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Effects of Academic and Nonacademic Factors on Undergraduate Electronic Engineering Program Retention

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Walden University
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MA, Norfolk State University, 1990

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Dissertation Submitted in Partial Fulfillment

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Abstract

Science, technology, engineering, and mathematics (STEM) programs in higher education institutions, particularly engineering programs, face challenges related to recruitment, retention, and graduation rates. The purpose of this study was to determine whether there are significant relationships among students' major preference, academic skills, nonacademic characteristics and perceptions, and retention to year 2 among students in electronic engineering, other STEM, and nonSTEM majors. The academic skills considered were study habits, intellectual interest, verbal and writing confidence, and academic assistance. The nonacademic factors included academic support, family support, financial support, and student social integration into the campus environment. Tinto's theory of retention served as the theoretical framework. The research design was quantitative with a general linear method of analysis using responses to the College Student Inventory (CSI) survey as secondary data to determine the relationships among the independent variables (major and academic and nonacademic factors) and dependent variable (retention). Participants were 3,575 first year undergraduate full-time students from three entering classes, 2012 to 2014. Findings suggested that student major and nonacademic factors had no effect on student retention, but student study habits and seeking academic assistance were predictors of retention in each of the three groups of majors: engineering, other STEM majors, and nonSTEM majors. Strategies to help increase undergraduate students' study skills and help seeking behaviors may contribute to positive social change at HBCU institutions.

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Dedication

I dedicate this project to my late father for his words of wisdom that continue to stay with me during this journey, and my mother for her everyday prayers that continue to strengthen my spiritual faith in God. To Blanch, love of my life. Thank you for your unconditional love, caring, and support during this journey. To my family and friends, I am very grateful for your encouraging words, caring support, and prayers that keep me going during this journey.

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Chapter 1: Introduction to the Study

In this chapter, I describe the purpose of this study, the background of the study, and the knowledge gap that exists in the discipline. The theoretical framework of this study was based on Tinto's (1975) theoretical contributions to understanding student persistence and attrition. Two research questions guided study.

For many years, student retention has been a concern of engineering educators. The challenges facing college science, technology, engineering, and mathematics (STEM) programs are related to recruitment, retention, and graduation rates (Donna, 2012; Knight, Carlson, & Sullivan, 2007). Researchers have examined student retention in undergraduate engineering programs in relation to the contextual effect of program curriculum and nonacademic factors. For instance, methods of instruction in classes in an engineering major have been found to predict student retention and graduation rates (Knight et al., 2007; Li, Swaminathan, & Tang, 2009).

Scientific and technological advancement play an increasingly significant role in the global economy and in competition among the developed nations. Nations are defined by their workforce and gross domestic product. These are often seen as a measure of the outcome of national education programs designed to provide skills that grow the nation's economy. In universities in the United States that offer engineering curricula, educators are required to practice the Accreditation Board for Engineering and Technology's model to increase student retention and graduation rates for undergraduate engineering students. This model defines student-learning outcomes for undergraduate engineering programs, and is supported by applying a continuous quality improvement model in education policy at the local and national levels (National Center for Education Statistics [NCES], 2008; Singer & Smith, 2013; Yoder, 2012). Increasingly, state public higher education institutions are using student retention as a measure of institutional effectiveness for performance-based funding. Institutional outcomes are defined by the number of students who finish their degree program within the time required.

Background

For many years, educators and researchers have noted the problems facing undergraduate student retention. Undergraduate engineering majors are no exception from this problem of student retention. Tinto (1993, 2007) noted in his student integration model that successful integration into the institutional environment, socially and academically, creates positive effects on students' retention. Tinto (1998) further noted that for integration to be successful, students must demonstrate their ability as stakeholders in their institution. Singer and Smith (2013) noted some of the variables that influence attrition in engineering programs include students not coping with academics, significant class sizes, inaccessibility of instructors, ineffective teaching strategies, insufficient student network support, and poor curricula integration. Retention and graduation rates of undergraduate students are also an institutional concern, especially during the first year (Knight et al., 2007) and require attention to changes that might be made campus-wide. The nonacademic factors that affect student retention include adjusting to a college environment, participating in student organizations, and coping with presence or lack of family and financial support. These nonacademic factors are typically assessed once students are enrolled into the university. Tinto (1987) noted that some additional factors include the student's level of commitment to graduate, confidence in academic ability, time management, study skills, and social integration into the university. These factors have been found to be strong indicators of student retention and a forward path to graduation.

Good academic practices and academic advising have been found to help insure student engagement and provide confidence to first year undergraduate engineering, other STEM, and nonSTEM students. Jackson (2006) noted that students' development is enhanced when their complex system of knowledge is well developed, allowing them to embrace the learning of science and engineering, which gives them a better chance to professionally contribute to solving the social and global challenges facing society.

Tinto (2007) noted that a student's decision to remain in college depends on several personal characteristics. These are characteristics students may bring to college and develop further, including academic skills, cognitive ability, and how the student integrates these characteristics across all levels of college experiences that include program curriculum, advising, and faculty interactions. These academic experiences provide the path for student incorporation into the collegiate environment and mold learner attitudes that influence the decision to continue pursuing a degree at the institution. Agreeing with Tinto's attention to the importance of students' skills and abilities, Bean (1990) noted that student beliefs and attitudes are also predictors of student persistence, which Bean portrayed in a student attrition model. Bean further noted that students' beliefs in themselves are particularly significant and influence their interaction with others and the institutional environment. In addition, theoretical models have revealed factors affecting student retention and persistence. These factors include financial support, institutional commitment, and grades earned in college (Hsung, 2012).

Problem Statement

Student retention in undergraduate engineering programs is a challenge that is also faced by other STEM programs. These challenges have led to changes in recruitment and pedagogical methods used in preparing undergraduate students in these programs, and particularly in historical black college and university (HBCU) institutions, where undergraduate student retention efforts have not shown significant improvement. Because of the academic requirements of undergraduate electronic engineering programs and the demographics of the student population at site of this study, a different kind of effort must be employed to increase student retention (Donna, 2012).

Yoder (2012) noted that undergraduate engineering enrollment increased in the United States by 5.6 % from 2010-2011. Similar statistical data (NCES, 2009) show that undergraduate engineering enrollment from 2006 to 2010 increased by 5.3%; however, these increases in enrollment have not necessarily translated to equivalent increases in retention and graduation rates.

Retention and graduation rates of undergraduate students are also an institutional concern, especially during the first year (Knight et al., 2007), and require that attention be paid to changes that might be made campus-wide. The nonacademic factors that affect student retention include adjusting to a college environment, participating in student organizations, and coping with presence or lack of family and financial support. These nonacademic factors may have a different effect on undergraduate students in HBCU institutions. These nonacademic factors are typically assessed once students are enrolled in the university. Tinto (2007) noted that some additional factors include the student's level of commitment to graduate, academic self-assurance, study skills, and social integration into the university. These factors have been found to be strong indicators of student retention and a forward path to graduation.

Purpose of the Study

The purpose of this quantitative study was to determine the difference between academic factors and nonacademic factors as elements in student retention for undergraduate electronic engineering, other STEM, and nonSTEM students. The study used the College Student Inventory (CSI) by Noel-Levitz (2009) to discover if there is a correlation between program curriculum and nonacademic factors with student retention. The current study used the CSI survey to compare electronic engineering, other STEM, and nonSTEM students regarding the effect of first-year students' self-efficacy and perceptions of academic preparation at an HBCU in the United States to further understand variables that might affect retention.

Research Questions and Hypotheses

RQ1: Is there a difference in the relationship between first-year students' self-efficacy and perceptions of academic preparation and retention in year two for first-year undergraduate electronic engineering students, other STEM students, and nonSTEM students at an HBCU in a Mid-Atlantic state in the United States?

$H_0 1$: There is no significant difference in the relationship between first-year students' self-efficacy and perceptions of academic preparation and retention in year two for first-year undergraduate electronic engineering students, other STEM students, and non-STEM students at an HBCU in a Mid-Atlantic state in the United States..

H_a1: There is a significant difference in the relationship between first-year students' self-efficacy and perceptions of academic preparation and retention in year two for first-year undergraduate electronic engineering students, other STEM students, and non-STEM students at an HBCU in a Mid-Atlantic state in the United States.

RQ2: Is there a difference in the relationship between first-year students' perceptions of family, financial, and social support on retention in year 2 for first-year undergraduate electronic engineering students, other STEM students, and nonSTEM students at an HBCU in a Mid-Atlantic state in the United States?

H_02: There is no significant difference in the relationship between first-year students' perception of family, financial, and social support on retention in year 2 for first-year undergraduate electronic engineering students, other STEM students, and non-STEM students at an HBCU in a Mid-Atlantic state in the United States.

H_a2: There is a significant difference in the relationship between first-year students' perception of family, financial, and social support on retention in year 2 for first-year undergraduate electronic engineering students, other STEM students, and non-STEM students at an HBCU in a Mid-Atlantic state in the United States.

Theoretical Framework

The theoretical framework of this study used Tinto's (1975) theoretical contributions to understanding student persistence and attrition. Tinto formulated a theory that attempted to explain the processes motivating a student to remain enrolled in colleges and universities. Tinto's (2007) theory addresses the fundamental concepts of persistence, which defines the correlation between student motivation and academic skills, and the institution's academic and social environments. Tinto's theoretical framework has been used in many areas of higher education, specifically in undergraduate disciplines. This study used Tinto's theory as it has been applied to student academic and social integration. Via this model, Tinto also asserts that student retention depends on academic and nonacademic factors such as student coursework performance and institutional and family support.

Nature of the Study

The nature of the study was quantitative, using existing data gathered from one historically black state university. Data included retention rates to year 2 for electronic engineering, other STEM students, and nonSTEM students as well as archival, close-ended survey questions chosen to examine the effects of program curriculum and nonacademic factors on undergraduate electronic engineering programs, other STEM programs and compare them to non-STEM programs on student retention. The participants were previous respondents to the CSI consisting of a survey related to study skills, intellectual preferences, verbal, math, and science confidence, as well as family and financial support. This archival data was collected during 2012, 2013, and 2014, and were available from the college's Institutional Research office. A general linear method of analysis was use to analyze the data.

Definitions

In this study, I used the following terms, which may have multiple meanings. These definitions provide assistance in reading this study.

Student retention: A measure of student persistence in their academic performance, and measures of institutional commitment to students' academic success that result in graduation (Noel-Levitz, 2008).

Historical black college and university (HBCU): A historical black institution of higher education in the United States for the purpose of providing undergraduate and graduate education for the African American community (Office of Civil Rights, 1991).

Science technology, engineering, and mathematics (STEM): A program name for a cluster of majors in secondary and postsecondary education (NCES, 2011).

Assumptions

Two assumptions were built into this study that may impact the validity of these findings are (a) that participants provided responses that were truthful to all survey questions to the best of their knowledge and understanding of the meaning of all survey items, and (b) that participants' scale scores provided an accurate measure of factors that affect student retention. The CSI survey has been validated by Noel-Levitz (2008), leading to more confidence in the data than if I had designed a survey myself.

Scope and Delimitations

The scope of this study extends to undergraduate electronic engineering student retention and understanding it in relation to other STEM students and nonSTEM students at one public HBCU. Data was drawn from 3 recent years only. Retention was measured only to the start of year 2. First-time and full-time students who registered for at least 12 credits of coursework in the fall or spring semester of 2012, 2013, and 2014 were included in the study. There are delimitations in this study's design. The study participants did not include second, third, and fourth year undergraduate students.

Limitations

The following limitations may affect the findings of this study:

1. The unique characteristics of the students in this institution may affect the results in some unforeseen manner, making it harder to draw conclusions or apply the results to other settings.
2. The data provided from CSI survey contain variables that were used to measure background characteristics, degree aspiration, and self-perception of abilities to complete an undergraduate degree. It is possible that these variables may not adequately measure the constructs as intended, thereby limiting the viability of the findings.
3. Respondents provided self-reported data. It is possible that respondents may not have been truthful in their responses. If the respondents were not honest, then the results may be skewed.

4. Student participants who are electronic engineering, other STEM, and nonSTEM majors in first year in college were drawn from one HBCU institution located in the Central Atlantic states. Findings may not be applicable to other campuses and the engineering curriculum freshmen experience at this campus may not be comparable to other campuses.

Significance of the Study

Undergraduate engineering retention in United States is somewhat lower in comparison to other developed countries of Germany, the United Kingdom, and Finland, which all average 74% retention compared to United States' average of 72% (Marshall & Berland, 2012; NCES, 2008). This study may increase the awareness of how curriculum and nonacademic factors affect retention in undergraduate engineering programs. This study is significant to the site of this study, an HBCU, where undergraduate electronic engineering retention needs improvement. This institution is a public state university, where the state funding requirements are based on student enrollment, retention, and graduation numbers. Knowledge from this study may support engineering educators, particularly at the institution where this study is being conducted, and other HBCUs as they seek to design interventions to improve their undergraduate student retention. The results of this research may contribute to improving U.S. undergraduate engineering program retention rates. To improve student retention programs, curriculum and nonacademic factors must be addressed. This study may provide a body of evidence that might support continuous improvement in undergraduate engineering curriculum and pedagogy.

Summary

Student retention in undergraduate STEM disciplines, particularly engineering, is a major concern for many colleges and universities. Concerns regarding students' retention in undergraduate engineering programs are critical to the national workforce. This study examined factors that affect engineering students' retention. The theoretical framework of this study used literature related to student persistence and attrition based on Tinto's theory.

Chapter 2: Literature Review

Introduction

In this chapter, I describe the method used for the collection of articles for the literature review and explain the theoretical and empirical studies that attempt to demonstrate why students leave or stay in college. In this chapter, I also analyze the empirical literature on undergraduate STEM retention, student engagement and retention, academic achievement and student retention, institutional factors in student retention, and the role of colleges and universities in retaining their enrolled students.

The purpose of this study was to determine the difference between academic factors and nonacademic factors as elements in student retention for undergraduate electronic engineering, other STEM, and nonSTEM students regarding student retention during their freshman to sophomore year in a 4-year HBCU in the United States. Student retention in undergraduate engineering programs faces challenges similar to other STEM programs. These challenges have led to changes in recruitment and pedagogical methods used in preparing undergraduate students in these programs, particularly in HBCUs, where undergraduate student retention efforts have not shown significant improvement in student retention. Meeting enrollment numbers is another institutional challenge at HBCUs.

Literature Search Strategy

For the literature search and review, I used several libraries to seek out related research studies, including Norfolk State University, Old Dominion University, and Walden University in addition to resources at the American Society of Engineering

Education. The research databases I used included EBSCO and SAGE Premier. The key terms that were used for the literature search included *undergraduate student retention*, *retention and engineering student*, and *retention rates and graduation of STEM major*. This study used literature from peer reviewed journals from 2008 to 2016.

In this chapter, I describe the stages of retention research development, undergraduate STEM retention, nonacademic factors and student retention, student retention and self-efficacy, undergraduate student engagement and retention, academic achievement and student retention, and institutional factors and student retention. All the subsections describe the importance of student retention in undergraduate education.

Theoretical Foundation

Tinto (2007) formulated a theory that attempted to explain the processes that motivate students to leave or stay in U.S. colleges and universities. Tinto's theory addresses the fundamental concepts of persistence, which include a correlation between learner motivation and academic skills, and an institution's educational and social environments. Tinto's theoretical framework has been used in many areas of higher education, specifically in U.S. undergraduate academic disciplines. Tinto's model also shows that student retention depends on academic and nonacademic factors such as academic performance, institutional support, and family support.

Experts and scholars of higher education have used various definitions of student retention by amplifying certain elements based on their own theoretical perspectives. Terrell (2007) defined student retention as a student's successful completion of a degree program. Tinto's (1998) definition includes meeting educational goals, whether based on course by course success, or credit hours attained that indicate achievement in certain skill sets. According to Sutton and Sankar's (2011) definition, student academic success includes social integration and fit into the college community. In a similar view, Wilson et al. (2011) described student academic success in retention as when students' motivation matches their academic ability and social characteristics.

Tinto's model (1987) of institutional departure is supported by other studies reviewed in this chapter, which offer findings regarding institutional practices and designed methods of retaining students. Tinto's theory (2007) suggests institutional recruitment practices must embrace diversity in their student population and encourage positive learning experience, which must promote student academic success and career planning. Institutional supports must provide enhanced social integration and student institution compatibility and provide adequate financial resources built on student need (Tinto, 2007).

Tinto's (2007) theory is part of the development of the study of retention. Ohland et al. (2011) discussed four historical stages of retention research development. First, they found researchers focused on retention as an element of enrollment management that enabled researchers to create predictive models for attrition. Second, researchers shifted their attention to methods that reduce student attrition, especially those with an elevated risk, and searched for new strategies to achieve measurable outcomes. Third, academic interest expanded to include institutional factors for success, and concentrated on improving student retention by creating successful strategies that involve a campus wide effort. The fourth stage represented an institutional approach that considered faculty and staff competencies and the effect of caring attitudes and their impact on student retention.

Tinto (1998, 2007) noted that social integration and academics are crucial in minimizing dropout rates, with positive student and faculty relationships fostering retention. Tinto's (1998) theory directs attention to the significance of collaboration between individual and institutional components, without devaluing the importance of academic and social integration frameworks. Min, Zhang, Long, Anderson, and Ohland, (2011) suggested that there are models that combine background variables and individual characteristics. These variables include high school experience, education ambitions, and family support and are indicators of student academic standing, social assimilation in college settings, and how well students can negotiate and interact within organizational structures.

Astin and Sax (1997) claimed that student retention to graduation must emphasize student engagement and create mechanisms for student involvement. Student participation in academic and cocurricular activities is essential to retention. Student academic involvement is primarily measured by how much time is spent on academic tasks and studies. Development of advanced cognitive skills such as comprehension, analysis, application, synthesis, and assessment may determine student success. Student involvement in co curricular activities engages students in academic or preprofessional memberships and organized campus student activities reflecting institutional educational goals**.** Similarly, Kuh (2007) noted that student engagement has an important place in determining student success by creating activities that activate student learning and maintain academic focus and motivation. Kuh further noted that when students remain engaged, they access institutional resources and endeavor to succeed; however, these engagement activities vary because of institutional availability or support.

For years, educators and researchers have acknowledged there is a connection between student academic progress and student retention in colleges and universities (Amelink & Creamer, 2010). As college age populations become more diverse, this increases concern regarding the low retention rates that exist with minority and economically disadvantaged learners. Two important questions emerge from the literature reviews that underpin the theoretical framework of Tinto's (1987) student retention models: Why do students leave? Why do students remain? Tseng, Chen, and Sheppard (2011) noted that complexities surrounding student retention have led many colleges and universities to direct additional institutional resources to student populations identified as high-risk.

Retention Studies

Retention is one of the main focuses of institutional effectiveness for colleges and universities; however, the research has not fully supported a single dominant theory. Some studies have directed their attention to certain aspects of retention such as attrition, persistence, or graduation rates to assist in understanding the complexity of retention in higher education. In a policy report, ACT (2014) made recommendations based on several years of research on student retention practices and academic advising from colleges and universities, noting that an integrated approach is crucial to student retention through graduation. The report recommended that colleges and universities need to identify student characteristics and needs, set priorities as a measurement for the types of resources needed to increase student retention, integrate academic and nonacademic factors, and develop an academic. socially supportive, and inclusive learning climate. The report claimed that student scholastic support experiences must be comprehensive. In addition ,the report validated institutional early alert systems that assess, monitor, and effectively respond to the needs of at-risk students. In a more recent review of the literature, Marshall and Berland (2012) identified causes of attrition that could be caught by such early warning systems, including student academic boredom and uncertainty, transition and adjustment difficulties, and limited or unrealistic college expectations due to secondary school under-preparedness.

Undergraduate STEM and Retention

Retention has been a major issue in some colleges and universities, especially in HBCU undergraduate programs. Baber (2015) noted that retention is a “quiet crisis” which he described as the failure of U.S. institutions at the primary level (K-12), at the beginning of post-secondary level (higher education), and at the back-end of the post-secondary experience to prepare enough scientists and engineers for success in a highly technological globalized economy. Retaining engineering, science, and mathematics undergraduates through their first year to graduation is an important factor in alleviating this crisis (Meyer & Marx, 2014). Wilson et al. (2011) claimed that the majority of engineering students drop out of their programs due to inadequacies in four categories: (a) academic support and career counseling, faculty advising, (c) engineering program organization and curriculum, and (d) high school preparation for higher education.

Gershenfeld, Hood, and Zhan (2014) examined the importance of initial semester grade point average (GPA) as a means of predicting underrepresented student graduation rates. The study used graduation rates and GPAs of more than 1,900 undergraduate students who were enrolled in 2005 and 2006; a logistic regression model was employed to assess the data. The research found that academic performance in a first semester with a GPA below 2.0 on a 4.0 scale was correlated to underrepresented student graduation rates. It also noted that a low GPA may indicate that these students may not graduate within a 4 to 6 year period.

Walkins and Mazur's (2013) research suggested that one reason for low GPA might be the method of teaching in STEM classes. Walkins and Mazur's study used two methods of teaching, traditional lecture or peer instruction method, to teach introductory physics courses to more than 200 students and then determined the number of students who switched majors from STEM after taking the physics course. The study found that students who received the traditional lecture method of instruction were two times as likely to switch their majors from STEM in comparison to students who received their information through peer instruction methods. The findings of this study are also supported by Seymour (2006) who noted that students who leave STEM majors expressed their lack of interest in science and engineering introductory courses because of faculty teaching methods. This lack of student interest in introductory STEM courses affects undergraduate STEM retention. Improving instructional methods through students' active engagement in classroom and laboratory activities may promote STEM retention (James & Willoughby, 2011).

To improve the number of underrepresented minorities in STEM, Brothers and Knox (2013) explored in an essay some of the best practices used to increase retention of underrepresented minority students in STEM undergraduate programs. The authors examined best practices in STEM programs at six institutions within the Tennessee higher education system. All participating institutions were subsidized by the National Science Foundation through the Louis Stokes Alliance for Minority Participation program. The authors identified similarities in their best practices for recruitment and retention strategies. Some of the practices included peer mentoring, summer bridge programs, and undergraduate research programs. The study also found that each institution created their model to fit their students' needs.

Research studies have been conducted on individual factors influencing college student dropout rates. Meyer and Marx (2014) explored the experience of four undergraduate students who dropped out of an engineering program. This study used interviews to capture student experiences in order to understand the reasons why they dropped out of college. Meyer and Marx found that individual student factors such as poor academic preparation, lack of readiness for engineering course rigor, and lack of perseverance were significant. An institutional variable was their disappointment with engineering academic advising. Min et al.'s (2011) quantitative study also investigated the departure of undergraduate engineering students, focusing on the effect of cohort, gender, ethnicity, and math and verbal SAT scores from a longitudinal database for the purpose of researching engineering development in nine public higher education institutions located in Southeastern United States. The data used were all from freshman participants who declared their major as engineering from 1987 to 2004 and included more than 100,179 participants. Using a nonparametric survival analysis, the study found that students with low math and high verbal SAT scores were more inclined to leave engineering programs compared with students who demonstrated high math and low verbal SAT scores.

Meyer and Marx (2014) noted that even with high SAT score in mathematics, achievements in secondary high school math and science courses did not assure student success in first-year engineering classes among the four students they interviewed. This discrepancy may be due to a wide divergence in academic standards of achievement adopted by each school district for secondary education, in addition to the quality of education offered.

Institutional Factors and Student Retention

Researchers and institutions have tried to discover the key factors that point to why students leave or remain in the institution. Seymour (2006) noted in an essay that engineering students were disappointed with their program of study and structure. Other research studies with similar outcomes have attributed this dissatisfaction to inadequate advising, teaching, mentoring, or the lack of program connection to intended field of practice. In addition, inadequate counseling, and a culture that is perceived as unreceptive in some engineering departments where there is no active student professional organization are viewed as factors in this decision. Haag and Collofello (2008), based on an institutional database report on student surveys that assessed attitude and college experiences in engineering majors, noted in their essay's conclusion, that a learning environment where faculty members are unapproachable makes academic integration more difficult for first-year students who are migrating from a single building learning environment to a multiple buildings setting coupled with complicated engineering curricula.

The sequential structure of an engineering program creates a curriculum flow chart for students to follow. Such program flow charts can be used by faculty members to enhance their provision of academic advising. Haag and Collofello (2008) used an institutional database of more than 5000 engineering students from one institution located in Midwestern region of United States. The authors used logistic regression and multivariate analysis. They found that use of the academic flow chart without academic advising created complaints from students not satisfied with their engineering academic advising, which resulted in attrition. Students' satisfaction has been found to start with good academic advising, which enhances student academic performance, and therefore, fewer students may drop out (Wilson et al., 2014). Haag and Collofello reported that 53% of students in engineering were unhappy with their academic advising experience, or how academic requirements and coursework were presented to them during advising. In addition, many students did not believe they were allowed adequate time for advising services because instructors were too busy or not available.

Tseng et al. (2011) found a positive correlation between learners and advisers when students were given additional time to ask questions; this was effective in growing retention and helped ease transition, especially for first-year undergraduates who were thinking of dropping out, or changing their major from engineering. Some studies have also noted that student success in engineering programs is connected to the professor and student relationship. Students see the relationship as a sense of belonging and caring for their successful completion of an engineering program (Hurtado, Eagan, & Chang, 2010).

Effective academic advising plays a positive role in student academic achievement and retention, as well as a positive perception of the institution (Menekse et al., 2013). Bean and Eaton (2008) saw student advising as an effective academic process that develops student and faculty quality interactions in advising. Academic relationships with faculty advisors are important in helping students feel connected to faculty, particularly first-year students. One of the undergraduate program goals is to prepare learners for careers in their respective disciplines or future enrollment in graduate school. This implies that when students see their academic achievement and believe they are equipped for professional advancement or postgraduate education, they are more inclined to complete their degree program (Adam et al., 2011).

Tinto (2007) described that the link between student retention and faculty development has not been fully developed. Seymour, in a congressional subcommittee hearing on science noted that, “What I think is underlying the problem we face is a historic decline in the perceived value of teaching” (Seymour & Hewitt, p.3, 1997). Seymour’s explanation of the reason for the deterioration in the significance of teaching is the absence of professional development programs for instructors at the university. Yoder (2012) noted this faculty resistance, and that higher education leaders link instructional quality to student retention. Faculty members see their roles as that of teacher or researcher, not as an academic counselor, and they do not consider that modifications in student and faculty relationships would grow retention (Austin, Connolly, & Colbeck, 2008).

Student Engagement and Retention

Research studies on student engagement have shown student engagement and experience to be predictive of persistence among undergraduate engineering students. Student engagement in engineering curriculum through internships was found by Gershenfeld et al. (2014) to impact retention and students' success. Hernandez, Schultz, Estrada, Woodcock, and Chance (2013) completed a longitudinal study based on goal theory to provide an understanding of underrepresented minorities' academic performance and persistence in undergraduate STEM disciplines. They surveyed participants from 38 institutions in the United States, using structural sequence modeling to analyze 3 years of data from more than 1,400 participants. The study found that underrepresented learners who participated in undergraduate work in STEM disciplines were motivated to be persistent in their academics. Undergraduate research is one factor identified as beneficial for students that has emerged from the National Survey of Student Engagement. However, Hsung (2012) argued that underrepresented minorities in STEM majors would need more than just undergraduate research experience, but a cooperative learning environment that encourages group work in all their learning activities.

Studies have also identified some important differences among students who persist in their field of study, and those who switch majors in order to complete a degree. Students who struggle in their academic performance are more likely to change majors or leave college. Some of the aspects that influence student decision to major and remain in engineering disciplines do not have as much to do with ability, and more to do with student approaches, program organization, quality of academic advising, and curriculum and teaching effectiveness (Hernandez et al., 2013; Seymour, 2006). Studies that look at how different curricular and instructional methods affect student satisfaction, as well as student learning outcomes for undergraduate engineering or other STEM student experiences in comparison with non-STEM students, are very rare (Lichtenstein et al., 2010).

Singer and Smith (2013) suggested that students' experience prior to college and interaction with college experience has a lot to do with academic achievement and academic management skills. This study used "quality of effort" as an indicator of learner engagement and success, where the relationship between students' participation and their educational experiences provide effective retention. The study used a college student experiences questionnaire as the survey instrument, which is used to measure students' efforts into their studies, and how institution organization and policy deploys their resources to improve students' participations in learning activities and experiences.

Academic Achievement and Student Retention

Student success in academic achievement is a positive indicator for student retention in his or her academic program. For many students, their academic achievement is their motivational drive to continue with their education and finish their degree program. Menekse et al. (2013) completed a study based on presenting course materials in STEM to students using three different types of learning modes (active, constructive, and interactive) to understand the effect of learning mode in test and quiz scores, and in relation to undergraduate retention. ANOVA analysis was used, through a one-way repeated measure of tests and quizzes.

Effective academic advising played a positive role in students' academic achievement and retention, and a positive perception of the institution (Menekse et al., 2013). Bean and Eaton (2008) saw student advising as an effective academic process that develops student and faculty quality interactions in advising. Academic relationships with faculty advisors are important for undergraduates to feel connected to faculty, particularly first-year students. One of the undergraduate program goals is to assist learners with finding careers in their chosen field or further graduate education. This implies that when students see their academic achievement, and believe they are ready for professional positions or graduate programs, they are more inclined to complete their degree program of study (Adam et al., 2011).

Billups (2008) noted the importance of faculty members as social agents for helping students to adjust to college life and their academic settings. This author further noted that where faculty members are fully engaged with students' academic success and nonacademic activities, these types of supports provide strong self-confidence for first and second year students. Prior studies also indicated that in addition to effective academic advising, smaller class sizes were found to be important to student satisfaction and learning experiences because they provide an increase in attention and interaction between students and faculty in their learning settings (Parayitam, Desail, & Phelps, 2007).

Students' perception of the grading system in both major and non-major courses defines student academic satisfaction and progress (Parayitam et al. 2007). When students see the grading procedures to be fair, it creates a feeling of satisfaction in their academic program. Prior studies have shown that assessment of student work is a very significant factor to their overall satisfaction to complete their program of study (Sampson, Leonard, Ballenger, & Coleman, 2010). Hsieh, Sullivan, Sass, and Guerra's (2012) study used a theoretical model to examine the relationship between course final grade and academic variables to understand undergraduate engineering student academic performance and retention. The study used algebra math test scores from engineering students in a large institution located in southwest region of United States. The authors used a correlational analysis for data analysis, and found that there was a significant relationship between student academic factors and student retention. Specifically math test scores were a strong predictor of success among undergraduate engineering students.

Student Retention and Self-Efficacy

Undergraduate engineering retention is a major concern to colleges and universities, and it has become an academic research area of interest for both internal and external institutional reasons. The engineering field is a practice focused learning profession where learning goals and student retention has a promising link with the concept of self-efficacy theory (Kahn & Nauta, 2009). Self-efficacy can be explained as a person's perceived level of ability and willingness, or the extent he or she believes they are able to finish a task. There are dynamics that influence experience and changes with time. Self-efficacy expectations are important for student learning and determine whether an individual will demonstrate or attempt a given behavior. Bandura (as cited in Raelin et al., 2014) identified four areas of performance achievements: vicarious experience, verbal persuasion, and physiological and affective states (p 602). Expanding on the general concept of self-efficacy, Lent et al. (2002), developed a social cognitive career theory. These researchers described a conceptual framework geared toward discovering the mechanisms through which individuals formulate educational or vocational interests. Students' academic success increases their self-efficacy beliefs. Gershenfeld et al. (2014) noted a longitudinal study that indicated a low first semester GPA is one of the main reasons why students change their major, or dropped out of their institution. Other reasons for this behavior included academic problems, the incompatibility of educational and professional goals, and a lack of assimilation into the academic and social campus environment.

Analysis of data from the National Survey of Student Engagement suggested that undergraduates who persisted in STEM majors participate more in internships and job co-op program experiences, suggesting that work experience that is related to the major increases retention. However, students who were employed off campus in unrelated jobs were most inclined to leave their program after taking some general education classes and not doing well in those classes (Gershenfeld et al., 2014).

Raelin et al. (2014) and Casentino de Cohen (2009) noted that women and minorities are lacking in representation in engineering disciplines. Between 2000 and 2011 the number of women who earned an undergraduate engineering degree dropped from 20.6% to 18.4% (Yoder, 2012). According to a National Science Board report, only

13% of engineering positions are held by women (National Science Board, 2015). To help students make meaningful career choices, and achieve success in their educational and occupational disciplines, social cognitive career theory stresses the function of conceptual and learning variables and provides a means to address the discouraging factors. In particular, this can be applied to those underrepresented occupations such as engineering and other STEM careers (Friedlander, Reid, Shupak, & Cribbie, (2007).

Some models have made an attempt to explain the reason students are dropping out of undergraduate programs. These models are also influenced by social cognitive career theory through the role of self-efficacy that provides a connection of personal agency in career planning and path (Schmidt, Hardinge, & Rokutani, 2012). Self-efficacy traits are crucial to enhancing students' perceptions of the consequence of staying in school and succeeding in college (Friedlander et al., 2007; Raelin et al., 2014).

Social and Family Support and Undergraduate Retention

Few studies of retention have addressed the issue of nonacademic factors which include social and family support that affect undergraduate students retention (Jamelske, 2009). It is likely that a combination of both academic and factors have an impact on student retention. Jamelske (2009) noted that colleges and universities strive and plan for comprehensive retention programs, but institutions also understand the complexity and dynamic involvement between nonacademic and academic factors. Therefore, colleges and universities must develop strategies that will combine these factors together for retention programs. Koenig, Schen, Edwards, and Bao (2012), in a quantitative study where the participants were first year undergraduate students, found that both nonacademic and academic aspects were very important in a student's decision to either stay or leave college. This study noted that collecting and applying accurate and comprehensive information about student needs is significant to enhancing their success in college.

Jamelske (2009) noted that colleges and universities strive and plan for comprehensive retention programs, but institutions also understand the complexity and dynamic involvement between nonacademic and academic factors. Colleges and universities, therefore, must develop strategies that will combine these factors together for retention programs.

Hutchison-Green, Follman, and Bodner (2010) noted that the socioeconomic status of the students' parents is a strong nonacademic factor that influences student retention or continued enrollment in college. They found parents' economic status helps provide financial support and encouragement to keep the student enrolled, whereas, students with less financial support are more inclined to leave of college. Many colleges and universities know the importance of financial aid support for students to continue enrollment in their academic programs. Institutions also recognize that students with little or no financial aid are more likely to seek additional funding sources by way of having a job. These types of students are at a higher risk of leaving their higher education studies compared to those students who are financially stable (Ishitani & DesJardins, 2002).

Ishitani and Des-Jardins's (2002) work was based on a study of U.S. students who dropped out of college, the Beginning Post-secondary Students Longitudinal Survey, sponsored by the National Center for Education Statistics (NCES), They found that basic academic skills including organization of time, study behaviors, attending classes regularly, and being on time for class were correlated with positive retention characteristics. Other contextual influences must be taken into consideration that include student financial support, institution population size, and why students choose to attend that institution. Student confidence and self-esteem are motivation factors that help students to understand institution commitment to their educational goals.

Summary

In this chapter I have examined theory and research related to undergraduate retention in engineering and non-STEM students. For many years, student retention has been a concern of engineering educators. The challenges and level of difficulties facing STEM programs are related to recruitment, retention, and graduation rates. Previous research was summarized showing non-cognitive characteristics as contributing to the academic success of first-year undergraduate student.

Tinto’s (2007) student integration model was discussed as the study’s theoretical framework. Chapter 3 covers the overall research design along with the statistical methods and survey instrument used in this study.

Chapter 3 Research Method

Introduction

The purpose of this study was to determine the difference between program curriculum and nonacademic influences as factors in student retention for undergraduate electronic engineering students, other STEM students, and nonSTEM students. The design for this study was quantitative, and it employed a general linear model analysis method. The central phenomenon of this study was retention of electronic engineering students and their possibly unique attributes and perceptions compared to nonSTEM students. This chapter describes the study’s research design, site and sample selection, instrumentation and operationalization of construct, data collection procedures, data analysis, validity and reliability of the instrument, threats to validity, and ethical procedures.

Research Design and Rationale

This study was designed to explore the following research questions:

RQ1: Is there a difference in the first-year students’ self-efficacy and perceptions of academic preparation and retention in year two for first-year undergraduate electronic engineering students, other STEM students, and non-STEM students at an HBCU in a Mid-Atlantic state in the United States?

RQ2: Is there a difference in the relationship between first-year students’ perception of family, financial, and social support on retention in year two for first-year undergraduate electronic engineering students, other STEM students, and non-STEM students at an HBCU in a Mid-Atlantic state in the United States?

The central phenomenon of this study was retention of electronic engineering students and their possibly unique attributes and perceptions compared to other STEM students and nonSTEM students.

The design for this study was quantitative and employed general linear model analysis methods. This study used existing survey data to help explain the phenomenon of retention of engineering students at an HBCU. I did not assign any treatment conditions and did not explore any experimental techniques in data collection and analysis that would risk ethical challenges.

The degree of correspondence and directional relationships between predictors and outcome or variables is determined by correlational methodology design (Fielder, 2011; Gravetter & Wallnau, 2009). The results of correlational design studies do not support casual relationships; therefore, no assumption of causality should be concluded from the results. However, in the data analysis phase, some correlational studies allow limited inferences where multiple regression or partial correlation is used (Tyson, 2011).

Based on Creswell’s (2014) definitions, a qualitative design would not have been appropriate or compatible with the purpose of this study. A good qualitative study on retention might demand collecting interview data over time, and I am not available to do this. I also sought a large dataset which would not have been possible to collect in a qualitative study. Analyzing a large set of preexisting survey data allowed me to understand the relationship of program curriculum and nonacademic factors to student retention. This study used existing survey data for analysis.

Method

This study research design used quantitative methodology. The target population was first-year undergraduate electronic engineering students, other STEM students and nonSTEM students at a historical black university.

Site and Sample Selection

An overview of the institution where this study took place was useful in understanding the selection of the site. The study institution is a historically black, midsize state university with a student enrollment of approximately 6,500 students. It is a teaching and research university located in a Mid-Atlantic state of United States. Students who apply to this institution and complete an application for admission into an undergraduate program are required to select a major from more than 60 undergraduate academic programs offered by four colleges within the institution. Admission data allowed me to determine the proportion of electronic engineering majors, which is the only engineering program, to other STEM majors and nonSTEM majors. The entering students also completed the CSI, the tool used for instrumentation in my study. Below in Table 1 is the list of STEM and nonSTEM majors.

Table 1

List of Academic Program By Major

STEM majors	NonSTEM majors
Biology	English
Computer Science	Fine art and
Chemistry	History
Electronic Engineering	Mass Communications
Mathematics	Journalism
Nursing and Allied Health	Music
Physics	Political Science
Information Technology	Psychology
Medical Technology	Sociology
Computer Technology	Accountancy
Electronic Technology	Business
Health Services management	Early Childhood Education
	Health and Physical Education
	Tourism and Hospitality Management

Institutional data from 2012 to 2014 including enrollment management reports have shown an average of 519 first-year students over these 3 years. In 2012, approximately 4% of the total first-time students were electronic engineering majors, and 35% were other STEM majors. nonSTEM first-time students composed 61% of the majors. In 2013, of the total first time students, 4% were electronic engineering majors, 39% were other STEM majors, and 61% were nonSTEM majors. The report data in 2014 shows that first-time electronic engineering students were 0.9 %, (indicating a significant drop in initial enrollment), other STEM majors were 35%, and 65% were nonSTEM majors.

In order to determine the appropriate sample size in this research, statistical power, alpha, and effect size were established. This study used G* power 3 (version 3.0) with settings of 0.80 or 0.90 probability power, 0.05 for alpha calculation, and effect size of Cohen d = 0.05 to 0.080 with two independent variables (Burkholder, 2012). Of the average population of 417 new students each year, the sample size of students who completed the CSI survey (Noel-Levitz, 2009) was determined to insure that the response rate by the small pool of electronic engineering majors was adequate for analysis. A sample size indicator suggested that I would need 50-100 respondents in each of the 3 years.

Existing responses to the CSI survey (Noel-Levitz, 2009) were used, drawing on first-year student responses from the last 3 years (2012, 2013, and 2014). I used data from the engineering and other STEM majors as well as nonSTEM majors. I also used college majors and student identification numbers to identify electronic engineering, other STEM, and nonSTEM students to ensure confidentiality.

Data used was from a convenience sampling from a large population from whom direct and accessible data was collected during routine surveying. Because each cohort of first-time students responded to the same survey for 3 years, the data was easily accessible. This type of sampling design provides an advantage, particularly from individuals who are familiar with the use of technology for educational reasons, such as college students. Convenience sampling does not allow for randomization, but provides population accessibility, and therefore allows for readiness of data analysis (Matusovich, Streveler, & Miller, 2011). The campus office of enrollment management and the office of institutional research personnel administer the survey each year and claim the response rate over 3 years (i.e., 2012, 2013, and 2014) has been between 70% and 80%. The data were collected from newly matriculated students in September and January of every fall and spring semester. Participants were required to participate in the CSI survey in a computer-based setting as part of course requirements in freshmen seminar classes.

Instrumentation and Operationalization of Constructs

The data set for this study was created from a secondary data report that was provided by two departmental offices of the institution that administered the survey, the office of enrollment management and the office of institutional effectiveness and sponsored research programs. A request was made to the enrollment management office to provide reports with the following information about the participants admitted into the university's undergraduate program during the selected 3 academic years. The information included the student's identification number, choice of major, and enrollment in a fall or spring (2012 or 2013 or 2014) school term. The student's identification number that is provided by enrollment management office was used to determine the student's full-time status, course credits, and first-year status. The office provided the same information for those students who continue to their second school year in January or September.

The office of institutional research provided the responses to selected survey questions of students who participated in the CSI survey in the fall or spring of 2012, 2013, and 2014. The survey questions have been clustered to address the variables represented by this study's research questions. The participants were identified using the student identification numbers that matched the identification numbers of the full-time and first-year students provided by the office of enrollment management. Through student identification numbers, the study was able to identify participants' college major.

Validity and Reliability of the CSI Instrument

The CSI profile includes student demographics, secondary school experiences, reasons for pursuing higher education, expectations of college or university experience, family support, financial assistance, degree objectives, career and life goals, personal attitudes, and life plans. Overall, the CSI survey is a standardized survey instrument that consists of multiple sections with 100 questionnaire items. Validity is the extent to which the CSI survey measures what it intends to measure, as listed in Table 2. General linear model analysis is a statistical technique that groups like items measuring the same construct to determine if all the items have the same impact on results.

Content validity can be described as the degree to which a researcher expects that the instrument captures the central phenomenon of the study (Creswell, 2014). The content validity of the CSI survey is based on the recent assessment made by the Noel-Levitz Advisory Board (2013). This board of higher education experts from across the United States and Canada ensures that the CSI survey continues to meet its intended purpose. The CSI is administered by hundreds of institutions of higher education in the United States and Canada, with thousands of students participating every year.

Instrument reliability is defined by the extent to which an instrument is internally consistent, and shown by the continuity of stable measures over a given period of time (Sutton & Sankar, 2011). The consistency of answers for the majority of the CSI survey items has remained stable over its 3 decades of existence, which indicates its reliability (Noel-Levitz, 2008). For example, Miller (2005) conducted a study to examine the reliability and validity of the CSI-Form B. Miller found that the overall scale reliability or Cronbach's alpha was 0.79, considering 17 of the 18 scales and 85 of the 105 items (Miller, 2005). Miller's study's exclusions included the internal validity category comprised of 5 items and the 20 items related to background and demographic information. The majority of the scales, 13 of 17, had reliability coefficients that met or exceeded a coefficient of 0.80.

Studies have been performed to discover the predictive validity of the CSI Form B. As described above, Miller (2005) conducted a validity study on freshman year enrollment retention. The study used the CSI-Form B to determine the dropout proneness and predict academic difficulty composite scales by testing the predictive validity. Miller's study also used 2001 data based on student enrollment and GPA. Finally, the conclusions of Miller's study were based on the following assessments:

1. Predicted academic difficulty and dropout proneness that showed significant relationships with the student's respective criterion variables, a cumulative GPA, and dropout proneness.
2. Academic performance such as high school GPA was used and thus determined that student academic success was outperformed on both scales (e.g., dropout proneness and predicted academic difficulty).

Given that the purpose of this study, which is to test whether CSI-Form B scores will significantly predict first-year student retention, and the difference between electronic engineering, other STEM and non-STEM majors.

Data Collection and Procedures

Data collection started after I received approval from both the Institutional Review Board (IRB) of the institutional research site and Walden University. The Walden IRB number was 4.215. The IRB office at the institutional research site has permission from Noel-Levitz, the survey designer, to share the results. A request detailing the stated purpose of the study, research questions, sample selection, and methodology was submitted to the institutional research site. IRB approval was documented, indicating I may conduct my study at the institution. I requested the data set from the office of enrollment management and the office of institutional research, assessment and planning, which are responsible for administering the CSI survey.

The CSI data set was collected by the HBCU's institutional research office in an effort to examine the characteristics of the first-year entering student body. The CSI survey is administered as a routine process every year during the first 3 weeks of classes. Institutional guidelines are set for proctoring of the CSI survey, which is computer-based, and thereby, provides flexibility to enable 70 to 80% participation of all first-year students. The institutional research office used the list of first-year student cohorts of 2012, 2013, and 2014, and identification numbers to find CSI data of those students who completed the survey. The student's CSI and retention data sets that was available for analysis was not included in the students' identification numbers. Considering the absence of student identification numbers, the anonymity of participants was maintained.

The CSI Survey Operationalization of Variables

The CSI, a well-known survey instrument since the 1980s, is designed and published by Noel-Levitz Inc, a consultant for higher education. As mentioned earlier, this instrument have been used by many institutions of higher education in the United States and Canada, and has its reliability and validity with consistent results (Miller, 2005).

Considering the purpose of this study, not all of the 105 CSI survey items within the 18 independent scales are appropriate. Instead, the study used 10 of the 17 independent scales that represent the three categories of the CSI survey (see column 1, Table 2). These 10 scales are considered relevant to the research questions and analysis of this study and were used to represent the variables (see Table 2). Appendix A shows the list of the 32 CSI survey instrument questions that make up the 10 scales related to the study research questions.

Table 2

College Student Inventory Categories and Study Variables Drawn from 10 Scales

CSI-form B categories	Variables used in study
Academic motivation (academic factors)	Study habits Intellectual interest
	Verbal and writing confidence
	Math and science confidence
	Academic Assistance
s	Desire to finish college Attitude towards educator
General coping ability (nonacademic factors)	Family emotional support
	Sense of financial security
	Sociability
Receptivity to support services	(no variable used in study)

The study used five variables that measure academic factors, (i.e., study habits, intellectual interest, verbal and writing confidence, math and science confidence, and academic assistance).A participant's study habits are measured by survey questions that address the willingness to make a sacrifice and achieve success in their academic pursuit. A survey question reflecting enjoyment of the learning process demonstrates intellectual interest scale. What describes the degree of student interest in intellectual discussion and ideas depends on self-motivation in the learning environment. The CSI's verbal and writing confidence variable measures the level of confidence and capability to excel in courses that substantially rely on writing and speaking in public. Writing and public speaking tasks are an indicator of self-esteem that defines student interest and motivation.

The scale that measures math and science confidence attends to the student's perceived academic capability and confidence in math and science tasks, which is relative to the undergraduate engineering curriculum or engineering coursework requiring significant mathematics. Overall, this scale (desire to finish college) measures the degree to which students value, and also perceive, the long-term benefits of completing a college education. The desire to finish college scale is an indicator that identifies students who possess a high interest and determination to graduate regardless of previous academic achievements. Attitude towards educator is a variable that measures student feelings towards their learning experiences with the educators.

The second of the three categories of scales, the General Coping category, measures the relationship between sociability and nonacademic factors, and students' interest in joining social activities. The family emotional support scale measures the quality and satisfaction of students' communication with family and how much support they received from the family for college endeavors. The sense of financial security scale quantifies the extent a student believes he or she is confident in meeting financial obligations as related to enrollment in college. Only one scale in the last of the three categories of scales, which is receptivity to student services, describing academic assistance and associated with the student's desire for tutoring in a specified course.

Data Analysis Procedures

This study used the following research questions and hypotheses to analyze the data set.

RQ1: Is there a difference in the relationship between first-year students’ self-efficacy and perceptions of academic preparation and retention in year two for first-year undergraduate electronic engineering students, other STEM students, and non-STEM students at an HBCU in a Mid-Atlantic state in the United States

$H_0$1: There is no significant difference in the first-year students’ self-efficacy, and perceptions of academic preparation on retention in year two for first-year undergraduate electronic engineering students, other STEM students, and non-STEM students at an HBCU in a Mid-Atlantic state in the United States.

H_a1: There is a significant difference in the relationship between first-year students’ self-efficacy, and perceptions of academic preparation on retention in year two for first-year undergraduate electronic engineering students, other STEM, and non-STEM students at an HBCU in a Mid-Atlantic state in the United States.

RQ2: Is there a difference in the relationship between first-year students’ perception of family, financial, and social support on retention in year two for first-year undergraduate electronic engineering students’ retention, other STEM students, and non-STEM students at an HBCU in a Mid-Atlantic state in the United States?

$H_0 2$: There is no significant difference in the relationship between first-year students' perception of family, financial, and social support on retention in year two for first-year undergraduate electronic engineering students', other STEM students, and non-STEM students at an HBCU in a Mid-Atlantic state in the United States.

$H_a 2$: There is a significant difference in the relationship between first-year students' perception of family, financial, and social support on retention in year two for first-year undergraduate electronic engineering students', other STEM students, and non-STEM students at an HBCU in a Mid-Atlantic state in the United States

Secondary data analysis for this study employed the use of Statistics Package for the Social Science (IBM SPSS Version 21). The analysis was conducted on previously collected survey data and enrollment data in an attempt to answer new research questions as posed by this study. An inferential statistics method was utilized in connection with the research questions. Descriptive statistics were used to describe the general characteristics of the study sample. General linear model analysis was used for the two research questions, to determine the relationships among the independent variables in Table 2, which were study habits, intellectual interest, verbal and writing confidence, math and science confidence, desire to finish college, attitude towards educator, family emotional support, sense of financial security, sociability, academic assistance, and retention as the dependent variable, and the difference between engineering and non-engineering undergraduates. This analysis helped in the interpretation of the study groups, which are the undergraduate electronic engineering, other STEM and non-STEM majors (Matusovich, 2011). Some studies have noted the advantage of this type of method (Eris et al., 2010).

The study classified the participants into one of three types of majors: electronic engineering major (EM), non-STEM (NSTEM), and other STEM (OSTEM) majors based on the enrollment data provided by the office of institutional research, and undergraduate enrollment management office (i.e., admissions) for the years 2012, 2013, and 2014. For this classification variable, it is appropriate to assign dummy coding that entailed assigning values of 1 for an engineering major (EM=1), 2 for a non-STEM major (NSTEM=2), and 3 for other STEM majors (OSTEM = 3). The current institutional research site for this study is identified as one of the HBCUs in the United States.

Threats to Validity

This study used data that was collected from the past 3 years (i.e., 2012, 2013, and 2014) at the site of one HBCU in a Mid-Atlantic state. The survey instrument (CSI-Form B) was used to retrieve the data. This survey has been anonymously administered by the office of institutional research of the university since 2000. As the researcher of this study, I acknowledged that students who completed the survey bear no responsibility to accurately reflect their true experiences. Considering the use of 3 years of preexisting data, I also recognized that students in each year of data collection might have experienced unusual situations that might have affected their responses. It is my assumption that any incomplete survey had been addressed by the institutional research office which administered the survey. The site of this research study is my workplace. To ensure proper data collection, I partnered with a member of the office of institutional research who ensured that there was no missing or overlooked data.

The threats to validity in this study begin with the reliability of the research instrument, which addresses the extent to which the instrument is shown to provide internal consistency and continuity of a stable measure during a given time period. The consistency of answers for most of the CSI-Form B survey items have remained stable for over its 3 decade existence.

Ethical Procedures

This study followed ethical procedures as outlined by Walden University's IRB. The office of institutional research at the research site of this study provided all data relevant to this study. As discussed above, online surveys were conducted at the selected research site prior to this study. Each participant who completed the CSI-Form B survey was required to read the informed consent statement that provided an option to accept or decline participation. I assumed that all participants who completed the survey agreed and consented to participate, and therefore, understood their rights and any ethical concerns. Noteworthy is that all participants that completed the survey in 2012, 2013, and 2014 were anonymous.

Summary

The design for this study was quantitative and employed a general linear model with descriptive and correlational methods. The central phenomenon of this study is retention of U.S. HBCU postsecondary engineering students and other STEM students, and their possibly unique attributes and perceptions compared to non-STEM students.

The research institutional site is a, midsize public HBCU with a student enrollment of approximately 6,500 students.

For data collection, the study used higher educational institution data from the past 3 years of enrollment management reports, which allowed me to determine the relationship among 10 variables: electronic engineering program curriculum, nonacademic factors in first-year undergraduate students’ experiences, and student retention through the second year of enrollment. In data analysis for chapter 4, two research questions were used with 10 independent variables, to compare electronic engineering, STEM, and non-STEM undergraduate student retention.

Chapter 4: Results

Introduction

The purpose of this quantitative study was to determine whether there is a difference in the relationship between first-year students' self-efficacy and perceptions of academic preparation, family, financial and social support, and retention in year two of first-year undergraduate students at an HBCU in a Mid-Atlantic state. The hypotheses were evaluated by using general linear model analysis.

In this chapter, I present the method and time frame of data collection, the characteristics of participants, and the findings of the study regarding the effects and the interaction of the variables as they relate to the participant groups in undergraduate electronic engineering (ENGR); non-science, technology, engineering, and mathematics (NSTEM); and other-STEM (OSTEM).

Data Analysis

With the assistance of the university's institutional research office, I assembled a secondary data set of student responses to the CSI from 2012-2014: students who majored in electronic engineering (ENGR); non-science, technology, engineering, and mathematics (NSTEM); and other-STEM (OSTEM). During the academic years of 2012-2014, 70% of first year undergraduate students participated in the CSI survey, and 97% of these students at this HBCU were African American students. The office of institutional research on campus helped me collect retention data regarding 100% of the second-year students. The study used data from a convenience sample, the type that is mostly considered for large populations from whom a study can draw direct and accessible data. Because each cohort of first-time students responded to the same survey for 3 years, it was possible to combine the three cohort data sets to create a larger dataset that might increase the reliability of the results. There was no departure from the data collection method described in chapter 3.

Results

The study used a general linear model analysis to address the hypotheses included in Appendix B, showing the total mean scores for the five independent variables related to academic factors of first-year undergraduate students in the three groups of majors (ENGR, NSTEM, and OSTEM) averaged across the 2012 to 2014 academic years. All three groups of students who were retained were more likely to indicate they had academic motivation and skills than those who were not retained, as shown in Table 3. A scale of 1-5 was used, and 5 represented a high average.

Table 3

Descriptive Statistics for Average Scores on Academic Skills for Retained and Non-retained Students by Major 2012 -14, on a scale of 1-5.

Major	Retain	*Mean*	*Std. deviation*
ENGR	Not-Retain	1.91	1.22
	Retain	2.91	1.0
	Total	2.65	1.40
NSTEM	Not-Retain	2.17	1.28
	Retain	2.84	1.34
	Total	2.65	1.40
OSTEM	Not-Retain	2.08	1.24
	Retain	2.89	1.36
	Total	2.65	1.40

Appendix C shows the total mean scores measured for the five independent variables related to nonacademic factors for those students who were retained and those who were not retained of the three participant groups. The average of the mean scores for all nonacademic factors for each of the three groups were higher for those who were retained, as shown in Table 4.

Table 4

Descriptive Statistics for Average Scores of Nonacademic Factors for Retained and Non-retained Students, by Major 2012 -14, on a scale of 1-5.

Major	Retain	*Mean*	*Std. deviation*
ENGR	Not-Retain	2.19	1.29
	Retain	2.60	1.52
	Total	2.50	1.48
Non-STEM	Not-Retain	2.11	1.39
	Retain	2.46	1.44
	Total	2.40	1.435
Other-STEM	Not-Retain	2.11	1.40
	Retain	2.42	1.44
	Total	2.36	1.44

Research Question 1 Regarding Academic Preparation and Retention

The first research question of this study used general linear model analysis to examine whether there is a difference in the relationship between first-year students' self-efficacy and perceptions of academic preparation and retention in year two of first-year undergraduate electronic engineering students, other STEM students, and non STEM students at an HBCU in a Mid-Atlantic state. Table 5 shows results of the tests of between subjects' effects by major and the five variables representing self-efficacy and perceptions or academic preparation (categories) and retention (DV) that tested the study hypotheses. There is statistically significant interaction between the independent variables (IVs) and retention (DV) with a *p* value of $p < .001$ from alpha level of 0.05 for each of the three groups. The interaction between independent and dependent variables supports RQ1's alternative hypothesis. This interpretation indicated that the academic factors were strong predictors of retention in all majors. There is no statistically significant interaction between major and retention, which supports the research null hypothesis, although the effect size of the data used was significant in all groups. Appendix D shows profile plot graphs of majors, academic variables, and retention and the estimated marginal mean scores measured from independent variables on academic factors, which include study habits, intellectual interest, writing and verbal confidence, math and science confidence, and academic assistance.

Table 5

Tests of Between-Subjects Effects by Major, Academic Variables (IV) and Retention 2012 -14

	Type III sum of squares	Df	Mean square	F	Sig.	Partial eta squared
Corrected Model	714.20[a]	29	24.63	14.41	.000	.105
Intercept	11590.85		11590.85	6781.13	.000	.657
Major	2.57	2	1.29	.75	.471	.000
Categories	92.56	4	23.14	13.54	.000	.015
Retain	328.32	1	328.33	192.08	.000	.051
Major * Categories	24.64	8	3.080	1.80	.072	.004
Major * Retain	7.61	2	3.81	2.23	.108	.001
Categories * Retain	158.41	4	39.60	23.17	.000	.025
Major * Categories * Retain	30.78	8	3.85	2.25	.021	.005
Error	6059.40	3545	1.71			
Total	33212.00	3575				
Corrected Total	6773.60	3574				

Table 6 shows the general linear analysis results regarding academic variables for ENGR, NSTEM, and OSTEM majors. The mean scores (M) in all majors and students who were retained show similarity, and the mean scores of students who were not-retained in year two show similarity in academic variable scores. The descriptive scores show 95% confidence interval and with lower and upper bound values.

Table 6

Descriptive Statistics Academic Variables, Majors and Retention (DV)
*Major * Retention 2012-14, on a 1-5 point scale*

				95% confidence interval	
Major	Retain	Mean	Std. error	Lower bound	Upper bound
ENGR	Not-Retain	1.91	.12	1.68	2.13
	Retain	2.91	.06	2.79	3.04
NSTEM	Not-Retain	2.17	.08	2.01	2.33
	Retain	2.84	.04	2.77	2.917
OSTEM	Not-Retain	2.08	.07	1.94	2.23
	Retain	2.89	.04	2.82	2.96

Table 7 provides further evaluation of the statistically significant interaction between majors (IV) and variables related to academic factors (IV) that influenced student retention and for those who were not retained in year two. The average mean score of retained students on each IV was above 2.2 mean score, and for not retained, the mean score was below 1.5.

Table 7.

*Descriptive Statistics of Academic Variables and Retention (IV and DV) Categories * Retention, on a 1-5 Point Scale*

				95% confidence interval	
Categories	Retain	Mean	Std. error	Lower bound	Upper bound
Study Habits	Not-Retain	1.44	.12	1.20	1.67
	Retain	2.91	.06	2.79	3.03
Intellectual Interest	Not-Retain	1.77	.12	1.539	2.01
	Retain	2.93	.06	2.81	3.05
Verbal &Writing Confidence	Not-Retain	2.33	.12	2.09	2.56
	Retain	3.23	.062	3.11	3.35
Math &Science Confidence	Not-Retain	1.94	.12	1.711	2.18
	Retain	2.80	.06	2.68	2.92
Academic Assistance	Not-Retain	2.78	.12	2.55	3.015
	Retain	2.55	.06	2.43	2.67

Research Question 2 Regarding Nonacademic Preparation and Retention

In research question two, the study used a general linear model to examine whether there is a difference in the relationship between first-year students' perception of family, financial, and social support on retention in year 2 of first-year undergraduate electronic engineering students, other STEM students, and non-STEM students at an HBCU in the US. Table 8 shows descriptive statistics on test of between subjects' effects that includes major, nonacademic categories (IV) and retention (DV) which tested the research question hypotheses, as shown in table 8. There is no statistically significant interaction between academic factors (IV) and retention (DV) with a *p* value of $p<.855$ from alpha level of 0.05 for any of the survey variables. Lack of interaction between independent and dependent variables support the null hypothesis. This interpretation indicated that nonacademic factors related to independent variables was not a predictor of student retention in any of the three majors, and there no statistical interaction between major and retention. Appendix E shows profile plot graph of the estimated marginal mean scores measured from independent variables on nonacademic factors, which include desire to finish college, attitude towards educators, sociability, family emotional support, and sense of financial security.

Table 8.

Tests of Between-Subjects Effects by Major, non- Academic Variables (IV) and Retention 2012-14

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	141.81[a]	29	4.89	2.38	.000	.019
Intercept	10184.82	1	10184.82	4954.65	.000	.583
Major	4.70	2	2.35	1.14	.319	.001
Categories	31.79	4	7.95	3.87	.004	.004
Retain	60.77	1	60.78	29.56	.000	.008
Major * Categories	8.73	8	1.09	.53	.834	.001
Major * Retain	.68	2	.34	.17	.847	.000
Categories * Retain	8.07	4	2.02	.982	.416	.001
Major * Categories * Retain	8.28	8	1.03	.50	.855	.001
Error	7278.91	3541	2.06			
Total	27935.00	3571				
Corrected Total	7420.72	3570				

Table 9 shows the general linear model result, providing statistical data scores of ENGR, NSTEM, and OSTEM majors regarding nonacademic variables. The average mean scores regarding nonacademic values for students retained (M =2.492) in all majors and not-retained (M= 2.134). The statistical scores shows 95% confidence interval and including lower and upper bound scores.

Table 9

*Descriptive Statistics nonacademic Variables for Majors and Retention (DV) Major * Retention*

				95% Confidence Interval	
Major	Retain	Mean	Std. Error	Lower Bound	Upper Bound
ENGR	Not-Retain	2.18	.13	1.94	2.43
	Retain	2.60	.070	2.46	2.74
NSTEM	Not-Retain	2.11	.09	1.94	2.29
	Retain	2.46	.04	2.38	2.5 4
OSTEM	Not-Retain	2.12	.08	1.95	2.27
	Retain	2.42	.04	2.34	2.50
Average	Not-Retain	2.13			
	Retain	2.49			

Table 10 shows general linear model that provide an evaluation of statistical data that shows no interaction between categories (IV) and retention (DV) variables related to non- academic factors, which have no effect on students retained and not-retained in year two. The mean score of retained students on each IV variable is 2.4, and mean score for not-retained is 2.1.

Table 10.

*Descriptive Statistics of nonacademic and Retention (IV and DV) Categories * Retention*

				95% Confidence Interval	
Categories	Retain	Mean	Std. Error	Lower Bound	Upper Bound
Desire to Finish College	Not-Retain	1.91	.13	1.65	2.17
	Retain	2.40	.07	2.26	2.53
Attitude Towards Educators	Not-Retain	2.04	.13	1.77	2.30
	Retain	2.55	.07	2.42	2.69
Sociability	Not-Retain	2.140	.130	1.89	2.40
	Retain	2.45	.07	2.32	2.58
Family Emotional Support	Not-Retain	2.47	.13	2.21	2.73
	Retain	2.63	.07	2.50	2.76
Sense of Financial Security	Not-Retain	2.12	.13	1.86	2.371
	Retain	2.43	.07	2.30	2.56

Summary

The current study's findings found that all retained students in all majors responded positively to all five independent variables (study habits, intellectual interest, verbal and writing confidence, math and science confidence, and academic assistance) related to academic factors. Students who responded positively to possessing academic skills during their first year were more likely to be retained than those who did not respond positively. The interaction between independent and dependent variables supported the first research question's alternative hypothesis which tested the academic factors, (study habits, intellectual interest, verbal and writing confidence, math and science confidence, and academic assistance) and the dependent variable retention. The second research hypothesis tested indicated no statistically significant interaction between independent and dependent variables (desire to finish college, attitude towards educators, sociability, family emotional support) support the null hypothesis. From the five variables related to academic factors, the variables of study habits and seeking academic assistance support the alternative hypothesis, and were the strongest predictors of retention in each of the three majors. Students who reported having good study habits and seeking academic assistance were more likely to be retained in year two.

Chapter 5: Conclusions and Recommendations

Introduction

Undergraduate retention has been a major concern for many HBCUs. The current study was conducted in an effort to determine the effects of academic factors and non academic factors on student retention among undergraduate electronic engineering, other STEM, and non STEM students. The nature of the study was quantitative, and a secondary archival data set was used for analysis and interpretation. The archival data were collected during 2012, 2013, and 2014, and were available from the office of institutional research. A general linear model was used to analyze the data.

The study found that there is a statistically significant interaction between student retention to year two and independent variables related to academic factors (study habits, intellectual interest, verbal and writing confidence, math and science confidence, and academic assistance) in all the groups (ENGR, NSTEM, and OSTEM). The study findings also revealed that the independent variables related to nonacademic factors (desire to finish college, attitude towards educators, sociability, family emotional support, and sense of financial security) were not statistically related to retention in any of the three groups.

Interpretation of the Findings

Regarding the first research question related to academic variables and their relationship to retention in three groups of majors, I observed statistically significant interaction between student retention and academic factors. I found from the general linear model analysis results in the test of between-subject effects that the three majors had no effect on student retention. Furthermore, of the five variables related to academic factors, the variables of study habits and seeking academic assistance were the strongest predictors of retention in each of the three majors. Gershenfeld et al. (2014) examined the importance of first semester grade point average, finding that students with a low grade point average as a result of poor study skills are more likely to drop out of college. In a similar study, Wilson et al. (2011) found that engineering students who dropped out of college had poor academic skills. The current study found that study habits and academic assistance factors were the strongest predictors of academic skills, which influence student retention. In comparison, Tinto’s (2007) findings suggested academic integration was the key factor in retention, noting that students who were able to combine social and academic activities in a college environment were more likely to be retained.

The current study’s findings confirm results of other previous studies on study habits and student academic achievement. Siahi and Maiyo (2015) found that students with good study habits performed better in their academic activity. The authors also noted that students who developed and practiced consistency in study habits had above average scores on an academic achievement test. Nonis (2010), in a study on performance of college students and the impact of study time and study habits, found that students who developed and practiced study time routines and study habits were more successful, noting that students who managed their time well also developed good study habits and sought other academic assistance that supported their academic performance. These findings support the current study findings, where students in all majors who were retained in year two, had scores that were significantly higher in academic assistance variable (IV) than those students who were not retained.

Regarding the second research question, I found that the independent variables related to nonacademic factors (desire to finish college, attitude towards educators, sociability, family emotional support, and sense of financial security) had no statistically significant interaction between the groups of student majors and student retention to year two. I observed that for students in all majors who were retained and not retained in year two, their mean scores in desire to finish college and family emotional support independent variables were similar. Few studies have noted in general terms that there is a relationship between nonacademic variables and student retention. Jamelske (2009) noted that combinations of academic and nonacademic factors are related to student retention. Furthermore, he emphasized that because of the diversity of some institutions, comprehensive programs are required to maintain undergraduate retention. Koenig et al. (2012), in a quantitative study of first year undergraduate students, found that both academic and nonacademic factors had the same significant effect in a student's decision to stay or leave college. The study also noted, as did my study, that student major had no effect on decision to stay or leave college. In a similar study, Hutchison-Green et al. (2010) noted that socioeconomic status of the student's parent is a strong nonacademic factor that helps a student to stay in college through financial support, but I found that a sense of financial security has no effect on student retention.

Unlike previous studies (Koenig et al., 2012;Jamelske, 2009), this study found that family emotional support was positive for students retained and not retained in all groups. This study concluded that continued student enrollment in college is influenced by family support and the financial aid support they received for their education. The study also revealed that most of the students who were retained responded positively in regard to a desire to finish college more than did students who were not retained in all majors.

Limitations of the Study

As discussed in chapter 1, the current study, like any other study, was subject to limitations:

1. The unique characteristics of the students in this institution (an HBCU in a Mid-Atlantic state) may affect the results in some unforeseen manner, making it harder to draw conclusions or apply the results to other settings.
2. The data provided from CSI survey contain variables that were used to measure background characteristics, degree aspiration, and self-perception of abilities to complete an undergraduate degree, as well as nonacademic variables. It is possible that these variables may not adequately measure the constructs as intended, thereby limiting the viability of the findings.
3. Respondents provided self-reported data. It is possible that respondents may not have been truthful in their responses. If the respondents were not honest, then the results may be skewed.

These limitations could have affected data collection and its reliability. I assumed that some specific factors may potentially affect the generalizability of findings, and more so, the reliability and validity of conclusions.

Recommendations for Future Research

The use of one pre-existing survey, the CSI, may have limited my effort in this study to find what nonacademic variables influence retention. Further research could be done with different tools that capture variables that are emerging from current research regarding retention of students of color or those at HBCUs in the STEM fields. I also may have missed questions on the CSI survey that I didn't chose to analyze, which may have differentiated variables that characterized electronic engineering students who were not retained.

Implications for Positive Social Change

In the following section, I highlight academic resources and student engagement considerations as they apply to future application in promoting undergraduate retention.

Academic Resources

Institutional resources directed towards academic skills are critical to undergraduate retention. In addition, experiences or academic success or lack of academic success are related to why students who leave college are linked to academic and nonacademic factors (Hutchison-Green et al., 2010). Students' satisfaction has been observed to start with good academic advising, which enhances student academic performance, and therefore, fewer students may drop out. The current study's finding regarding study skills being related to retention suggests that program specific academic tutoring may have an effect on retention as well, as observed in Tseng et al.'s (2011) study. Given my findings that students who were not retained scored low in study habit and academic assistance factors suggests that faculty adviser and program specific advising may improve undergraduate student retention.

Student Engagement and Nonacademic Factors

Gershenfeld et al. (2014) found an emphasis on providing student industrial experience through internships was predictive of persistence among undergraduate engineering students. My findings suggest that the academic motivation resulting from experiential learning might increase motivation to gain study skills and seek academic assistance, the two variables most associated with retention. A similar result may be the consequence of undergraduate research engagement in STEM disciplines, which has been identified to be beneficial factor for underrepresented minority students (Hernandez et al., 2013; Seymour, 2006). A cooperative learning environment has emerged to support student engagement (Hsung, 2012). Program structures with academic advising may motivate students to finish college (Menekse et al., 2013). Student engagement that promotes academic relationships with faculty advisors may be important for undergraduate students' academic confidence, and to make students feel connected to faculty and the institution, particularly for first-year students (Adam et al., 2011).

Should this study, in connection with other studies in the field, increase student retention in engineering and other STEM disciplines in HBCUs and thereby increase numbers of graduates entering the workforce, it may result in positive social change in society. Preparing minority undergraduate students in STEM disciplines is part of the contribution to technological advancement that encourages positive social change in society. Scientific and technological advancement play an increasingly significant role in the global economy. Workforce and gross domestic product define nations. These are often seen as a measure of the outcome of national education programs designed to provide skills that grow the nation's economy through individual contributions (Singer & Smith, 2013; Yoder, 2012). As highlighted in the current study, an increase in undergraduate engineering retention and graduation rate in minority institutions may also provide increase in institutional funding resulting from maintaining the student tuition stream. Increase in institutional funding provides funding for academic support services that promote student retention.

Conclusion

For many years, student retention has been the concern of engineering educators. This study examined academic and nonacademic factors that affect undergraduate retention in electronic engineering, other STEM, and nonSTEM majors in one HBCU in a Mid-Atlantic state. The current study results of the correlational analyses revealed that there was a statistically significant relationship between academic factors and student retention. However, there was no statistically significant relationship between nonacademic factors and student retention.

In addition, this study's statistical results indicated that students in all majors who were retained had high mean scores on study habits and academic assistance as related to academic factors. Undergraduate student retention must be based on academic and social integration, and institutional resources that are directed towards students' academic success. In conclusion, more academic support services will be required to improve first year undergraduate retention.

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Appendix A

College Student Inventory Survey Instrument Questions Related to Research Questions

Drawn from the 100 question CSI survey

I have hard time understanding and solving complex math problems

Math has always been a challenge for me.

I would like to receive some individual help in improving my math skills

I have a good grasp of the scientific ideas I've studied

My understanding of physical science is very weak

.I have always enjoyed the challenge of trying to solve complex math

. I have a very strong desire to continue my education, and I am quite determined to finish a degree

I am deeply committed to my education goals, and I'm fully prepared to make the effort and sacrifices n that will be needed to attain them.

I can think of many things I would rather do than go to college

My study is very irregular and unpredictable

I would like to receive help in improving my study habits

. I have developed a solid system of self-discipline, which helps me keep up with my schoolwork.

I study very hard for all my courses, even those I don't like

I have great difficulty concentrating on schoolwork, and I often get behind.

I wish that society did not put so much pressure on people to go to college, as I'd really rather be doing other things at this point in my life.

I dread the thought of going to school for several more years and there is a part of me that would like to give up the whole thing

I would like to receive some instruction in the most effective ways to take college exams

I would like to receive some help in improving my study habits.

I would like to receive some individual help in Improving my math skills

. I would like to receive tutoring in one or more of my courses.

I would like to receive some training to improve my reading skills.

My family and I communicated very well when I was young, and we had a good understanding of each other's point of view

My family had one way of looking at me when I was a child, and they didn't understand my feelings very well.

I am in a bad financial position, and the pressure to earn extra money will probably interfere with my studies

When I was a child, the other members of my family often said hurtful things that caused unpleasant feelings

I don't have any financial problems that will interfere with my schoolwork

While enrolled in classes, the amount of time I spend in working at a job is approximately

I would like to attend an informal gathering, where I can meet some new friends.

I would like to find out more about the clubs and social organizations at my college

Participating in large social gatherings is of little interest to me.

It is hard for me to relax and just have fun with a group of people.

Appendix B

Descriptive Statistics for Retention and Non-retention by Major 2012 -14

Major	Categories	Retain	*Mean*	*Std. Deviation*	N
ENGR	Study Habits	Not-Retain	1.72	.98	25
		Retain	2.93	1.40	85
		Total	2.65	1.40	110
	Intellectual Interest	Not-Retain	1.35	.75	26
		Retain	3.15	1.37	84
		Total	2.73	1.47	110
	Verbal &Writing Confidence	Not-Retain	1.88	1.14	26
		Retain	3.21	1.42	84
		Total	2.90	1.47	110
	Math &Science Confidence	Not-Retain	2.19	1.55	26
		Ren	2.82	1.34	84
		Total	2.67	1.41	110
	Academic Assistance	Not-Retain	2.38	1.33	26
		Retain	2.45	1.37	84
		Total	2.44	1.35	110
	Total	Not-Retain	1.91	1.22	129
		Retain	2.91	140	421
		Total	2.68	1.42	550
NSTEM	Study Habits	Not-Retain	1.31	.68	51
		Retain	2.83	1.36	251
		Total	2.58	1.39	302
	Intellectual Interest	Not-Retain	1.92	1.04	51
		Retain	2.84	1.27	251
		Total	2.69	1.28	302
	Verbal &Writing Confidence	Not-Retain	2.53	1.35	51
		Retain	3.21	1.37	251
		Total	3.09	1.39	302
	Math &Science Confidence	Not-Retain	1.88	.95	51
		Retain	2.80	1.35	251
		Total	2.65	1.33	302
	Academic Assistance	Not-Retain	3.20	1.43	50
		Retain	2.54	1.31	252
		Total	2.65	1.35	302
	Total	Not-Retain	2.17	1.28	254

		Retain	2.84	1.35	1256
		Total	2.73	1.36	1510
Other-STEM	Study Habits	Not-Retain	1.27	.73	62
		Retain	2.97	1.37	241
		Total	2.62	1.44	303
	Intellectual Interest	Not-Retain	2.05	1.09	62
		Retain	2.80	1.30	241
		Total	2.64	1.29	303
	Verbal &Writing Confidence	Not-Retain	2.56	1.33	62
		Retain	3.26	1.37	241
		Total	3.12	1.39	303
	Math &Science Confidence	Not-Retain	1.76	1.20	62
		Retain	2.77	1.34	241
		Total	2.56	1.36	303
	Academic Assistance	Not-Retain	2.76	1.29	63
		Retain	2.65	1.36	240
		Total	2.67	1.34	303
	Total	Not-Retain	2.08	1.24	311
		Retain	2.89	1.36	1204
		Total	2.72	1.38	1515
Total	Study Habits	Not-Retain	1.37	.77	138
		Retain	2.90	1.37	577
		Total	2.61	1.41	715
	Intellectual Interest	Not-Retain	1.87	1.04	139
		Retain	2.87	1.30	576
		Total	2.67	1.32	715
	Verbal &Writing Confidence	Not-Retain	2.42	1.32	139
		Retain	3.23	1.37	576
		Total	3.07	1.40	715
	Math &Science Confidence	Not-Retain	1.88	1.149	139
		Retain	2.79	1.34	576
		Total	2.62	1.35	715
	Academic Assistance	Not-Retain	2.85	1.37	139
		Retain	2.57	1.34	576
		Total	2.63	1.35	715
	Total	Not-Retain	2.08	1.26	694
		Retain	2.87	1.36	2881

	Total	2.72	1.38	3575

Appendix C

Descriptive Statistics for Academic Variables, Retention and Non-retention by Major 2012 -14

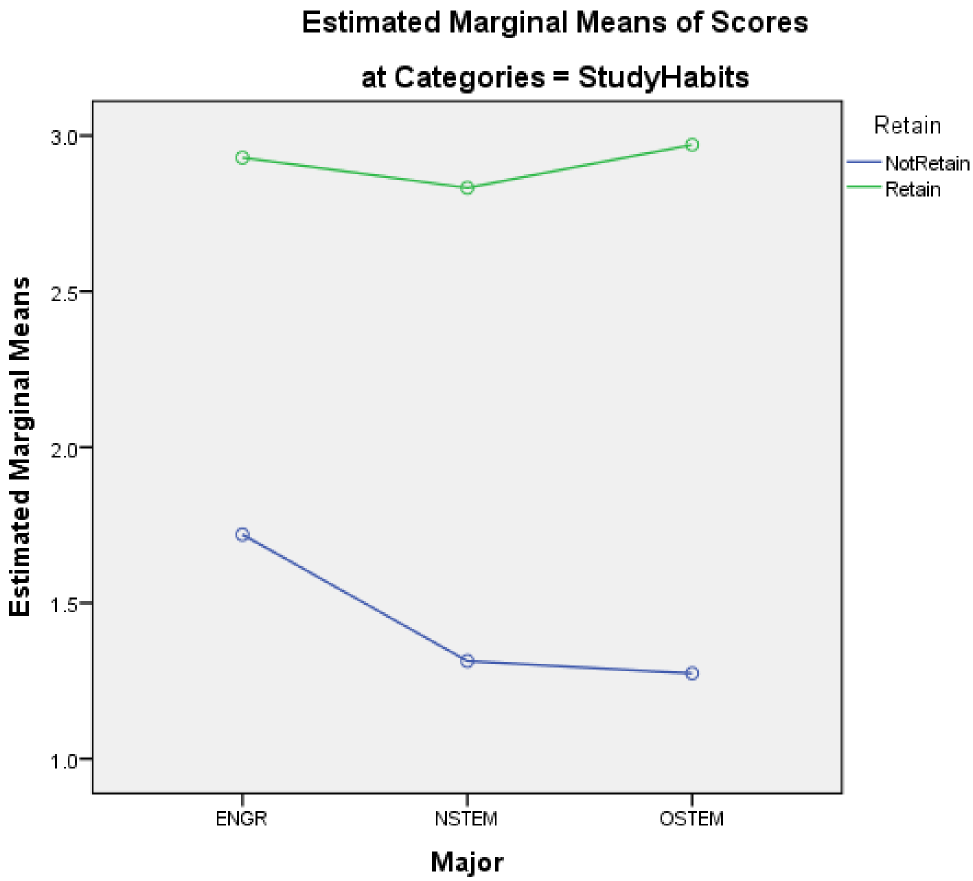
Major	Categories	Retain	Mean	Std. Deviation	N
ENGR	Desire To Finish College	Not-Retain	1.96	1.10	25
		Retain	2.45	1.45	84
		Total	2.34	1.39	109
	Attitude Towards Educators	Not-Retain	2.12	1.31	26
		Retain	2.61	1.55	84
		Total	2.49	1.50	110
	Sociability	Not-Retain	2.04	1.25	26
		Retain	2.69	1.54	84
		Total	2.54	1.50	110
	Family Emotional Support	Not-Retain	2.69	1.59	26
		Retain	2.67	1.57	84
		Total	2.67	1.575	110
	Sense Of Financial Security	Not-Retain	2.12	1.12	26
		Retain	2.57	1.49	84
		Total	2.46	1.42	110
	Total	Not-Retain	2.19	1.292	129
		Retain	2.60	1.52	420
		Total	2.50	1.48	549
NSTEM	Desire To Finish College	Not-Retain	1.94	1.26	51
		Retain	2.44	1.41	251
		Total	2.36	1.40	302
	Attitude Towards Educators	Not-Retain	2.04	1.43	51
		Retain	2.59	1.47	251
		Total	2.49	1.47	302
	Sociability	Not-Retain	2.06	1.19	51
		Retain	2.33	1.33	251
		Total	2.28	1.31	302
	Family Emotional Support	Not-Retain	2.49	1.57	51
		Retain	2.64	1.57	251
		Total	2.62	1.50	302
	Sense Of Financial Security	Not-Retain	2.04	1.44	50
		Retain	2.29	1.36	252
		Total	2.25	1.39	302
	Total	Not-Retain	2.11	1.39	254

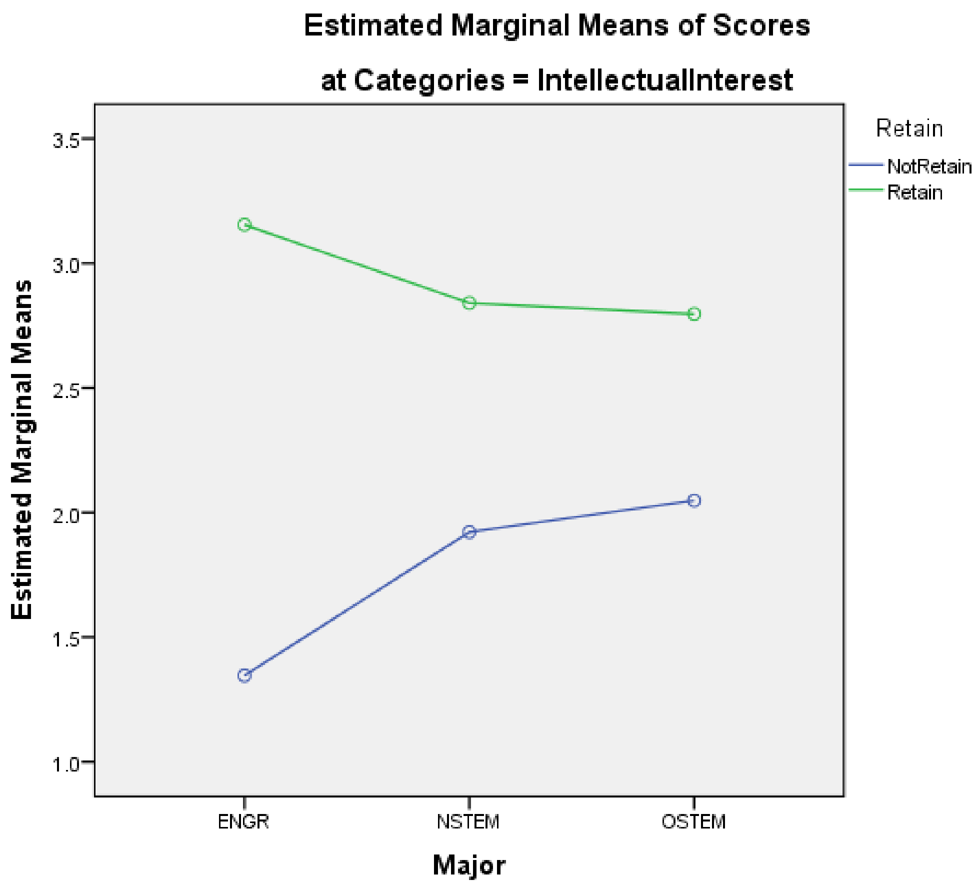
		Retain	2.46	1.44	1256
		Total	2.40	1.44	1510
Other-STEM	Desire To Finish College	Not-Retain	1.82	1.12	62
		Retain	2.30	1.39	240
		Total	2.20	1.35	302
	Attitude Towards Educators	Not-Retain	1.97	1.46	62
		Retain	2.47	1.43	241
		Total	2.37	1.45	303
	Sociability	Not-Retain	2.32	1.41	62
		Retain	2.34	1.37	241
		Total	2.33	1.38	303
	Family Emotional Support	Not-Retain	2.23	1.47	62
		Retain	2.58	1.55	239
		Total	2.50	1.54	301
	Sense Of Financial Security	Not-Retain	2.19	1.48	63
		Retain	2.43	1.44	240
		Total	2.38	1.45	303
	Total	Not-Retain	2.11	1.40	311
		Retain	2.42	1.44	1201
		Total	2.36	1.44	1512
Total	Desire To Finish College	Not-Retain	1.89	1.16	138
		Retain	2.38	1.41	575
		Total	2.29	1.38	7713
	Attitude Towards Educators	Not-Retain	2.02	1.41	139
		Retain	2.54	1.46	576
		Total	2.44	1.47	715
	Sociability	Not-Retain	2.17	1.30	139
		Retain	2.38	1.38	576
		Total	2.34	1.37	715
	Family Emotional Support	Not-Retain	2.41	1.53	139
		Retain	2.62	1.56	574
		Total	2.58	1.55	713
	Sense Of Financial Security	Not-Retain	2.12	1.40	139
		Retain	2.39	1.42	576
		Total	2.34	1.42	715
	Total	Not-Retain	2.12	1.37	694
		Retain	2.46	1.45	2877

Total	2.40	1.44	3571

Appendix D

Descriptive Profile Plot Graphs of Majors, Academic Variables, and Retention on Academic Factors 2012 -14. One plot graph for each of the five academic variables, followed by the estimated marginal mean scores of each of the five academic variables.

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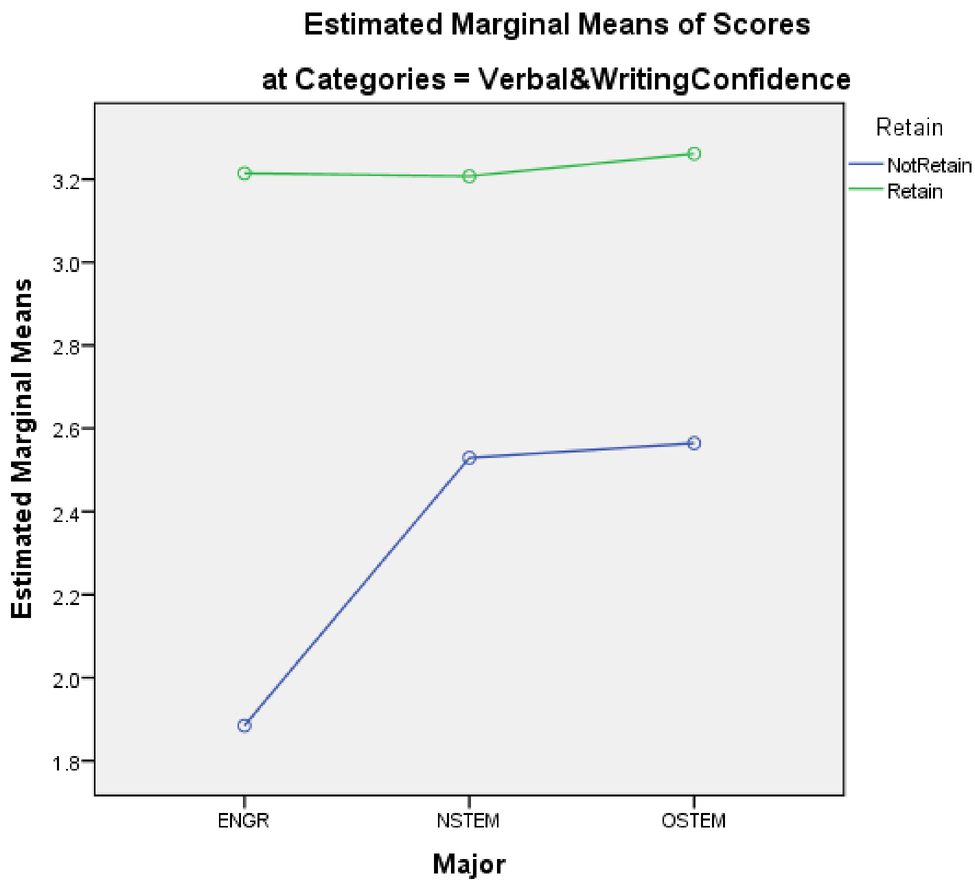
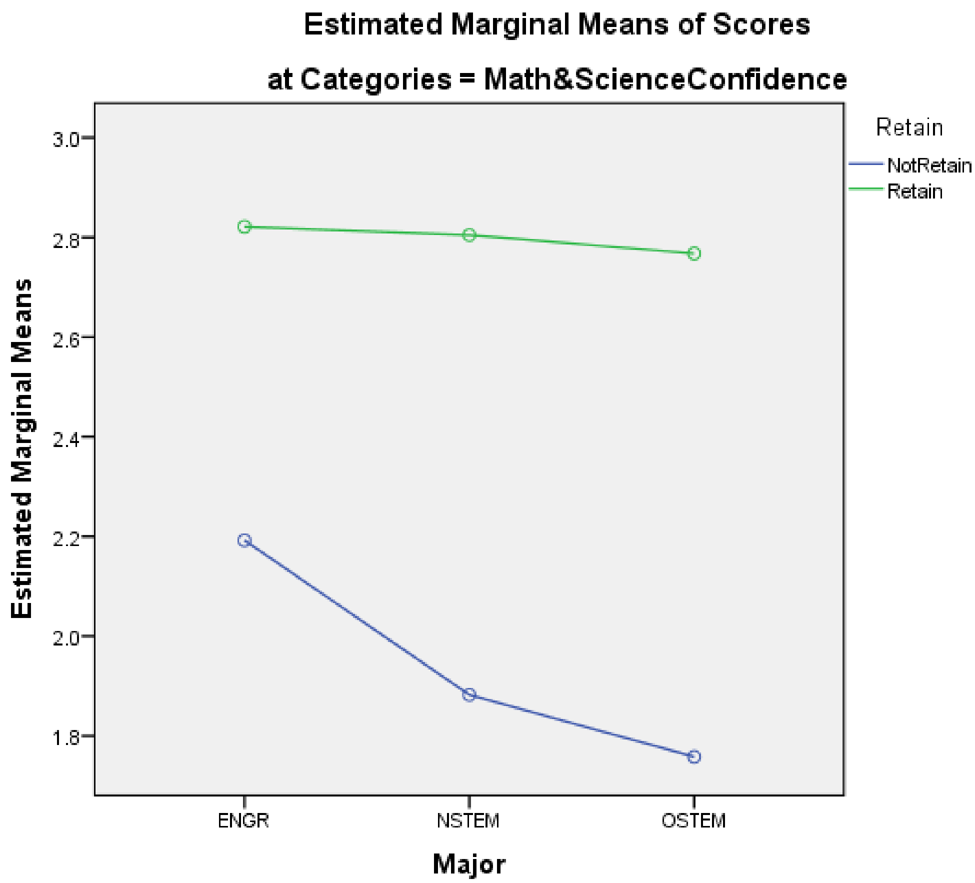
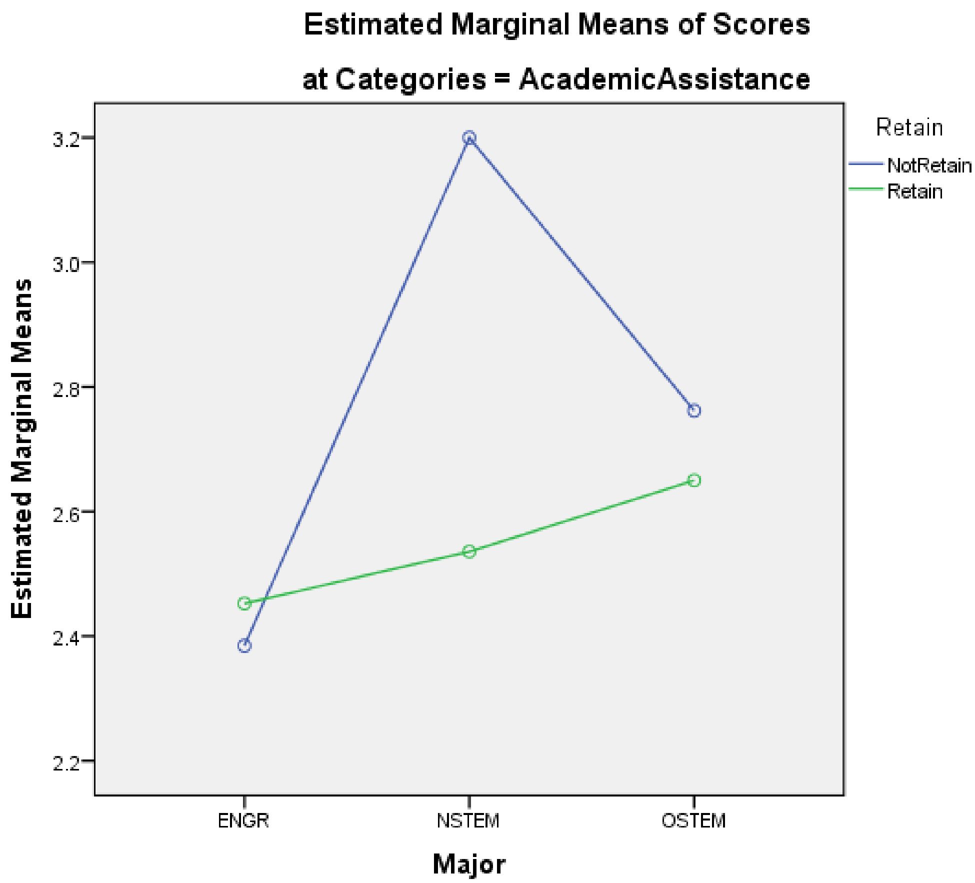
at Categories = IntellectualInterest
Retain
NotRetain
Retain
Estimated Marginal Means
3.5
3.0
2.5
2.0
1.5
1.0
ENGR
NSTEM
OSTEM
Major


Estimated Marginal Means of Scores
at Categories = Verbal&WritingConfidence
Retain
NotRetain
Retain
Estimated Marginal Means
3.2
3.0
2.8
2.6
2.4
2.2
2.0
1.8
ENGR
NSTEM
OSTEM
Major


Estimated Marginal Means of Scores
at Categories = Math&ScienceConfidence
Estimated Marginal Means
3.0
2.8
2.6
2.4
2.2
2.0
1.8
ENGR
NSTEM
OSTEM
Major
Retain
NotRetain
Retain


Estimated Marginal Means of Scores
at Categories = AcademicAssistance
Retain
NotRetain
Retain
Estimated Marginal Means
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3.0
2.8
2.6
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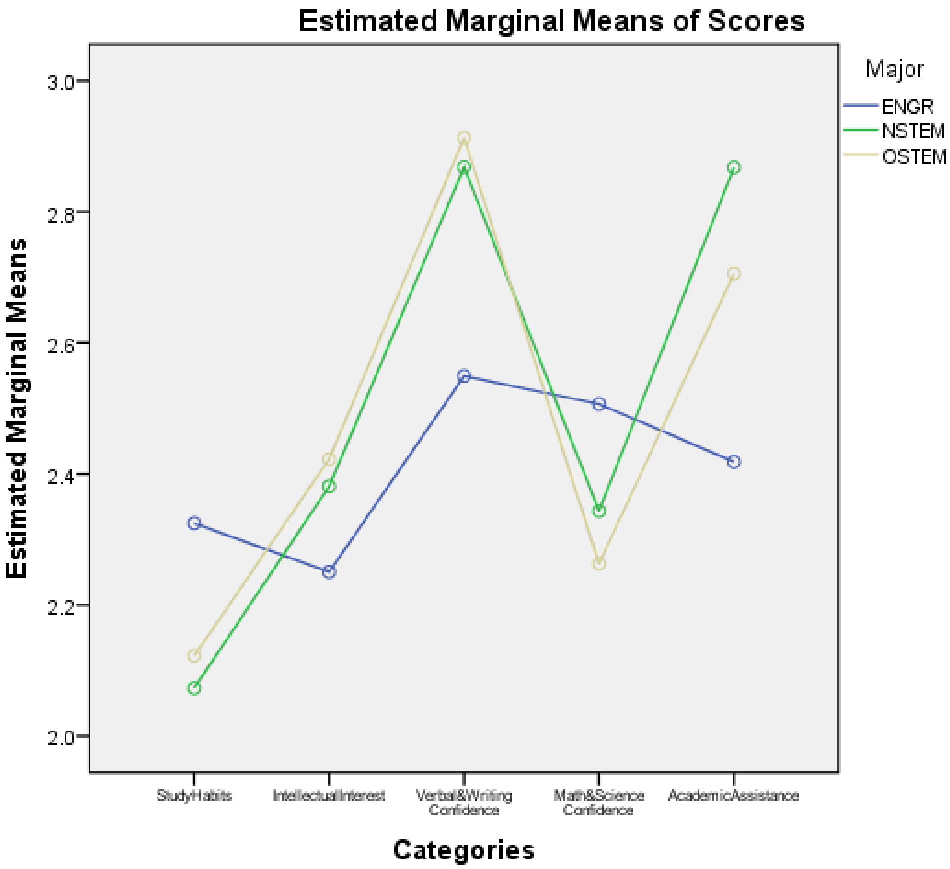
ENGR
NSTEM
OSTEM
Major


Estimated Marginal Means of Scores
Estimated Marginal Means
3.0
2.8
2.6
2.4
2.2
2.0
Major
ENGR
NSTEM
OSTEM
StudyHabits
IntellectualInterest
Verbal&Writing Confidence
Math&Science Confidence
AcademicAssistance
Categories

Appendix E

Descriptive Profile Plots Graph of Majors, Nonacademic Variables and Retention on Non- Academic Factors 2012 -14