of first-generation college students enrolled in a STEM discipline and the supportive environment of an HBCU, a qualitative approach is recommended. These studies could examine the perspectives of these students' unique experiences and perceptions of the social engagement challenges faced in the STEM educational environment and their sense of belongingness to an HBCU; furthermore, a qualitative approach that includes the parents' perspectives about their sons or daughters attending college and enrolling in a STEM discipline will allow for a more in-depth rich analysis of these students' perspectives about the social experiences and challenges that they face. d) A study that examines the faculty-student interaction is recommended. Perhaps this study could look at the advantages and disadvantages of how first-generation students view their relationships with professors in and out of the classroom environment. e) It is vital that first-generation college students have realistic expectations and perceptions as to how success is achieved, that they interact effectively with their peers and instructors, and that they are able to control feelings of anxiety. Integration or transition programs aimed at first-generation college students enrolled in a STEM discipline should focus on developing these essential social skills. It is important to acknowledge that non-academic attributes play a significant role in the success of high-risk students at the college level. f) This study did not take into consideration differences between coursework attempted and course work completed and differences in students' major or concentration. These factors, singly or in combination, may have also had an effect on the outcome variables examined in this study; therefore, a study that examines these factors should be undertaken.

Conclusion

As colleges and universities are welcoming more and more diverse student populations within the STEM disciplines, the number of African American first-generation students that have access to these disciplines will continue to increase. This study adds to the body of research by providing a perspective on African American first-generation college students' social experiences. It is also important to emphasize that not all first-generation college students will be socially ready for the demands of college. As a preventive measure, an effective college transition and orientation program aimed at first-generation college students, which focuses on enhancing those essential socialization skills, would be beneficial. College transition and orientation administrators could use this information to continue and develop additional programs to better facilitate retention and, ultimately, degree attainment for first-generation students as well as other at-risk students. Successful retention programs need to involve coordinated efforts of student affairs and counseling professionals as well as admission personnel. These

programs could challenge students to foster attitudes conducive to earning good grades, persisting, and ultimately graduating. These programs could also provide first-generation students with the nonacademic skills needed to persist, such as interacting with faculty and other students and participating in campus social events; furthermore, college transition and orientation administrators and faculty members in the classroom setting could use these findings regarding African American first-generation students enrolled in a STEM discipline to demystify the college experience, to dispel some of the misconceptions about the difficulties of the STEM discipline, and to assist them with effectively integrating into the university social environment. Hopefully, this study has provided researchers and practitioners with the next steps toward future work with African American first-generation college students.

References

- Astin, A. W. (1990). *Assessment for excellence: The philosophy and practice of assessment and evaluation in higher education*. New York: Macmillan.
- Barry, C., & Finney, S. (2009). Can we feel confident in how we measure college confidence? A psychometric investigation of the college self-efficacy inventory, *Measurement and Evaluation in Counseling and Development*, 42, 197-222.
- Bassoff, E. (1988). *Mothers and daughters: Loving and letting go*. New York: Penguin Books.
- Becker, K., & Kyungsul, P. (2011). Effects of integrative approaches among science, technology, engineering, and mathematics (STEM) subjects on students' learning: A preliminary meta-analysis. *Journal of STEM Education*, 5, 23-37.
- Billson, J. M., & Terry, M. B. (1982). In search of the silken purse: Factors in attrition among first-generation students. *College and University*, 58, 57-75.
- Breakwell, G. M., Hammond, S., Fife-Schaw, C. R., & Smith, J. A. (Eds.) (2006). *Research methods in psychology* (3rd ed.). Sage: London.
- Duggan, M. (2001). *Factors influencing the first-year persistence of first generation college students*. ERIC (ED459673).
- Ewell, P. T., & Jones, D. P. (1996). *Indicators of "good practice" in undergraduate education: A handbook for development and implementation*. Boulder, CO: National Center for Higher Education Management Systems.
- Gary, S. (2010). *Four portraits: The role of historically Black colleges and universities in the development of Black science, technology, engineering and mathematics Ph. D students* (Doctoral dissertation). Available from Dissertation Abstract International, 71(6), 853 (UMI No. AAT 3410468).
- Harper, S. R., & Quaye, S. J. (2008). *Student engagement in higher education: Theoretical perspectives and practical approaches for diverse populations*. London: Routledge.

- Hicks, T. (2003). First-generation and non-first-generation pre-college students' expectations and perceptions about attending college. *Journal of College Orientation and Transition*, 11, 5-17.
- Hicks, T. (2002). Assessing parental involvement of first-generation and second-generation college students, *Act 101 Journal*, 9, 12-16.
- Hoffman, K., Llagas, C., & Snyder, T. D. (2003). *Status and Trends in the Education of Blacks* (NCES 2003-034). U.S. Department of Education, Institute for Education Sciences. Washington, DC: National Center for Education Statistics.
- Hurtado, S. (2007). The sociology of the study of college impact. In P. Gumpert's (Ed.), *The sociology of higher education: Contributions and their contexts* (pp. 94-112). Baltimore, MD: The Johns Hopkins University Press.
- Hurtado, S., Cabrera, N. L., Lin, M. H., Arellano, L., & Espinosa, L. L. (2009). Diversifying science: Underrepresented student experiences in structured research programs. *Research in Higher Education*, 50, 189-214.
- Inman, W. E., & Mayes, L. (1999). The importance of being first: Unique characteristics of first generation community college students. *Community College Review*, 26, 3-22.
- Johnson, C. F. (2002). Factors related to mastery and psychosocial development in Black male undergraduate students enrolled in traditionally Black and predominately White institutions (Doctoral dissertation). Available from Dissertation Abstracts International (UMI No. 3067056).
- Karp, D., & Holmstrom, I. (1998). Leaving home for college: Expectations for selective reconstruction of self. *Symbolic Interaction*, 21, p. 253.
- Kuh, G. D., Kinzie, J., Schuh J., Whitt, E., & Associates. (2005). *Student success in college: Creating conditions that matter*. San Francisco: Jossey-Bass.
- Kuh, G. D., Pace, C. R., & Vesper, N. (1997). The development of process indicators to estimate student gains associated with good practices in undergraduate education. *Research in Higher Education* 38, 435-454.
- Lowery, G. (2010). Tougher grading is one reason for high STEM dropout rate. *Chronicle Online*. Retrieved from <http://www.news.cornell.edu/>
- Murphy, C., & Hicks, T. (2006). Academic characteristics among first-generation and non-first-generation college students, *College Quarterly*, 9, 2-20.
- Pace, C. R., & Kuh, G. D. (1998). *College student experiences questionnaire, fourth edition*. Bloomington, IN: Indiana University Center for Postsecondary Research and Planning.
- Pascarella, E. (2001). Using student self-reported gains to estimate college impact: A cautionary tale. *Journal of College Student Development*, 42, 488-492.
- Pascarella, E. T., & Terenzini, P. T. (2005). *How college affects students: A third decade of research*. San Francisco: Jossey-Bass.
- Pascarella, E. T., Pierson, C. T., Wolniak, G. C., & Terenzini, P. T. (2004). First-generation college students: Additional evidence on college experiences and outcomes. *Journal of Higher Education* 75, 249-284.
- Pike, G. R. (1993). The relationship between perceived learning and satisfaction with college: An alternative view. *Research in Higher Education*, 34, 23-40.

- Pike, G. (2000). The influence of fraternity or sorority membership on students' college experiences and cognitive development. *Research in Higher Education, 41*, 117-139.
- Pike, G. (1995). The relationship between self-reports of college experiences and achievement test scores. *Research in Higher Education, 36*, 1-21.
- Pizzolato, J. E. (2007). Impossible selves: Investigating students' persistence decisions when their career-possible selves border on impossible. *Journal of Career Development, 3*, 201-233.
- Schenker, J., & Rumrill, P. (2004). Causal comparative designs in rehabilitation research. *Journal of Vocational Rehabilitation, 21*, 117-123.
- Southern Education Foundation (2005). *Igniting potential: Black colleges and universities and science, technology, engineering and mathematics*. Retrieved from www.southerneducation.org
- Strayhorn, T. L. (2009). *Work in progress: Academic and social barriers to Black and Latino male collegians in engineering*. ASEE/IEEE Frontiers in Education Conference. San Antonio, TX.
- Swail, W. S., Redd, K. E., & Perna, L. W. (2003). Retaining minority students in higher education: A framework for success. *ASHE-ERIC Higher Education Report, 30*(2). San Francisco: Jossey-Bass.
- Terenzini, P. T., Springer, L., Yaeger, P. M., Pascarella, E. T., & Nora, A. (1996). First generation college students: Characteristics, experiences, and cognitive development. *Research in Higher Education, 37*, 1-22.
- Terenzini, P. T., Rendon, L. I., Upcraft, M. L., Millar, S. B., Allison, K. W., & Gregg, P. L. (1994). The transition to college: Diverse students, diverse stories. *Research in Higher Education 35*, 57-73.
- Tinto, V. (1993). *Leaving college: Rethinking the causes and cures of student Attrition* (2nd ed.). Chicago: University of Chicago Press.
- Warburton, E. C., Bugarin, R., & Nunez, A. (2001). *Bridging the gap: Academic preparation and post-secondary success of first-generation students* (No. 2001-153). Washington, D.C.: National Center for Educational Statistics.