Factors that predict students' educational experience at a Midwestern research university: A comparative study of STEM and non-STEM majors

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Factors that predict students’ educational experience at a Midwestern research university: A comparative study of STEM and non-STEM majors

by

Emerald Corrine Amanda Wilson

A thesis submitted to the graduate faculty
in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

Major: Interdisciplinary Graduate Studies (Biological and Physical Sciences)

Program of Study Committee:
Thomas Greenbowe, Co-Major Professor
Frankie Santos Laanan, Co-Major Professor
Larry H. Ebbers
Gary Phye

Iowa State University
Ames, Iowa
2010

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DEDICATION

This thesis is dedicated to my mother

Emily C. Wilson
And my godmother
Felicia J. Rose
And my best friend
Heather D. Edwards

Who supported me with unconditional love throughout this process

Lisa Volaric and Dr. Joseph MacNeil
Who encouraged me to continue in chemistry from an educational perspective

Dr. Howard Mayne and Dr. Charles (Chuck) Zercher
Who supported me when I wanted to enhance my understanding of organic chemistry

Dr. George A. Jackson
Who recognized my commitment and perseverance in completing a graduate degree that highlights my diverse interests and talents

To whom I owe much gratitude for he is the reason there are words on these pages.
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**ABSTRACT**

The National Survey of Student Engagement (NSSE) is an annual, nationwide survey used to assess the level of engagement of four-year college and university students. Only randomly sampled freshman and seniors participate in the self-reporting of their college experience. Annually, the survey results are organized into five benchmarks or clusters of survey questions as a common language/framework for institutions to compare themselves to similar institutions. However, the NSSE benchmarks do not account individual institutional characteristics. Therefore, the purpose of this quantitative study was to use secondary NSSE data from 2005-2008 to examine the relationship between a students’ declared major and their educational experience satisfaction at Iowa State University (ISU). In addition, a comparative study between STEM and non-STEM majors employed a different perspective on the influence of engagement by examining the influence of academic major on educational experience satisfaction. The findings of this study will inform research, policy, and practice.
CHAPTER ONE: INTRODUCTION

Overview

College is a potentially transformative experience, which challenges one’s previous ways of knowing, thinking, and behaving (Kuh, 2003). Attending an institution of higher education is a major commitment, which offers the potential to develop economic self-sufficiency and responsible citizenship (Kinize, Gonyea, Shoup, & Kuh, 2008). Pascarella and Terenzini (2005) attribute any exposure to postsecondary education to enhanced self-esteem, quality of life, and understanding of others. Long-term cognitive, social, and economic benefits in individuals are strongly associated with earning a bachelor’s degree (Kuh, Cruce, Kinzie, & Gonyea, 2008). Consequently, it is important to engage students in a variety of educational and productive activities in order to build a foundation of skills and dispositions for students to live a productive, satisfying life after college (Kuh, 2009a).

In general, engagement is a shared responsibility between administrators, educators, and students. The concept of student engagement considers the critical role institutions play in channeling a student’s participation in effective educational practices such as Chickering and Gamson’s (1987), *Seven principles for good practice in undergraduate education* (Wolf-Wendel, Ward, & Kinzie, 2009). Kuh, Kinzie, Schuh, Whitt, and associates (2005) refer to these principles as perhaps the best-known set of engagement indicators.

Administrators and faculty are responsible for facilitating an environment that engages diverse populations of students in activities that are purposeful to their educational development, both inside and outside of the classroom (Harper & Quaye, 2009). In addition, purposeful activities that promote engagement allows a student to achieve an assortment of educational and personal objectives regardless of their educational background or social
economic status (Kuh, 2009b). Educational and purposeful activities that are classroom or
 curriculum related include the following: (a) first-year seminars, (b) learning communities,
 (c) service-learning projects, (d) undergraduate research, (e) study abroad, and (f) capstone
courses and projects (Kinize, Gonyea, Shoup, & Kuh, 2008). Conversely, out-of-class
activities include participation in student organizations, membership in a Greek organization,
athletics, and volunteer work.

In higher education, assessment has become increasingly important due to external
demands for accountability used to provide support for institutional improvement (Pike,
2006). Colleges and universities are encouraged to demonstrate how they make a difference
in students’ lives, how they contribute to the economic development of their communities,
and how they contribute to the national welfare (Schuh, 2009). Widely utilized and highly
regarded assessment tools can be an important public demonstration of an institution’s
commitment to evidence-based assessment and improvement (McCormick, 2009).

According to McCormick (2009), the National Survey of Student Engagement (NSSE) has
been a widely used and nationally accepted assessment tool for examining student
engagement.

In 2000, the NSSE was launched as an annual survey to obtain information from four-
year colleges and universities nationwide about student participation in empirically
confirmed, good practices in undergraduate education (Kinize, Gonyea, Shoup, & Kuh,
2008). The NSSE allows institutions to receive information about student engagement at the
institutional level, which helps determine how well the institution fosters student learning
(Kuh, 2003). Since its inception, NSSE has acquired a reputation for being a prominent,
formal assessment tool that facilitates the studying of student engagement at four-year
colleges and universities (Nelson Laird, Smallwood, Niskode-Dosset, & Garver, 2009). Thus, a common language and framework to facilitate a comprehensible way to discuss the NSSE has been identifying clusters of survey questions by referring to them as benchmarks (Kuh, 2009a). There are five benchmarks: (a) level of academic challenge, (b) active and collaborative learning, (c) student-faculty interaction, (d) enriching educational experiences, and (e) supportive campus environment. These benchmarks are a form of institutional accountability, which allow institutions to compare their NSSE data with similar institutions by providing empirical evidence of student engagement to provide guidance as to whether acceptable standards are on track with competing institutions (Schuh, 2009).

**Problem Statement**

The NSSE benchmarks provide an excellent starting point for understanding student engagement data, but institutions must be willing to closely scrutinize the data and determine what engagement looks like for them (LaNasa, Cabrera, & Trangsrud, 2009). Empirical testing of the NSSE benchmarks are important given political and policy pressures that exist on discourse of institutional performance about the nature of the educational experience (Gordon, Ludlum, & Hoey, 2008). In other words, researchers need to go beyond comparing differences between institutions and begin identifying differences with institutions (Umbach & Porter, 2002).

According to Pike (2006), the disaggregation of the benchmarks may help uncover opportunities for improvements to allow colleges and universities to develop more focused profiles of engagement levels within the institution. In addition, institutions seeking to bring about change among students on particular engagement traits should pay more attention to
survey items that provide the best measurement at their individual institution (Carle, Jaffee, Vaughan, & Eder, 2009).

Each institution that participates in the NSSE receives their own data for further analysis, in order to assist institutional researchers in informing faculty and staff about data-driven pedagogical changes to benefit their students (Kuh, 2001a). “Results are more likely to get noticed and then acted on when they are connected to particular interests of different campus audiences” (Kinzie & Pennipede, 2009, p. 94). In particular, disaggregating data by department or major seems more likely to convince faculty and staff members to update policies and investigate different pedagogy to meet the mission of their institution (Kuh & Hu, 2001a). As Kuh, Kinzie, Schuh, Whitt, and Associates (2005) state: “The mission establishes the tone of a college and conveys its educational purposes, whether based on religious, ideological, or educational beliefs, giving direction to all aspects of institutional life, including the policies and practices that foster student success” (p. 25). In other words, an institution’s mission dictates the campus culture by providing a framework for how people are to act (Kezar & Kinzie, 2006).

NSSE’s power to influence change through research, policy, and practice has motivated researchers to examine their results to assess ways to promote institutional change (Kezar & Kinzie, 2006). Several institutions have been successful in implementing change with NSSE data such as Georgia Institute of Technology, Illinois State University, Mississippi State University, Pace University, Skidmore College, South Dakota Board of Regents, Western Michigan University, University of Central Oklahoma, and University of Wisconsin System (Banta, Pike, & Hansen, 2009; Kinzie & Pennipede, 2009). Iowa State University has participated in the NSSE since 2000 with the exception of two years in 2003.
and 2004. To date, ISU has not analyzed their NSSE data beyond the NSSE benchmarks. Therefore, this study will analyze the NSSE data of ISU seniors from 2008 through 2008 without categorizing the data into benchmarks.

Furthermore, academic majors are considered “a prerequisite for understanding variability in college faculty members’ professional lives as well as change and stability in students that result from their undergraduate experience” (Smart, Feldman, & Ethington, p. 25, 2000). For example, researchers Brint, Cantwell, and Hanneman (2008) conducted a quantitative study on upper-division students in the University California system, which gave rise to two distinct cultures of undergraduate academic engagement. These two cultures were strongly associated with postgraduate degree plans. One engagement culture was identified within the arts, humanities and social sciences due to interaction, participation, and interest of ideas (Brint, Cantwell, & Hanneman, 2008). Meanwhile, the natural sciences and engineering focused on the improvement of quantitative skills through collaborative study (Brint, Cantwell, & Hanneman, 2008). These results suggest a clear difference in educational experience due to students’ academic major in STEM versus non-STEM.

**Purpose of the Study**

The purpose of this study was to examine the relationship between a students’ declared major and their educational experience at Iowa State University (ISU) using secondary data from the National Survey of Student Engagement (NSSE). A comparison study was conducted to assess 2,525 seniors at ISU by major, STEM and non-STEM. The response to one survey item, “How would you rate your entire educational experience at this institution?” was used as the dependent variable. A hierarchical multiple regression in the form of three blocks: (a) background characteristics, (b) college experiences, (c) and student
engagement experiences. The block representing background characteristics included race/ethnicity, sex, and highest level of parental education (father and mother). Meanwhile, college experiences were considered to be a students’ enrollment and transfer status, grades, and on/off campus living arrangement. The independent variables, student engagement experiences, were defined as (a) acquisition of knowledge and skills, (b) personal development, (c) communication with faculty/instructors, (d) high-order thinking, (e) overall institutional support, (f) active and collaborative learning experiences, and (g) reading and writing expectations.

Research Questions

Based on the objective of this study, the following research questions guided this study:

1. What are the demographic characteristics of seniors at Iowa State University who major in STEM and non-STEM? Specifically, how do these students differ by demographic characteristics such as by age, gender, race/ethnicity, academic enrollment, and their parental education?

2. Is there a statistically significant difference between STEM or non-STEM majors in the following seven factors: (a) acquisition of knowledge and skills, (b) personal development, (c) communication with faculty/instructors, (d) high-order thinking, (e) overall institutional support, (f) active and collaborative learning experiences, and (g) reading and writing expectations.

3. What are the unique effects of background characteristics, college experiences, and student engagement experiences: (a) acquisition of knowledge and skills, (b) personal development, (c) communication with
faculty/instructors, (d) higher-order thinking, (e) overall institutional support, (f) active and collaborative learning experiences, (g) and reading and writing expectations toward the satisfaction of their educational experience at Iowa State University? How do these factors differ between STEM and non-STEM majors?

**Methodological Approach**

A quantitative methodological approach was employed to analyze secondary data from the National Survey of Student Engagement (NSSE) to examine senior students at Iowa State University by major: STEM and non-STEM. Descriptive and inferential statistics were conducted to examine the previously mentioned research questions. In addition, a hierarchical multiple regression model was used to identify factors such as the effects of background characteristics as well as college and student engagement experiences on the level of satisfaction reported by seniors at Iowa State University (ISU) based on a major in STEM or non-STEM.

**Significance of the Study**

This study is significant due because it provides a different perspective on the influence of student engagement by looking at the effects of academic major and students’ satisfaction of their educational experience satisfaction. Unfortunately, the NSSE presents a misconception that all good educational practices are assumed to be relevant across all majors (Brint, Cantwell, & Hanneman, 2008). The analysis of STEM and non-STEM majors will contribute to the ongoing discussion about what forms of student engagement works best for students in different groups to avoid a hegemonic thinking (Kuh, 2009). This study provides information pertaining to student engagement experiences, while controlling for
background characteristics and college experiences. Ultimately, there are three goals for this study: a) report the educational experience satisfaction of ISU seniors who participated in the NSSE from 2005 through 2008 by STEM and non-STEM major, b) contribute to existing research that analyzes NSSE data without the use of benchmarks, and c) report any unique characteristics of engagement experiences based on students’ major. The results of this study will be useful for ISU administrators, faculty, and institutional researchers when they implement or modify programs to enhance student engagement.

Conceptual and Theoretical Frameworks

Creswell (2009) defines a framework as “an organizing model for the research questions or hypotheses and for the data collection procedure” (p. 55) used for the entire study. In quantitative research, conceptual and theoretical frameworks are employed to predict future conditions of natural phenomena while using current conditions (Camp, 2001). According to Camp (2001), the primary role of theory is to provide a rational explanation of the collaborative relationship between constructs, definitions, and propositions.

Conceptual framework

The conceptual framework used for this study was the Input-Environment-Output (I-E-O) model. Alexander W. Astin developed the I-E-O model to assess the impact of environmental experiences such as faculty, peers, and institutional programs and policies by determining if students change after exposure to the college environment (Astin, 1993). In general, Astin’s I-E-O model provides a conceptual guide for the study of college student development after holding a certain number of student input factors constant (Tam, 2002).

As applied to this study, the input factors were background characteristics such as race/ethnicity, sex, and highest level of parental education (father and mother) as well as
college experiences, which includes enrollment and transfer status, grades, and on/off campus living arrangement. Therefore, the independent variable, student engagement experiences was expected to explain the dependent variable, student satisfaction, which is an item on the survey, “How would you rate your entire educational experience. It is important to note, student engagement experiences represent seven composite variables: (a) acquisition of knowledge, (b) personal development, (c) communication with faculty/instructors, (d) higher-order thinking, (e) overall institutional support, (f) active and collaborative learning experiences, and (g) reading and writing expectations. These engagement experiences were included in the prediction model to investigate the extent to which they predict satisfaction with educational experience.

**Theoretical framework**

In a research university setting, ideas about engagement involving active participation such as classroom discussions with intense interest in ideas may be relevant primarily to students in the arts, humanities, and social sciences or non-STEM majors (Brint, Cantwell, & Hanneman, 2008). However, these types of engagement activities are not always conducive to the educational enrichment of STEM majors. To test this hypothesis, the researcher employed a tri-fold theoretical framework using (a) Biglan (1973a, 1973b) classification scheme, (b) Holland’s theory of personality-environmental fit, and (c) a publication written by Brint, Cantwell, and Hanneman (2008).

There are numerous academic disciplines and majors. Appendix A presents a list of academic disciplines/majors from the National Center of Educational Statistics (http://nces.ed.gov/) classification of instruction programs (CIP), which includes majors that are science and math intensive: (a) agricultural, agricultural operations, and related sciences;
(b) biological and biomedical sciences; (c) engineering; (d) mathematics and statistics, and
(e) physical sciences. However, the development new/updated majors and instructional
programs are common practice at academic research institutions. This vast number of majors
has led to the use of the terminology STEM and non-STEM. It is important to note that
STEM represents majors with an intensive math and science curriculum.

To ascertain the terminology of STEM and non-STEM, the investigator employed the
classification scheme proposed by Biglan (1973a, 1973b). Biglan (1973a) organized
academic subjects into three categories: (a) hard versus soft, (b) pure versus applied and (c)
life versus non-life. Appendix B presents Biglan’s three-dimensional classification scheme
of academic disciplines. For the purposes of this study, the category of hard versus soft was
most similar to the terminology of STEM and non-STEM. “The hard versus soft dimension
dichotomy is characterized by the extent to which there is agreement among members of a
discipline about the important research questions and methods of exploration in the field”
(Whitmire, 2002). Thus, hard disciplines have high agreement and soft disciplines have low
agreement. Overall, the investigator used Biglan’s classification scheme to define the
operational terminology of STEM and non-STEM within this study.

To ascertain the effects of organizational systems such as academic disciplines,
Holland’s (1985a, 1985b, 1997) theory provides an approach to studying the effects of
college students from a sociological perspective (Pike, 2006a). Holland’s theory proposes
that most individuals can be classified into six personality types: (a) artistic, (b) conventional,
(c) enterprising, (d) investigative, (e) realistic, and (f) social. In addition, these personalities
are associated with six corresponding environments. Holland’s (1985a, 1985b, 1997) theory
has three suggestions about college students and their academic majors :”(1) students actively
seek out and select their academic major (self-selection); (2) academic majors differently 
reinforce and reward student abilities and interests (socialization); and (3) students are more 
likely to flourish in environments that are congruent with their personality types 
(congruence)” (Pike, 2006a, p. 805). Finally, the publication by Brint, Cantwell, and 
Hanneman (2008) provided evidence in regards to the presence of two engagement cultures 
using data similar to NSSE.

Definition of Terms

There are several terms used throughout this study. It is important to provide the 
meaning of these terms used in this study, thus specific terms follow.

Active and collaborative learning is a NSSE benchmark that consists of seven items 
on the extent of class participation, the degree of collaborative work with other students, and 
the amount of involvement in community-based projects (Pascarella, Seifert, & Blaich, 
2010).

Construct is a set of interrelated concepts or variables (Creswell, 2009).

Enriching educational experiences is a NSSE benchmark that contains 12survey 
items which asks about the extent of students’ interactions with peers from different 
racial/ethnic backgrounds as well as individual with different values or political views, their 
use of information technology, and participation in activities such as internships and study 
abroad (Pascarella, Seifert, & Blaich, 2010).

Freshman refers to a student who has completed one semester at their current 
institution.

Level of Academic Challenge is a NSSE benchmark that consists of 11 items that 
allows students to report the amount of time spent on preparing for class, the amount of time
reading and writing done, and their perception of the institution expectation for academic performance (Pascarella, Seifert, & Blaich, 2010).

*non-STEM* corresponds to individuals who major that was less likely to require a student to take upper level mathematics and science courses.

*NSSE* is an acronym for the National Survey of Student Engagement and the survey instrument used for this study.

*Senior* refers to a student in the year preceding graduation from a university.

*STEM* is an acronym for science, technology, engineering, and mathematics. For the purposes of this study, a STEM major was defined as a major that was more likely to require a student to take upper level mathematics and science courses.

*Student engagement* is defined as the time and energy that student devote to educationally purposeful activities and the extent to which the institution gets students to participate in activities that promote student success (Kuh, 2003).

*Student involvement* “refers to quantity and quality of the physical and psychological energy that students invest in the college experience” such as academic work and extracurricular activities (Astin, 1984).

*Student-faculty interactions* represents a NSSE benchmark that consists of six items that allows students to report the extent they interact with faculty members and advisors outside of the classroom such as on research projects as well as the dissemination of prompt feedback on academic performance and work (Pascarella, Seifert, & Blaich, 2010).

*Supportive campus environment* is a NSSE benchmark that consists of six items measuring the extent students perceive how the campus helps them succeed academically and
socially, coping with nonacademic responsibilities, and promotes supportive relationships among their peers, faculty members, and staff (Pascarella, Seifert, & Blaich, 2010).

Theory is defined as an interrelated set of constructs formed into propositions, or hypotheses, that specifies a relationship to help explain/predict phenomena (Creswell, 2009).

Summary

The purpose of this study was to examine the relationship between students’ academic major and the satisfaction with educational experience at Iowa State University (ISU) using secondary data from the National Survey of Student Engagement (NSSE). Chapter 2 presents a literature review organized in the following five areas: (a) the historical perspective of student engagement, (b) importance of assessing undergraduate students, (c) background information about NSSE, and (d) critics of NSSE.

Chapter 3 presents the methodology used for this study, which includes information pertaining to the research design, data management and population accumulation, the dependent and independent variables, data analysis, and an explanation of the predictive model used for multiple regression analysis. Chapter 4 presents the results of the study with descriptive statistics, exploratory factor analysis (EFA) results, independent t-test results, and hierarchal regression analysis. Finally, Chapter 5 presents the discussion, conclusion, and implications for policy, practice, and future research.
CHAPTER TWO: LITERATURE REVIEW

Introduction

This chapter focuses on the review of the literature pertaining to the engagement experiences of college seniors. This study sought to examine engagement factors as they related to a student’s choice in major. According to Creswell (2009), a literature review provides a framework for establishing the importance of the study undertaken as well as a benchmark for comparing the results with other findings by presenting the results of other closely related studies. Therefore, this chapter contains five main sections deemed relevant to this study: a) historical perspective of student engagement, b) assessment of college students, c) background of NSSE, and d) critics of NSSE.

Historical Perspective of Student Engagement

As a concept, student engagement has been an evolving organizational construct for institutional assessment, accountability, and improvement efforts for over 70 years (Kuh, 2009a). The construct of student engagement has evolved from several college impact models concerning the environmental or sociological origins of change in college students (Pascarella & Terenzini, 2005). There are two separate strands in the literature on college students: sociological and psychological (Stage, 1989). Therefore, this literature review will follow psychological theories related to the development of college students. According to Kuh (2009a), a combination of several psychological theories has resulted in the definition of student engagement as a term, which represents quality of effort and involvement in productive learning activities.
**Time on task learning**

The earliest pioneer of student engagement was an educational psychologist, Ralph W. Tyler, who showed positive effects of time on task learning in the 1930’s (Harper & Quaye, 2009). The concept of time on task learning may be defined as the amount of time the mind needs to process an intellectual task (Finder, 2004). During the early part of the Great Depression, Tyler and his colleagues conducted an eight-year formative evaluation on students who graduated from high school and attended college as well as those who entered the workforce (Strickland, 1986). By 1949, Tyler used his insights from the eight-year study to publish the book, *Basic principles of curriculum and instruction*, which has influenced the world by being translated into 16 languages (Strickland, 1986). Tyler’s book emphasized the necessity of learning being accessible to all students with educators using flexible to instructional methods to accommodate different types of individuals or groups (Finder, 2004).

In 1956, Tyler was the founding director for the Center for Advanced Study in Behavioral Sciences at Stanford University for 14 years (Rubin, 1994). By 1965, Tyler was the founding figure and president for the National Academy of Education (Horowitz, 2001). Over the course of his career, Tyler assisted in the development of others by being an adviser and/or mentor (Finder, 2004). Consequently, Tyler aided in the careers of Benjamin Bloom, Lee Cronbach, Allison Davis, Robert Havighurst, David Krathwohl, Hilda Taba, Herbert Thelen, and others who have made extraordinary contributions in the field of education (Rubin, 1994).
Quality of effort

Three decades later, C. Robert Pace became the second contributor to the student engagement construct by theorizing that a portion of a student’s college success could be determined by the “quality of effort” a student invested in their college experience (Tanaka, 2002). Pace (1982) defines quality of effort as the time and effort one invests in college activities. The concept of quality of effort was built upon Tyler’s concept of time on task learning, which led to the development of the College Student Experiences Questionnaire (CSEQ) (Kuh, 2009a). The CSEQ collects information about student characteristics, such as age, gender, race, place of residence, parental education, enrollment status, and academic major. In addition, all questions tap into student behaviors that are highly correlated with desirable learning and personal development outcomes (Kuh & Hu, 2001a).

According to Kuh (1999), the CSEQ was designed into three main sections with the first portion measuring the amount of time or energy students devote to various activities such as studying, reading, and writing during their current academic year in college. The second section measures student perceptions of their institution’s environment as it relates to learning and personal development (Hu, Kuh, & Li, 2008). In particular, this section represents a broad collection of outcomes such as Chickering and Gamson’s well-known publication, Seven Principles for Good Practice in Undergraduate Education (Kuh, 1999). Chickering & Gamson (1987) seven principles indentified how teachers teach, how students learn, how students interact with each other, and how faculty and students communicate with each other. The third and final portion of the CSEQ collects information on how students perceive their institutional environment (Kuh, 1999).
Over the years, CSEQ results have shown that students gained more from their studies and other aspects of their college experience when they invested more time and energy in educationally purposeful activities such as applying what they were learning to concrete situations and tasks as well as interacting with their peers and instructors (Pace, 1990). Consequently, the CSEQ has been useful in studying students who attend four-year institutions as well as the opportunities provided by the institution (Ethington & Horn, 2007).

**Student Involvement Theory and the I-E-O Model**

In 1984, Alexander W. Astin, a psychologist, was the third researcher to contribute to the student engagement construct by highlighting the physiological and behavioral dimensions of Tyler’s time on task learning and Pace’s quality of effort in his student involvement theory (Kuh, 2009b). Involvement encompasses the amount of physical and psychological energy a student devotes to his/her academic experience (Astin, 1984). Typically, involvement has been used in Astin’s Input-Environment-Output (I-E-O) model, which allows a researcher to control individual characteristics in order to isolate the effects of on-campus participation in various academic and social activities on various student outcomes (Wolf-Wendel et al., 2009). These outcomes may include aspirations, grades, graduation and retention rates, and student satisfaction. Consequently, Astin’s theory has “proven to be a robust, heuristic conceptualization that predicts the impact of a broad range of interacting factors on student outcomes” (Tanaka, 2002, p. 274).

In general, Astin’s I-E-O model provides a conceptual guide for the study of college student development after holding a certain number of student input factors constant (Tam, 2002). This model assesses the impact of environmental experiences such as faculty, peers, and institutional programs and policies by determining if students change after exposure to
the college environment (Astin, 1993). The inputs refer to student characteristics that cannot be changed such as demographics, family background, and social and experiences encountered prior to attending college (Pascarella & Terenzini, 2005). The environment refers to culture, experiences, people, and policies students encounter while they are in college (Astin, 1984). Finally, the outcomes are attitudes, beliefs, behaviors, knowledge, and values affected after attending college (Pascarella & Terenzini, 2005).

The combination of Astin’s student involvement theory and his I-E-O model were able to expand the premise of time on task learning and quality of effort by accounting for the role of the environment (Wolf-Wendel et al., 2009). The acknowledgement of an institution’s environment facilitates development of student behaviors, emotions, and understanding of their college experience (Harper & Quaye, 2009). The institution is important due it being the central space for students to encounter a variety of academic and social opportunities, which incurs change among students due to their involvement with new ideas, people, and experiences (Pascarella & Terenzini, 2005). Consequently, Pascarella & Terenzini (2005) confer Astin’s theory of involvement and I-E-O model have provided faculty and administrators with a conceptual and useful way to examine how college affects students.

**Student Departure Theory**

In 1985, Vincent Tinto, a sociologist, developed his “theory of academic and social integration,” the first theory used to explain students’ voluntary departure from a college or university as issue with both the student and the institution (Tinto, 1993). Tinto’s theory was similar to Astin’s theory but specifically explored why college students withdraw from college (Pascarella & Terenzini, 2005). Tinto (1993) defined integration as a student’s
academic and social connection to an institution. Social integration referred to a students’ perception of interactions with their peers, faculty, and staff at the institution as well as involvement in extra- and co-curricular activities (Wolf-Wendel et al., 2009). Meanwhile, academic integration referred to a students’ perception of interactions with faculty, staff, and other students both inside and outside of the classroom that enhances scholastic development (Wolf-Wendel et al., 2009). In addition, student departure theory brought awareness to the importance of both environmental and sociological factors that affect college students (Tam, 2002).

**General Causal Model for Assessing Change**

In 1985, Ernest T. Pascarella became the fifth contributor to the student engagement construct by suggesting a general causal model for assessing change, which considers the influences of an institution’s structural characteristics and organizational characteristics or the role of individual student’s effort (Pascarella & Terenzini, 2005). This model built upon Tinto’s student departure model with the inclusion of Pace’s quality of effort concept and institutional characteristics (Tam, 2002). Pascarella’s model measures five constructs related to integration: 1) peer group interactions, 2) interactions with faculty, 3) faculty concern for student development and teaching, 4) academic and intellectual development, and 5) goal and institutional commitment (Wolf-Wendel et al., 2009). Additionally, these variables directly and indirectly influence cognitive development and student learning (Tam, 2002). Kuh and Hu (2001b) found “Pascarella’s model to be consistent with the theoretical basis on which the CSEQ activities items and scales are designed” (p.314). Therefore, Pascarella’s model uncovered “the importance of studying the interrelationship between the college environment, what students do while enrolled, and college outcomes” (Tam, 2002, p. 214)
Seven Principles for Good Practice in Undergraduate Education

In 1987, Arthur W. Chickering and Zelda F. Gamson synthesized research on the impact of college on students and distilled it into seven broad categories or principles for good practice in undergraduate education (Pascarella, et al., 2006). The seven categories or principles are: a) encourages contact between students and faculty, b) develops reciprocity and cooperation among students, c) uses active learning techniques, d) gives prompt feedback, e) emphasizes time on task, f) communicates high expectations, and g) respects diverse talents and ways of learning (Chickering & Gamson, 1987). “Emphasizing good educational practices helps focus faculty, staff, students, and others on the tasks and activities that are associated with higher yields in term of desired student outcomes” (Kuh, 2001b, p. 1). Cruce, Wolniak, Seifert, and Pascarella (2006) point out that “the influence of Chickering and Gamson’s seven principles on the field of higher education has been extensive.” For example, the NSSE was designed to access the extent to which students are engaged in empirically driven good educational practices as well as what they gained from their college experience (Kuh, 2001a, 2001b).

Student Engagement

According to Kuh (2003) student engagement is defined as the time and energy that student devote to educationally purposeful activities and the extent to which the institution gets students to participate in activities that promote student success. Although researchers tend to use involvement and engagement interchangeably, “there is a key qualitative difference between involvement and engagement: It is entirely possible to be involved with something without being engaged” (Harper & Quaye, 2009, p. 5). A more accurate definition of student engagement would include it being a combination of quality of effort,
student involvement, and academic and social integration with special consideration given to
the incorporation of good practices in undergraduate education.

**Background of the NSSE**

In 1998, Peter Ewell assembled a design team, which included Alexander Astin, Gary
Barnes, Arthur Chickering, John Garner, George Kuh, and Richard Light, to develop a
survey to the extent to which students participate in empirically driven good educational
practices and what they gain from the experience (Kuh, 2001a). The resulting survey, NSSE,
used many survey items or questions from other collegiate surveys such as the College
Experiences Questionnaire (CSEQ), the Cooperative Institutional Research Program (CIRP)
Freshman Survey and follow-up surveys, and as well as surveys administered by the
University of North Carolina (UNC) system (Carini et al., 2003; Wolf-Wendel et al., 2009).
In fact, about two-thirds of the original NSSE items were similar to questions on the CSEQ
(Kuh, 2001a).

The NSSE relies on self-reported information from students, which is a common
practice when assessing the quality of undergraduate education (Kuh, 2001b). In addition,
“self-reported information is particularly relevant for measuring aspects of the college
experience, such as character development, that cannot be accessed through other means”
(Kuh & Umbach, 2004, p. 40). The self-reported data are considered valid under the
following five conditions:” 1) when the information requested is known to participants, 2) the
questions are clearly worded, 3) the questions refer to recent activities, 4) do not intrude into
private matters; and 5) psychometric analyses produce acceptable reliability levels and
reasonable response distribution” (Kuh, 2001b, p. 3). Consequently, the NSSE has three
main purposes. The first and most important purpose was to provide high quality, actionable
data that may be used to improve the undergraduate experience at individual institutions (Kuh, 2009a). The second purpose was to discover more about the effects of educationally practices in postsecondary settings through careful, ongoing analyses of the annual results (Kuh, 2009a) Finally, the third purpose was to advocate for public acceptance and use empirically derived conceptions of college quality (Kuh, 2009a).

Over the years, the NSSE has acquired a reputation for being a prominent, formal assessment tool that facilitates the studying of student engagement at four-year colleges and universities (Nelson Laird, Smallwood, Niskode-Dosset, & Garver, 2009). This survey provides institutions with information about how students use resources at their particular institution to assist improvement efforts (Kuh, 2001a). Only randomly selected freshman and seniors are invited to participate in the survey (Hayek & Kuh, 2002).

The individual survey items were grouped into five categories referred to as the NSSE Benchmarks of Effective Educational Practice (Pascarella, Seifert, & Blaich, 2010). These benchmarks provide a common language and framework for discussing and reporting student engagement and institutional performance results (Kuh, 2009a). In addition, the benchmarks serve three important purposes: (a) they represent educational practices that are familiar to faculty and administrators; (b) they assist in establishing current levels of student engagement of effective educational practices on a national scale; and (c) they allow researchers to compare engagement levels across different types of institutions (Kuh, 2001a). Appendix C represents the survey items that correspond to the benchmarks: (a) level of academic challenge, (b) active and collaborative learning, (c) student-faculty interactions, (d) enriching educational experiences, and (e) supportive campus environment.
Student-Faculty Interactions

The third benchmark, student-faculty interactions, consists of six items that allows students to report the extent they interact with faculty members and advisors outside of the classroom such as on research projects as well as the dissemination of prompt feedback on academic performance and work (Pascarella, Seifert, & Blaich, 2010). Student-faculty interactions are considered an important part of a student’s college experience in relation to student development (Kim & Sax, 2009). Faculty members are an important resource offered to students to create a favorable environment, which stimulates learning and enhances student satisfaction (Cotten & Wilson, 2006). Their attitudes, beliefs, and behaviors create a culture that fosters student learning both inside and outside of the classroom (Umbach & Wawrzynski, 2005). According to Chickering and Gamson (1987), frequent interactions both inside and outside of the classroom can enhance a students’ intellectual commitment. Sax, Bryant, and Harper (2005) reported that both men and women benefited from faculty support, which was related to numerous positive outcomes such as increased self-confidence, emotional well-being, and satisfaction with their campus community. Consequently, the interactions students have with faculty have positive net effects on the amount of effort students devote to other educationally purposeful activities during college (Kuh & Hu, 2001).

Inside the classroom

The classroom is the only venue that student have to interact with their peers and faculty in a formal setting (Kuh, Cruce, Kinzie, & Gonyea, 2008). Course-related student-faculty interactions leads students to obtain higher GPAs, aspire to pursue advanced degrees, achieve larger gains in critical thinking and communication, and be more satisfied with their
overall college experience (Kim & Sax, 2009). In addition, Pascarella, Seifert, and Whitt (2008) found that faculty members, who exposed their students to instructional behaviors that enhance learning, might increase the probability of a student’s persistence at an institution by increasing the students’ overall satisfaction with the education they received.

**Outside the classroom**

Cox and Orelovec (2007) were able to identify five different types of student-faculty interactions outside of the classroom: (a) disengagement, (b) incidental contact, (c) functional interaction, (d) personal interaction, and (e) mentoring. The first type of interaction, disengagement, was defined as faculty and students not interacting outside of the classroom, which does not add value to the educational experience (Cox & Orelovec, 2007). Disengagement suggests a diminishing influence of higher education on personal development (Kuh, 2001). In particular, doctoral-granting institutions who rely on the systems of graduate school socialization and institutional rewards that encourage faculty members to devote more time to research and less to teaching (Sax, Astin, Arredondo, & Korn, 1996). Hu, Kuh, and Gayles (2007) report students who have a research experience could improve undergraduate education.

The second interaction, incidental contact, is a trivial interaction, which includes polite greetings and body gestures such as hand waving (Cox & Orelovec, 2007). Students who perceived their professors as being approachable, genuinely respectful, and available for frequent out-of-class interactions were more likely to report being confident in their academic skills and being motivated (Komarraju, Musulkin, & Bhattacharya, 2010).

Functional interactions have a specific, institutionally related purpose such as asking academic questions and working on a research project (Cox & Orelovec, 2007). This type of
interaction with faculty may empower students to believe in themselves and encourage them to engage in other educationally purposeful activities (Kuh & Hu, 2001). In addition, functional interactions contribute to making students more comfortable (Cotten & Wilson, 2006). A quantitative study conducted by Sax, Bryant, and Harper (2005) found men who interacted with faculty reported to have an enhanced awareness of their mathematical self-confidence and interest in medical careers. However, Kuh and Hu (2001) found students working with faculty on a research project as the least frequent type of contact in their study. Regardless, women who had an opportunity work on a research project reported a growing interest pursuing in scientific research careers (Sax, Bryant, & Harper, 2005).

Personal interactions are professional interactions requiring personal interest from both the student and the faculty member, which makes the interaction more comfortable than the three previous interactions (Cox & Orehovec, 2007). A relationship with a faculty member may lead to an internship, job opportunity, or higher grade (Cotton & Wilson, 2006). Students who speak informally with faculty members seem to be more likely to find the learning process enjoyable and stimulating as well as gaining a better understanding of how their college education could prepare them for the job market (Komarraju, Musulkin, & Bhattacharya, 2010). Concurrently, Sax, Bryant, and Harper (2005) predicted male students who spent more time talking with faculty members reported an increased sense of cultural awareness, a stronger commitment to racial understanding, and entertained political orientations that were more liberal.

Mentoring was the fifth and most infrequent type of student-faculty interaction that occurred outside of the classroom (Cox & Orehovec, 2007). However, Crisp and Cruz (2009) were able to identify three previous studies that synthesized mentoring in four major
domains. These four domains include: 1) psychological and emotional support, 2) support for setting goals and choosing a career path, 3) academic subject knowledge support aimed at advancing a student’s knowledge relevant to their chosen field, and 4) the existence of a role model. Psychological and emotional support involves listening, providing encouragement, and establishing a supportive relationship between the student and the mentor (Crisp & Cruz, 2009). According to Cruz and Crisp (2009), a mentor can assist students with setting goals and choosing a career path by assessing their strengths and weaknesses as well as assisting in setting academic goals conducive to the student’s abilities. The third domain, academic subject knowledge support, means the mentor needs to provide support of the student’s academic success both inside and outside of the classroom (Crisp & Cruz, 2009). Finally, the ability for the mentor to serve as a role model allows the student to learn from their mentors past achievements and failures (Crisp & Cruz, 2009).

**Controversy about the NSSE**

Currently, colleges and universities are assessing their curricular and co-curricular programs in response to external demands for accountability and institutional improvement (Pike, 2006b). Assessment of student learning and personal development are important but represents an incomplete picture of the quality of undergraduate education (Kuh, 1999). However, there is controversy over the validity of NSSE due to its wide spread use as a prominent assessment too (Porter, 2009).

**Alternative Analyses of NSSE Data**

LaNasa, Cabrera, and Trangsrund (2009) point out that the benchmarks are an excellent jumping-off point but suggest institutions should closely analyze the individual survey items that comprise the benchmarks as well as scrutinize the remaining data to
determine what engagement looks like for their institution. Unfortunately, the benchmarks only represent a composite of 42 survey items when there are over 60 items available for analysis (McCormick, 2009). The benchmarks are a blend of theory and empirical analysis but the consistency of some of the scales may be an object of concern (Gordon, Ludlum, & Hoey, 2008). Unfortunately, a confirmatory factor analysis was unable to support the benchmarks as a definitive explanation of NSSE data, which prompted researchers to try an alternative approach (LaNasa, Cabrera, & Trangsrund, 2009).

NSSE Scalelets

In 2004, Gary Pike derived 12 scalelets or clusters of questions on similar topics to provide more concise and actionable data for academic departments within institutions (Gordon, Ludlum, & Hoey, 2008). Kuh (2009a) described scalelets as increasing NSSE’s utility by containing more exploratory power than the benchmarks. These scalelets were derived from 50 survey questions used to survey 50 senior students from each of the selected 50 institutions (Pike, 2006b). Pike (2006b) found the NSSE scalelets could provide a mechanism for disaggregating NSSE results to correspond to academic departments within an institution without oversampling large numbers of students. In addition, scalelets were better at predicting employment and pursuits of advanced degrees in graduating seniors (Gordon, Ludlum, & Hoey, 2008). In summary, the scalelets can provide information that is more useful to individuals involved in academic and student affairs as well as assessment professionals who are responsible for converting NSSE results into action (Pike, 2006c). Conversely, some researchers consider scalelets as a modest improvement in accounting for academic performance in comparison to the benchmarks (Gordon, Ludlum, & Hoey, 2008).
Summary

The purpose of this study was to examine the relationship between students’ academic major and the satisfaction with educational experience at Iowa State University (ISU) using secondary data from the National Survey of Student Engagement (NSSE). Chapter 2 provides a review of the literature about student engagement. Specifically, this chapter includes information about the (a) the historical perspective of student engagement, (b) importance of assessing undergraduate students, (c) background information about NSSE, and (d) critics of NSSE.
CHAPTER THREE: METHODOLOGY OF THE STUDY

Overview

The purpose of the study was to investigate senior students at Iowa State University in terms of their perception of their educational experience. Using secondary data from the National Survey of Student Engagement (NSSE), a comparison study based on their major, STEM or non-STEM, during a four-year period from 2005 through 2008 was conducted. Further, this study examines differences or similarities in the level of engagement reported by students.

Based on the objectives of this study, the following research questions guided this study:

1. What are the demographic characteristics of seniors at Iowa State University who majored in a STEM or non-STEM major? Specifically, how do these students differ by demographic characteristics such as by age, gender, race/ethnicity, academic enrollment, and their parental education?

2. Is there a statistically significant difference between STEM and non-STEM majors in the following seven factors: (a) acquisition of knowledge and skills, (b) personal development, (c) communication with faculty/instructors, (d) higher-order thinking, (e) overall institutional support, (f) active and collaborative learning experiences, (g) and reading and writing expectations.

3. What are the unique effects of background characteristics, college experiences, and student engagement experiences: (a) acquisition of knowledge and skills, (b) personal development, (c) communication with faculty/instructors, (d) higher-order thinking, (e) overall institutional support,
(f) active and collaborative learning experiences, (g) and reading and writing expectations toward the satisfaction of their educational experience at Iowa State University? How do these factors differ between STEM and non-STEM majors?

The Setting

The study takes place at Iowa State University (ISU), which is located in Ames, Iowa. ISU has nearly 28,000 students who represent all 50 states and more than 110 countries. Iowa State is an international, prestigious university with six undergraduate colleges offering more than 100 programs leading to a baccalaureate degree to accommodate the large population of undergraduate students. In addition, the Graduate College offers more than 200 programs leading to graduate and professional degrees and the College of Veterinary Medicine offers the doctor of veterinary medicine degree. The basic 2008 Carnegie classification of ISU is a public, research university with very high research activity (DR EXT). ISU is a land-grant institution with a primarily residential population of 26,380 students.

Research Design

In order to address the research questions posed by the researcher used secondary data from the National Survey of Student Engagement (NSSE), which was provided by the Office of Institutional Research at Iowa State University. The research design utilized secondary data from the National Survey of Student Engagement (NSSE) maintained by the Iowa State Institutional Research Office. The data included a population of undergraduate students who met the following criteria: (a) completed the NSSE in the timeframe of 2005 through 2008 and (b) classified as a freshmen or senior prior to participating in the survey.
These students were randomly selected to participate in the NSSE by the Iowa State Institutional Research Office who provided their names and email addresses to the Indiana University Center for Postsecondary Research. Identified individuals were invited to participate in the NSSE online survey through email from the Indiana University Center for Postsecondary Research. Each survey year implemented oversampling to increase the response rate. A response rate is the percentage of a sample that completes a questionnaire (Chen et al., 2009). The final response rate for each of the cohort years was 33% in 2005, 37% in 2006, 23% in 2007, and 28% in 2008.

**Authorization Process for Human Subjects Research**

The data for this study was accessed after the Institutional Research Board (IRB) determined the research did not involve human subjects according to federal regulations and was exempt. Prior to IRB completing the exemption process, a written agreement was made between the Institutional Research Office and the researcher to confirm the non-use of any identifiers such as name, birth dates, student ID, and social security number. This agreement protects the privacy of the survey participants (Porter, 2005). Appendix D displays the IRB approval letter, which approved the research as not involving human subjects according to federal regulations.

Once the IRB process was complete, the Institutional Research Office was contacted via email for a formal request of the NSSE data from 2005 - 2008 in SPSS format without student identifiers. In addition, the researcher attached a copy of the accepted IRB application and IRB exemption letter as confirmation of IRB approval. In response, the institutional research office sent four separate SPSS files to the researcher via email, which corresponds to each survey year requested with the 2005 NSSE codebook. The remaining
three codebooks were retrieved from the NSSE website (http://nsse.iub.edu/). Each dataset provided to the researcher from the Institutional Research Office was downloaded to a personal jump drive and each file was copied for future changes.

Data Management and Preparation

File Merge/Population Accumulation

The data used for this study were provided in four separate SPSS files, which required a manual merge of the data into one dataset to facilitate analysis of ISU seniors who participated in the NSSE survey from 2005 through 2008. Careful preparation of a multiyear dataset can be a tedious job, which includes identifying variables that have changed over the years and merging the cases from all years into a single file but can ensure accurate results (Cohen et al., 2009). However, multiyear studies provide more credibility to administrative leaders as well as faculty (Kinzie & Pennipede, 2009).

A detailed inspection of each codebook resulted in locating new and updated variables. However, each codebook was explicit about any changes to the questionnaire and/or data file from the previous year by using a series of asterisks. The use of one asterisk (*) denoted a variable that had been revised slightly from the last year, followed by two asterisks (**) referring to a variable that had been revised significantly from the previous year. Consequently, three asterisks (***)) denoted a new variable. Appendix C illustrates the complete list of majors with the coding modifications used by the researcher.

The “NSSE Multi-Year Data Analysis Guide” (NSSE, 2009) and the PowerPoint presentation “Analysis of Multiple Years of NSSE Data: Tips and Strategies” by Gonyea and BrckLorenz (2009) were used to assist in formulating the desired dataset. As precaution, the copied version of each data file was used to maintain the integrity of the original data. A
The National Survey of Student Engagement (2009) suggested the 2005 dataset be identified as the base year or the first year used in the study due to the various modifications between years. After the base year was identified, the copied 2005 dataset was revised first, due to it being the oldest file and having the most updates. The first step involved the revision of the description of the variable “facfeed” by rewording it to match the remaining three years. Next I modified the variable “snrx04” by rephrasing the phrase “senior project” to “project” to reflect changes in the 2006 codebook. The description of the variable “cocurr01” required the removal of the word social to remain coherent with variable coding to match the remaining three years. Then, the response label for variable “race05” for response value number two had an addition to the two options available by adding Asian. Subsequently, a new variable “Year” was created to keep track of the data by year in the merged dataset (Gonyea & BrckLorenz, 2009). The description for this new variable was “The year the data was created” with a response variable equaling “0” for 2005 to signify it being the base year. In addition, dummy-coding the year variable allows a researcher to test the base year against subsequent years for significant differences (Chen et al., 2009).

The only modification to the copied 2006 dataset was the addition of the “Year” variable with a response variable equaling “1.” The copied 2005 and 2006 datasets was merged using the merge files option in the PASW® Statistical GradPack18 program by adding new cases. This new merged file containing the 2005 and 2006 datasets had one modification with the variable “atdart07” by rewording the variable label to match the 2007 and 2008 datasets. The word “gallery” was replaced with two words: music and theater. Subsequently, the addition of the variable “Year,” to the copied 2007 dataset with a response
variable equaling, “2” was the only modification executed by the researcher. Afterwards, I merged the 2007 dataset with the previously merged 2005 and 2006 datasets using the same file merging procedure previously described above.

The copied 2008 dataset was modified with the “Year” variable with a response label equaling “3” with no further modifications. The copied 2008 dataset was merged with the previously merged 2005, 2006, and 2007 dataset that resulted in the final version of the desired dataset. Thus, new dataset was renamed, “ISUNSSE 2005 2008,” to signify it as the composite dataset I would be using for future analyses.

**Delimiting the Sample/Sample Selection**

The data file required further modification to assist in addressing the research questions by recoding the primary major variable “majrpcod” into a new variable “STEM”. This new variable was labeled as “How many students majored in STEM versus non-STEM.” Furthermore, the response variable equaled “0” for non-STEM majors and “1” for STEM majors. The grouped STEM disciplines/majors were recoded to correspond to the following label values: 12-19 (Biological Science), 34-41 (Engineering), 42-49 (Physical Science), 50 (Architecture), 57 (Veterinarian), 73 (Agriculture), 75 (Computer Science), 77 (Natural resources and conservation), and 78 (Kinesiology). Thus the remaining label values were set to equal “0” for non-STEM majors.

Subsequently, further modifications were made to the dataset to answer the research questions. Therefore, the select cases option in the PAWS Statistics® program was used to finalize the desired representative sample by selecting students who were seniors due to researcher’s interest in the overall experience of the students. The delimited sample was achieved by selecting the student self-reported variable “class” to equal “4,” which
corresponds to senior students. It is important to note that Gonyea and BrckLorenz (2009) suggested using the institution reported variable, “classran,” which is an institutional variable. The aforementioned variable was not used for two reasons: (a) the number of missing cases equaled 5.1% and (b) the use of this institutional variable was inconsistent with the use of self-reported variables. Therefore, the student reported “class” variable was used instead and only had four (.15%) missing cases.

In addition, Gonyea and BrckLorenz (2009) suggested researchers analyze students who were institutionally eligible to participate in the study. Each codebook defines eligible participants as individuals who met the NSSE criteria at the time of survey completion such as not graduating in December or leaving the university prior to graduating. As a result, the delimited sample was achieved by selecting the student self-reported variable “inelig” to equal “1,” which corresponds to eligible students.

Population and Sample

Population

The target population for this cohort comparison study included 6,404 students who were randomly selected by ISU to participate in the National Survey of Student Engagement (NSSE) from 2005 through 2008. The cohort was composed of freshman (44.8%), sophomores (2.2%), juniors (1.5%), and seniors (46.7%). By year, 1207 (18.85%) students took the survey in 2005, followed by 1733 (27.06%) in 2006, 1724 (26.92%) in 2007, and 1740 (27.17%) in 2008.

Sample

The sample for this study included 2,525 seniors who took the NSSE in the timeframe of 2005 through 2008, who were sorted by major. There were 85 majors to choose from on
the survey, which were re-coded into two groups: STEM majors or non-STEM majors. A STEM major was defined as a major that was more likely to require one to take upper level mathematics/science courses. The following majors and/or discipline areas fit the criteria for this study: Biological Sciences, Engineering, Physical Science, Architecture, Veterinarian, Agriculture, Computer Science, Natural Resources and Conservation, and Kinesiology. Therefore, a non-STEM major was defined as a major that was less likely to require one to take upper level mathematics/science courses. The following majors and/or discipline areas fit the criteria for non-STEM majors: Arts and Humanities, Business, Education, Social Science, Professional excluding Architecture and Veterinarian, and other excluding Agriculture, Computer Science, Natural Resources and Conservation, and Kinesiology.

Table 1 illustrates the 2,525 students who participated in NSSE as eligible seniors from 2005 to 2008 by their major. In 2005, 516 (20.4%) students were part of the sample with 262 (10.4%) majoring in STEM and 254 (10.1%) who were non-STEM majors. By 2006, 723 (28.6%) students were part of the representative sample with 366 (14.5%) STEM majors and 357 (14.1%) non-STEM majors. In 2007, 565 (22.4%) students were in the sample with 272 (10.8%) majoring in STEM and 293 (11.6%) who were non-STEM majors. By 2008, 721 (28.6%) students are part of the representative sample with 336 (13.3%) STEM majors and 385 (15.2%) non-STEM majors. Overall, 1236 (49.0%) students in the sample were STEM majors and 1289 (51.0%) were not majoring in STEM.
Table 1: Iowa State University Seniors by Major in STEM and Non-STEM and Year

<table>
<thead>
<tr>
<th>Year</th>
<th>n</th>
<th>STEM</th>
<th>n</th>
<th>non-STEM</th>
<th>n</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>262</td>
<td>10.4%</td>
<td>254</td>
<td>10.1%</td>
<td>516</td>
<td>20.4%</td>
</tr>
<tr>
<td>2006</td>
<td>366</td>
<td>14.5%</td>
<td>357</td>
<td>14.1%</td>
<td>723</td>
<td>28.6%</td>
</tr>
<tr>
<td>2007</td>
<td>272</td>
<td>10.8%</td>
<td>293</td>
<td>11.6%</td>
<td>565</td>
<td>22.4%</td>
</tr>
<tr>
<td>2008</td>
<td>336</td>
<td>13.3%</td>
<td>385</td>
<td>15.2%</td>
<td>721</td>
<td>28.6%</td>
</tr>
<tr>
<td>Total</td>
<td>1236</td>
<td>49.0%</td>
<td>1289</td>
<td>51.0%</td>
<td>2525</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

The Instrument

The National Survey of Student Engagement (NSSE) is an annual survey that collects information directly from randomly selected first-year or freshman students and seniors at participating colleges and universities to improve educational practices (Hayek & Kuh, 2002). The NSSE was designed to explore the way and manners by which undergraduate students engage in their campus communities (Nelson Laird, Bridges, Morelon-Quainoo, Williams, & Holmes, 2007). The NSSE data is the only reliable source of information available to an institution that is about student engagement in effective educational practices (Kuh, 2001). In addition, other variables are taken into account such as age, sex, race, transfer status, major field of study, and parents’ highest level of education (Kuh, 2003).

The student engagement information the NSSE collects are from five categories (Kuh, 2001). The first category asks students to indicate how often they participate in educationally purposeful activities. These activities include interacting with faculty and peers, the amount of time students spend on studying or participating in co-curricular activities such as service learning (Kuh, 2009a). The second category asks for student
perceptions about what intuitions require them to do such as the amount of reading and writing as well as coursework done during the current school year (Kuh, 2009a).

The third category on the NSSE asks students to provide information about their perception of their institution’s ability to provide support for their academic/personal achievement, persistence, and satisfaction (Kuh, 2009a). The fourth category pertains to students’ background information, such as their sex, age, race/ethnicity, enrollment, parental education, and major field (Carini, Hayek, Kuh, Kennedy, & Ouimet, 2003). The fifth category asks students to estimate their educational and personal growth such as their general knowledge; intellectual skills; written and oral communication skills; and personal, social, and ethical development since attending college (Kuh, 2009a). See Appendix E for the NSSE 2008 internet version of the survey. Consequently, the NSSE covers several dimensions of the college experience such as involvement in different types of in-class and out-of-class activities, perceptions of the campus environment, and satisfaction with their overall institutional experience (Carini et al., 2003).

**Variables in the Study**

**Dependent Variable**

The dependent variable used in this study was one survey question: “How would you evaluate your educational experience at this institution?” This survey question consisted of a four-point scale: 1 = poor, 2 = fair, 3 = good, and 4 = excellent.

**Independent Variables**

There were 15 independent variables used in this study, which were divided into three blocks: 1) background characteristics (student demographics), 2) college experiences, and 3)
student engagement experiences. Table 3 illustrates the independent variables and their coding scale. Block 1 (background characteristics) includes four variables: race/ethnicity, sex, and parental education. Block 2 (college experiences) includes four variables: enrollment and transfer status, living arrangement, and grades. Block 3 (student engagement experiences) includes seven composite variables: (a) acquisition of knowledge and skills, (b) personal development, (c) communication with faculty/instructors, (d) higher-order thinking, (e) overall institutional support, (f) active and collaborative learning experiences, and (g) reading and writing expectations. Each variable in the second block is a composite variable constructed from exploratory factor analysis (EFA). In addition, Table 2 presents the coding scale of each independent variable as well as the difference between blocks one, two, and three.
<table>
<thead>
<tr>
<th>Category/Variable</th>
<th>Coding/Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Independent Variables</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Block 1: Background Characteristics</strong></td>
<td></td>
</tr>
<tr>
<td><strong>(Student demographics)</strong></td>
<td></td>
</tr>
</tbody>
</table>
| Sex | Dichotomous  
1 = Male  
2 = Female  
Recoded to dichotomous variable for inferential statistics and multivariate analysis:  
0 = Male  
1 = Female |
| Race/ethnicity | 10-point scale for descriptive analysis:  
1 = American Indian or other Native American  
2 = Asian, Asian American or Pacific Islander  
3 = Black or African American  
4 = White (non-Hispanic)  
5 = Mexican or Mexican American  
6 = Puerto Rican  
7 = Other Hispanic or Latino  
8 = Multicultural  
9 = Other  
10 = I prefer not to respond  
Recoded to dichotomous variable for inferential statistics and multivariate analysis:  
0 = non-White  
1 = White (non-Hispanic) |
| Father’s highest level of completed education | 7-point scale for descriptive analysis  
1 = Did not finish high school  
2 = Graduated from high school  
3 = Attended college but did not complete degree  
4 = Completed an associate’s degree (A.A., A.S., etc.)  
5 = Completed a bachelor’s degree (B.A., B.S., etc.)  
6 = Completed a master’s degree (M.A., M.S., etc.)  
7 = Completed a doctoral degree (Ph.D., J.D., M.D., etc.) |
<table>
<thead>
<tr>
<th>Category/Variable</th>
<th>Coding/Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Independent Variables</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Block 1: Background Characteristics</strong></td>
<td></td>
</tr>
<tr>
<td>(Continued)</td>
<td></td>
</tr>
<tr>
<td>Mother’s highest level of completed education</td>
<td>7-point scale for descriptive analysis</td>
</tr>
<tr>
<td></td>
<td>1 = Did not finish high school</td>
</tr>
<tr>
<td></td>
<td>2 = Graduated from high school</td>
</tr>
<tr>
<td></td>
<td>3 = Attended college but did not complete degree</td>
</tr>
<tr>
<td></td>
<td>4 = Completed an associate’s degree (A.A., A.S., etc.)</td>
</tr>
<tr>
<td></td>
<td>5 = Completed a bachelor’s degree (B.A., B.S., etc.)</td>
</tr>
<tr>
<td></td>
<td>6 = Completed a master’s degree (M.A., M.S., etc.)</td>
</tr>
<tr>
<td></td>
<td>7 = Completed a doctoral degree (Ph.D., J.D., M.D., etc.)</td>
</tr>
<tr>
<td><strong>Block 2: College Experiences</strong></td>
<td></td>
</tr>
<tr>
<td>Enrollment status</td>
<td>Dichotomous</td>
</tr>
<tr>
<td></td>
<td>1 = Less than full-time</td>
</tr>
<tr>
<td></td>
<td>2 = Full-time</td>
</tr>
<tr>
<td></td>
<td>Recoded to dichotomous variable for inferential statistics and multivariate</td>
</tr>
<tr>
<td></td>
<td>analysis:</td>
</tr>
<tr>
<td></td>
<td>0 = Part-time</td>
</tr>
<tr>
<td></td>
<td>1 = Full-time</td>
</tr>
<tr>
<td>Grades</td>
<td>8-point scale for descriptive analysis</td>
</tr>
<tr>
<td></td>
<td>1 = C- or lower</td>
</tr>
<tr>
<td></td>
<td>2 = C</td>
</tr>
<tr>
<td></td>
<td>3 = C+</td>
</tr>
<tr>
<td></td>
<td>4 = B-</td>
</tr>
<tr>
<td></td>
<td>5 = B</td>
</tr>
<tr>
<td></td>
<td>6 = B+</td>
</tr>
<tr>
<td></td>
<td>7 = A-</td>
</tr>
<tr>
<td></td>
<td>8 = A</td>
</tr>
<tr>
<td>Category/Variable</td>
<td>Coding/Scale</td>
</tr>
<tr>
<td>-------------------</td>
<td>--------------</td>
</tr>
<tr>
<td><strong>Independent Variables</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Block 2: College Experiences (Continued)</strong></td>
<td></td>
</tr>
</tbody>
</table>
| Transfer status | Dichotomous  
1 = Started here  
2 = Started elsewhere  
Recoded to dichotomous variable for inferential statistics and multivariate analysis:  
0 = Did not start at ISU  
1 = Start at ISU |
| Living arrangement | 4-point scale for descriptive analysis  
1 = Dormitory or other campus housing (not fraternity/sorority house)  
2 = Residence (house, apartment, etc.) within walking distance of the institution  
3 = Residence (house, apartment, etc.) within driving distance of the institution  
4 = Fraternity or sorority house  
Recoded to dichotomous variable for inferential statistics and multivariate analysis:  
0 = On-campus  
1 = Off campus |
| **Block 3: Student Engagement Experiences (Engagement Constructs)** | |
| Acquisition of knowledge and skills (9 variables) | 4-point scale for descriptive analysis  
1 = Very little  
2 = Some  
3 = Quite a bit  
4 = Very much |
| Personal development (6 variables) | 4-point scale for descriptive analysis  
1 = Very little  
2 = Some  
3 = Quite a bit  
4 = Very much |
<table>
<thead>
<tr>
<th>Category/Variable</th>
<th>Coding/Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Independent Variables</strong></td>
<td></td>
</tr>
<tr>
<td>Block 3: Student Engagement Experiences (Continued)</td>
<td></td>
</tr>
<tr>
<td>Communication with faculty/instructors (7 variables)</td>
<td>4-point scale for descriptive analysis</td>
</tr>
<tr>
<td></td>
<td>1 = Never</td>
</tr>
<tr>
<td></td>
<td>2 = Sometimes</td>
</tr>
<tr>
<td></td>
<td>3 = Often</td>
</tr>
<tr>
<td></td>
<td>4 = Very often</td>
</tr>
<tr>
<td>Higher-order thinking (4 variables)</td>
<td>4-point scale for descriptive analysis</td>
</tr>
<tr>
<td></td>
<td>1 = Very little</td>
</tr>
<tr>
<td></td>
<td>2 = Some</td>
</tr>
<tr>
<td></td>
<td>3 = Quite a bit</td>
</tr>
<tr>
<td></td>
<td>4 = Very much</td>
</tr>
<tr>
<td>Overall institutional support (5 variables)</td>
<td>4-point scale for descriptive analysis</td>
</tr>
<tr>
<td></td>
<td>1 = Very little</td>
</tr>
<tr>
<td></td>
<td>2 = Some</td>
</tr>
<tr>
<td></td>
<td>3 = Quite a bit</td>
</tr>
<tr>
<td></td>
<td>4 = Very much</td>
</tr>
<tr>
<td>Active and collaborative learning experiences (5 variables)</td>
<td>4-point scale for descriptive analysis</td>
</tr>
<tr>
<td></td>
<td>1 = Never</td>
</tr>
<tr>
<td></td>
<td>2 = Sometimes</td>
</tr>
<tr>
<td></td>
<td>3 = Often</td>
</tr>
<tr>
<td></td>
<td>4 = Very often</td>
</tr>
<tr>
<td>Reading and writing expectations (5 variables)</td>
<td>5-point scale for descriptions analysis</td>
</tr>
<tr>
<td></td>
<td>1 = None</td>
</tr>
<tr>
<td></td>
<td>2 = 1-4</td>
</tr>
<tr>
<td></td>
<td>3 = 5-10</td>
</tr>
<tr>
<td></td>
<td>4 = 11-20</td>
</tr>
<tr>
<td></td>
<td>5 = More than 20</td>
</tr>
</tbody>
</table>
Data Analysis

Descriptive Statistics

The statistical package for social sciences, PASW Statistics® 18 for Windows®, was the computer software program used to execute the statistical analyses for this study. In order to address the first research question, descriptive statistics were conducted to examine background characteristics such as race/ethnicity, sex, enrollment and transfer status, living arrangement, grades, and parental education. In addition, the following three survey questions were included in the analysis: “Overall, how would you evaluate the quality of academic advising you have received at your institution?”, “How would you rate your entire experience at this institution?”, and “If you could start over again, would you go to the same institution you are attending now?”

Creswell (2009) defines descriptive statistics as an analysis of variables in a study that describes the data results though means, standard deviations, and ranges of scores. Thus, the comparative nature of this study required crosstabulations to determine differences between STEM and non-STEM majors. Crosstabulations are two-way frequency tables used to allow the researcher to access the relationships between discrete variables (Schuh, 2009). However, the researcher chose to present the results as percentages to simplify the interpretation of the results. Therefore, a positive percent difference refers to the results favoring STEM majors and a negative percent difference favors non-STEM majors. These results are available in Table 3 in Chapter 4.
**Exploratory Factor Analysis (EFA)**

An exploratory factor analysis (EFA) was used to assist the researcher in answering the second research question, “Is there a statistically significant difference between STEM and non-STEM majors?” and third research question, “What are the unique effects of background characteristics, college experiences, and student engagement experiences between STEM and non-STEM majors?” Factor analysis consists of a set of procedure to establish construct validity, which involves using the correlations among a set of variables to determine the number of composite variables or factors that underlay a large number of continuous variables (Schuh, 2009). In addition, EFA allows researchers to reduce the number of variables into workable scales that may have better reliability and convey more meaningful information than individual survey questions (Chen et al., 2009). Therefore, researcher used factor analysis to reduce the 60 NSSE variables into seven factors or composite variables, which was composed of 38 variables. Furthermore, the results of the EFA were used to compare means between STEM and non-STEM majors in independent t-tests and multiple regression analysis. In Chapter 4, Table 4 presents the EFA results including factor loading and alpha reliability coefficients.

**Independent t-tests**

In order to address the second research question, “Is there a statistically significant difference between STEM and non-STEM majors?” Independent t-tests were conducted to examine the statistical significance between STEM and non-STEM majors. T-tests are a robust test used to determine the existence of statistically significant differences or the likelihood the difference occurred by chance alone (Chen et al, 2009). Specifically, an
independent t-test determines the statistical significance difference between the means of two
groups (Johnson & Christensen, 2007). The seven composite variables discovered in the
exploratory factor analysis were used for the comparison. In Chapter 4, Table 5 presents the
independent t-test results.

**Hierarchical Multiple Regression**

Multiple regression analyses are a statistical technique that allows a researcher to
examine the relationship between a continuous dependent variable and two or more
independent variables (Tabachnick & Fidell, 2007). In order to address the third research
question, “What are the unique effects of background characteristics, college experiences,
and student engagement experiences between STEM and non-STEM majors?” A multiple
regression was conducted to predict the overall satisfaction of the educational experience at
Iowa State University (ISU) seniors.

The researcher used a hierarchical sequential regression model. A hierarchical
regression model allows the researcher to specify the order the independent variables are
entered one at a time or in blocks (Tabachnick & Fidell, 2007). There were three blocks:
background characteristics, college experiences, and student engagement experiences. The
block entry strategy was employed to allow the researcher to determine specifically which
blocks of variables may have caused changes in the beta coefficients (Sax & Arredondo,
1999). Figure 1 presents the conceptual model used to analyze the results, which is a
modified version of Astin’s I-E-O model.

The first block, background characteristics, includes four variables: race/ethnicity,
sex, and the highest level of mother’s and father’s education. The second block, college
experiences, included four variables: enrollment and transfer status, grades, and living
arrangement. The third block, student engagement experiences, includes seven composite variables developed in the exploratory factor analysis (EFA): (a) acquisition of knowledge and skills, (b) personal development, (c) communication with faculty/instructors, (d) higher-order thinking, (e) overall institutional support, (f) active and collaborative learning experiences, and (g) reading and writing expectations. The results of the regression are shown in Tables 6, 7, and 8 in Chapter 4.
Figure 1: Predictive Conceptual Model for the satisfaction with educational experience of ISU seniors
Summary

The purpose of this study was to examine the relationship between students’ declared major, STEM versus non-STEM, and the satisfaction of their educational experience at Iowa State University using secondary data from the National Survey of Student Engagement (NSSE). The study focused on how background characteristics, college experiences, and student engagement experiences affected students’ satisfaction of their educational experience. Figure 1 depicts the predictive model used to identify factors to predict the influence of satisfaction for ISU seniors’ based upon their educational experience. The figure is a modification of Astin’s I-E-O model with environmental influences separated into two parts: college experiences and student engagement experiences. In addition, I used the model to identify any similarities or differences between STEM and non-STEM majors on their student engagement experiences.

Chapter 3 provides an overview of the methodology used in this study. Specifically, this chapter includes information about the study’s setting, research design, the IRB approval process, how the researcher managed the data, the population and sample, information about the NSSE instrument, the variables used in the study, and the data analyses. Chapter 4 presents a comparison of student demographics for STEM and non-STEM majors (descriptive statistics), exploratory factor analysis results of the seven independent variables as well as the reliability of each construct, independent t-test results, and multiple regression results.
CHAPTER FOUR: RESULTS

This chapter provides an overview of the results from the statistical analyses used in this study. The general demographics of the 2,525 students in the sample are presented in the form of a profile of age, citizenship, gender, race/ethnicity, and parent’s educational background as well as place of residence, fraternity or sorority involvement, and athletic status was analyzed. In addition, the answers to following three survey questions are part of the profile: (a) “Overall, how would you evaluate the quality of academic advising you have received at your institution?”, (b) “How would you evaluate your entire educational experience at this institution?”, and (c) “If you could start all over again, would you go to the same institution you are now attending?”.

Demographics of Iowa State University Seniors

Table 3 illustrates that most of the seniors in this study were 20 to 23 years of age with 85.40% majoring in STEM and 78.57% non-STEM. The remaining students who reported majoring in STEM ranged in age from 24 to over 55 (13.46%) as well as 19 or younger (0.40%). Conversely, the age of the remaining non-STEM majors was 21.42% for the age range of 24 to over 55 years old. Overall, there was little difference in the representation of students in STEM and non-STEM majors based on age.

As expected, there were more men in STEM major (61.62%) as compared to women (38.38%). A similar proportional difference in the number of women in non-STEM majors (62.41%) than men (37.58%).

The race/ethnicity groups were recoded into two groups, white and non-white, due to the small percentage of individual minority groups. Most students were white (non-Hispanic) with 83.58% majoring in STEM and 84.48% were non-STEM majors. The
remaining non-white students represented 16.42% of the sample who were not majoring in STEM, followed by 16.52% in STEM.

In terms of enrollment status, a majority of the sample was comprised of full-time students with 95.38% STEM, followed by 94.10% non-STEM. The small percentage of part-time students represented less than 10% of the overall sample with 5.90% not majoring in STEM and 4.62% in STEM. In addition, the reported living arrangement for the sample was living off-campus with more non-STEM majors (83.07%) than STEM (78.82%).

Almost all the students reported being domestic with 96.12% declaring a non-STEM major, followed by 95.22% in a STEM major. Thus, international students consisted of 4.78% majoring in STEM and 3.58% in a non-STEM major. Over two-thirds of the sample began their postsecondary education at ISU with 64.10% having a non-STEM major, followed by 73.38% in STEM.

Most students were not a member of fraternity or sorority with 89.56% who majored STEM, followed by 87.41% not majoring in STEM. In regards to student athlete status, a small percentage of students reported being a student athlete with 2.18% in a non-STEM major, followed by 1.54% in STEM. Therefore, the non-student athletes constituted 98.46% in a STEM major, followed by 97.82% not majoring in STEM.

Two-thirds of the sample evaluated their academic advising as good or excellent with 70.52% in a STEM major, followed by 63.40% non-STEM. Approximately, one-fourth evaluated their academic advising as fair with 25.14% in a non-STEM major and 22.02% in a STEM major. In regards to the students’ entire educational experience, most students rated their experience as being good or excellent with 84.36% in a STEM major, followed by 63.40% not majoring in STEM. Furthermore, most students reported they would definitely
or probably attend ISU again if they could start their undergraduate education all over again with 86.38% in a STEM major, followed by 79.05% non-STEM majors.

Over half of the sample reported having a grade of a B+, B, or B- with 55.13% in a STEM major and 53.31% in a non-STEM major, followed by a grade of an A or A- with 36.03% in a STEM and 35.55% in non-STEM. A small percentage of the sample reported having a grade of a C- or lower with 0.81% in a STEM major and 0.47% who were not majoring in STEM.

In terms of father’s highest level of education, almost one-third reported the completion of a bachelor’s degree with 34.22% majoring in STEM and 28.15% were not in a STEM major, followed by one-fourth graduating from high school with 23.00% not majoring in STEM and 21.36% in STEM. Less than one-fifth reported having a father who completed a master’s or doctoral degree with 19.42% were STEM majors and 17.75% non-STEM.

Interestingly, almost one-third reported their mother’s highest level of education being a bachelor’s degree with 31.58% in a STEM majors and 30.25% non-STEM majors, followed by one-fourth graduating from high school with 23.72% not majoring in STEM and 21.21% in STEM. Less than one-fifth completed an associate’s degree with 17.41% majoring in STEM major and 17.26% who were not majoring in STEM.
Table 3: Demographics of Iowa State University Seniors  
*N = 2525*

<table>
<thead>
<tr>
<th>Variable</th>
<th>STEM (n=1236)</th>
<th>non-STEM (n=1289)</th>
<th>% difference(^a)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19 or younger</td>
<td>0.40%</td>
<td>0.0%</td>
<td>+0.40%</td>
</tr>
<tr>
<td>20-23</td>
<td>85.40%</td>
<td>78.57%</td>
<td>+6.83%</td>
</tr>
<tr>
<td>24-29</td>
<td>10.54%</td>
<td>14.65%</td>
<td>-4.11%</td>
</tr>
<tr>
<td>30-39</td>
<td>2.92%</td>
<td>4.36%</td>
<td>-1.44%</td>
</tr>
<tr>
<td>40-55</td>
<td>0.65%</td>
<td>2.18%</td>
<td>-1.53%</td>
</tr>
<tr>
<td>Over 55</td>
<td>0.08%</td>
<td>0.23%</td>
<td>-0.15%</td>
</tr>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>61.62%</td>
<td>37.58%</td>
<td>+24.04%</td>
</tr>
<tr>
<td>Female</td>
<td>38.38%</td>
<td>62.41%</td>
<td>-24.03%</td>
</tr>
<tr>
<td><strong>Race/Ethnicity</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White (non-Hispanic)</td>
<td>83.58%</td>
<td>83.48%</td>
<td>+0.10%</td>
</tr>
<tr>
<td>Non-White</td>
<td>16.42%</td>
<td>16.52%</td>
<td>-0.10%</td>
</tr>
<tr>
<td><strong>Enrollment status</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full-time</td>
<td>95.38%</td>
<td>94.10%</td>
<td>+1.28%</td>
</tr>
<tr>
<td>Part-time</td>
<td>4.62%</td>
<td>5.90%</td>
<td>-0.16%</td>
</tr>
<tr>
<td><strong>Citizen</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>95.22%</td>
<td>96.12%</td>
<td>-0.90%</td>
</tr>
<tr>
<td>No</td>
<td>4.78%</td>
<td>3.88%</td>
<td>+1.20%</td>
</tr>
<tr>
<td><strong>Transfer student</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>73.38%</td>
<td>64.10%</td>
<td>+3.29%</td>
</tr>
<tr>
<td>Yes</td>
<td>26.62%</td>
<td>35.98%</td>
<td>-5.31%</td>
</tr>
</tbody>
</table>

Note: \(^a\)A positive percent difference favors STEM majors, while a negative percent favors non-STEM.
Table 3 (continued)

<table>
<thead>
<tr>
<th>Variable</th>
<th>STEM (n=1236)</th>
<th>non-STEM (n=1289)</th>
<th>% difference(^a)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fraternity/Sorority member</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>89.56%</td>
<td>87.41%</td>
<td>+ 2.15%</td>
</tr>
<tr>
<td>Yes</td>
<td>10.44%</td>
<td>12.59%</td>
<td>- 2.15%</td>
</tr>
<tr>
<td>Living arrangement</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>On campus or Greek housing</td>
<td>21.73%</td>
<td>16.92%</td>
<td>+ 4.81%</td>
</tr>
<tr>
<td>Off campus</td>
<td>78.82%</td>
<td>83.07%</td>
<td>- 4.25%</td>
</tr>
<tr>
<td>Student athlete</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>98.46%</td>
<td>97.82%</td>
<td>+ 0.64%</td>
</tr>
<tr>
<td>Yes</td>
<td>1.54%</td>
<td>2.18%</td>
<td>- 0.64%</td>
</tr>
<tr>
<td>Evaluation of the quality of academic advising</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excellent</td>
<td>28.99%</td>
<td>23.27%</td>
<td>+ 5.72%</td>
</tr>
<tr>
<td>Good</td>
<td>41.53%</td>
<td>40.13%</td>
<td>+ 1.40%</td>
</tr>
<tr>
<td>Fair</td>
<td>22.02%</td>
<td>25.14%</td>
<td>- 3.12%</td>
</tr>
<tr>
<td>Poor</td>
<td>7.45%</td>
<td>11.56%</td>
<td>- 4.11%</td>
</tr>
<tr>
<td>Evaluation of entire educational experience</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excellent</td>
<td>31.36%</td>
<td>28.95%</td>
<td>+ 2.41%</td>
</tr>
<tr>
<td>Good</td>
<td>53.00%</td>
<td>54.00%</td>
<td>- 1.00%</td>
</tr>
<tr>
<td>Fair</td>
<td>12.97%</td>
<td>14.63%</td>
<td>- 1.66%</td>
</tr>
<tr>
<td>Poor</td>
<td>2.67%</td>
<td>2.41%</td>
<td>+ 0.26%</td>
</tr>
<tr>
<td>If you could start again, would you attend ISU?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Definitely Yes</td>
<td>45.62%</td>
<td>40.42%</td>
<td>+ 5.20%</td>
</tr>
<tr>
<td>Probably Yes</td>
<td>40.76%</td>
<td>38.63%</td>
<td>+ 2.13%</td>
</tr>
<tr>
<td>Probably No</td>
<td>9.89%</td>
<td>15.75%</td>
<td>- 5.86%</td>
</tr>
<tr>
<td>Definitely No</td>
<td>3.73%</td>
<td>5.20%</td>
<td>- 1.47%</td>
</tr>
</tbody>
</table>

Note: \(^a\)A positive percent difference favors STEM majors, while a negative percent favors non-STEM.
Table 3 (continued)

\(N = 2525\)

<table>
<thead>
<tr>
<th>Variable</th>
<th>STEM (n=1236)</th>
<th>non-STEM (n=1289)</th>
<th>% difference(^{a})</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Grades (continued)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>17.49%</td>
<td>17.00%</td>
<td>+ 0.49%</td>
</tr>
<tr>
<td>A-</td>
<td>18.54%</td>
<td>18.55%</td>
<td>- 0.01%</td>
</tr>
<tr>
<td>B+</td>
<td>22.27%</td>
<td>21.20%</td>
<td>+ 1.07%</td>
</tr>
<tr>
<td>B</td>
<td>21.85%</td>
<td>21.43%</td>
<td>+ 0.42%</td>
</tr>
<tr>
<td>B-</td>
<td>11.01%</td>
<td>10.68%</td>
<td>+ 0.04%</td>
</tr>
<tr>
<td>C+</td>
<td>5.26%</td>
<td>6.00%</td>
<td>- 0.74%</td>
</tr>
<tr>
<td>C</td>
<td>2.75%</td>
<td>2.73%</td>
<td>- 0.02%</td>
</tr>
<tr>
<td>C- or lower</td>
<td>0.81%</td>
<td>0.47%</td>
<td>+ 0.34%</td>
</tr>
<tr>
<td><strong>Father’s highest education</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Did not finish high school</td>
<td>2.75%</td>
<td>5.12%</td>
<td>- 2.37%</td>
</tr>
<tr>
<td>Graduated from high school</td>
<td>21.36%</td>
<td>23.00%</td>
<td>-1.64%</td>
</tr>
<tr>
<td>Attended college but did not complete degree</td>
<td>11.73%</td>
<td>14.00%</td>
<td>-2.27%</td>
</tr>
<tr>
<td>Completed an associate’s degree</td>
<td>10.52%</td>
<td>11.96%</td>
<td>-1.44%</td>
</tr>
<tr>
<td>Completed a bachelor’s degree</td>
<td>34.22%</td>
<td>28.15%</td>
<td>+ 6.07%</td>
</tr>
<tr>
<td>Completed a master’s degree</td>
<td>12.46%</td>
<td>11.34%</td>
<td>+1.12%</td>
</tr>
<tr>
<td>Completed a doctoral degree</td>
<td>6.96%</td>
<td>6.41%</td>
<td>+0.55%</td>
</tr>
<tr>
<td><strong>Mother’s highest education</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Did not finish high school</td>
<td>1.86%</td>
<td>3.11%</td>
<td>-1.25%</td>
</tr>
<tr>
<td>Graduated from high school</td>
<td>21.21%</td>
<td>23.72%</td>
<td>-2.51%</td>
</tr>
<tr>
<td>Attended college but did not complete degree</td>
<td>10.36%</td>
<td>13.84%</td>
<td>-3.48%</td>
</tr>
<tr>
<td>Completed an associate’s degree</td>
<td>17.41%</td>
<td>17.26%</td>
<td>+0.15%</td>
</tr>
<tr>
<td>Completed a bachelor’s degree</td>
<td>31.58%</td>
<td>30.25%</td>
<td>+1.33%</td>
</tr>
<tr>
<td>Completed a master’s degree</td>
<td>14.50%</td>
<td>10.11%</td>
<td>+4.39%</td>
</tr>
<tr>
<td>Completed a doctoral degree</td>
<td>3.08%</td>
<td>1.71%</td>
<td>+1.37%</td>
</tr>
</tbody>
</table>

\(^{a}\) Note: A positive percent difference favors STEM majors, while a negative percent favors non-STEM.

**Psychometrics of the National Survey of Student Engagement (NSSE)**

An exploratory factor analysis (EFA) was conducted on 60 survey items using principal component extraction and varimax rotation methods from the sample of 2,568
respondents. As a data reduction technique, EFA was used as a means to identify and construct composite variables for further analyses. Tabachnick and Fidell’s (2007) rule of thumb was used to interpret the factor loading for individual variables, which suggests interpretation of loadings equal to .32 and above. In addition, Cronbach’s alpha (α) was used to determine the reliability of each composite variable. Table 4 presents the alpha coefficients of the seven identified constructs as well as the factor loadings of each variable contained in the constructs. Furthermore, the variables within each construct are grouped by size of factor loading to facilitate interpretation.

In summary, the seven constructs, as defined by this study, are the following: (a) acquisition of knowledge and skills, (b) personal development, (c) communication with faculty/instructors, (d) higher-order thinking, (e) overall institutional support, (f) active and collaborative learning experiences, and (g) reading and writing expectations. The Cronbach’s alpha (α) coefficients ranged from .623 to .884 with 61.529% of the variance explained. Following the EFA, variables under each factor was recoded as composite variables for independent t-tests and multiple regression analyses intended to examine the level of satisfaction with their educational experience reported by senior students at ISU who took the NSSE during 2005 through 2008.
Table 4: Exploratory Factor Analysis Results  
\(N = 2461\)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Factor Loading</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acquisition of Knowledge and Skills ((\alpha = .884))</td>
<td></td>
</tr>
<tr>
<td>To what extent has your experience at your institution contributed to your knowledge, skills, and personal development in writing clearly and effectively</td>
<td>.688</td>
</tr>
<tr>
<td>To what extent has your experience at your institution contributed to your knowledge, skills, and personal development in thinking clearly and analytically</td>
<td>.675</td>
</tr>
<tr>
<td>To what extent has your experience at your institution contributed to your knowledge, skills, and personal development in speaking clearly and effectively</td>
<td>.666</td>
</tr>
<tr>
<td>To what extent has your experience at your institution contributed to your knowledge, skills, and personal development in using computer and information technology</td>
<td>.644</td>
</tr>
<tr>
<td>To what extent has your experience at your institution contributed to your knowledge, skills, and personal development in analyzing quantitative problems</td>
<td>.630</td>
</tr>
<tr>
<td>To what extent has your experience at your institution contributed to your knowledge, skills, and personal development in acquiring job or work-related knowledge and skills</td>
<td>.546</td>
</tr>
<tr>
<td>To what extent has your experience at your institution contributed to your knowledge, skills, and personal development in working effectively with others</td>
<td>.545</td>
</tr>
<tr>
<td>To what extent has your experience at your institution contributed to your knowledge, skills, and personal development in acquiring a broad general education</td>
<td>.494</td>
</tr>
<tr>
<td>To what extent has your experience at your institution contributed to your knowledge, skills, and personal development in solving complex real-world problems</td>
<td>.377</td>
</tr>
</tbody>
</table>
Table 4 (continued)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Factor Loading</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Personal Development (α = .851)</strong></td>
<td></td>
</tr>
<tr>
<td>To what extent has your experience at your institution contributed to your knowledge, skills, and personal development in developing a personal code of values and ethics</td>
<td>.755</td>
</tr>
<tr>
<td>To what extent has your experience at your institution contributed to your knowledge, skills, and personal development in understanding yourself</td>
<td>.725</td>
</tr>
<tr>
<td>To what extent has your experience at your institution contributed to your knowledge, skills, and personal development in the welfare of your community</td>
<td>.695</td>
</tr>
<tr>
<td>To what extent has your experience at your institution contributed to your knowledge, skills, and personal development in understanding people of other racial and ethnic backgrounds</td>
<td>.642</td>
</tr>
<tr>
<td>To what extent has your experience at your institution contributed to your knowledge, skills, and personal development in developing a deepened sense of spirituality</td>
<td>.618</td>
</tr>
<tr>
<td>To what extent has your experience at your institution contributed to your knowledge, skills, and personal development in learning effectively on your own</td>
<td>.533</td>
</tr>
<tr>
<td><strong>Communication with faculty/instructors (α = .768)</strong></td>
<td></td>
</tr>
<tr>
<td>In your experience at your institution during the current school year, about how often have you discussed ideas from your readings or classes with others outside of class (students, family members, co-workers, etc.)</td>
<td>.647</td>
</tr>
<tr>
<td>In your experience at your institution during the current school year, about how often have you talked about career plans with a faculty member or advisor</td>
<td>.619</td>
</tr>
<tr>
<td>Variable</td>
<td>Factor Loading</td>
</tr>
<tr>
<td>-------------------------------------------------------------------------</td>
<td>----------------</td>
</tr>
<tr>
<td><em>Communication with faculty/instructors</em> continued (<em>α</em> = .768)</td>
<td></td>
</tr>
<tr>
<td>In your experience at your institution during the current school year, about how often have you worked with faculty members on activities other than coursework such as committees, orientation, student life activities, etc.</td>
<td>.521</td>
</tr>
<tr>
<td>In your experience at your institution during the current school year, about how often have you discussed grades or assignments with an instructor</td>
<td>.515</td>
</tr>
<tr>
<td>In your experience at your institution during the current school year, about how often have you asked questions in class or contributed to class discussions</td>
<td>.499</td>
</tr>
<tr>
<td>In your experience at your institution during the current school year, about how often have you received prompt written or oral feedback from faculty on your academic performance</td>
<td>.451</td>
</tr>
<tr>
<td>In your experience at your institution during the current school year, about how often have you used email to communicate with an instructor</td>
<td>.363</td>
</tr>
<tr>
<td><em>Higher-order thinking</em> (<em>α</em> = .817)</td>
<td></td>
</tr>
<tr>
<td>During the current school year, how much has your coursework emphasized synthesizing and organizing ideas, information, or experiences into new, more complex interpretations and relationships</td>
<td>.749</td>
</tr>
<tr>
<td>During the current school year, how much has your coursework emphasized analyzing the basic elements of an idea, experience, or theory, such as examining a particular case or situation in depth and considering its components</td>
<td>.737</td>
</tr>
<tr>
<td>During the current school year, how much has your coursework emphasized making judgments about the value of information, arguments, or methods, such as examining how others gathered and interpreted data and assessing the soundness of their conclusions</td>
<td>.713</td>
</tr>
<tr>
<td>During the current school year, how much has your coursework emphasized applying theories or concepts to practical problems or in new situations</td>
<td>.707</td>
</tr>
</tbody>
</table>
Table 4 (continued)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Factor Loading</th>
</tr>
</thead>
</table>

**Overall Institutional Support** ($\alpha = .801$)

- To what extent does your institution emphasize providing the support you need to thrive socially  
  \[
  \text{Factor Loading} = .697
  \]

- To what extent does your institution emphasizes helping you cope with your non-academic responsibilities such as work, family, etc.  
  \[
  \text{Factor Loading} = .681
  \]

- To what extent does your institution encourages contact among students from different economic, social, and racial or ethnic backgrounds  
  \[
  \text{Factor Loading} = .649
  \]

- To what extent does your institution emphasizes attending campus events and activities such as special speakers, cultural performances, athletic events, etc.  
  \[
  \text{Factor Loading} = .600
  \]

- To what extent does your institution emphasizes providing the support you need to help you succeed academically  
  \[
  \text{Factor Loading} = .491
  \]

**Active and Collaborative Learning Experiences** ($\alpha = .688$)

- In your experience at your institution during the current school year, about how often have you made a class presentation  
  \[
  \text{Factor Loading} = .658
  \]

- In your experience at your institution during the current school year, about how often have you worked with other students on projects during class  
  \[
  \text{Factor Loading} = .657
  \]

- In your experience at your institution during the current school year, about how often have you worked with other students outside of class to prepare class assignments  
  \[
  \text{Factor Loading} = .531
  \]

- In your experience at your institution during the current school year, about how often have you worked on paper or project that required integrating ideas or information from various sources  
  \[
  \text{Factor Loading} = .519
  \]

- In your experience at your institution during the current school year, about how often have you put together ideas or concepts from different courses when completing assignments or during class discussions  
  \[
  \text{Factor Loading} = .345
  \]
Table 4 (continued)

\[ N = 2461 \]

\[ \begin{array}{ll}
\text{Variable} & \text{Factor Loading} \\
\hline
\text{Reading and Writing Expectations (} \alpha = .623 \text{)} \\
\text{During the current school, about how much reading and writing have you done for the number of written papers or reports between 5 and 19 pages} & .793 \\
\text{During the current school, about how much reading and writing have you done for the number of written papers of fewer than 5 pages} & .670 \\
\text{During the current school, about how much reading and writing have you done for the number of assigned textbook, books, or book-length packs of course readings} & .590 \\
\text{During the current school, about how much reading and writing have you done for the number of written papers or reports of 20 pages or more} & .565 \\
\hline
\end{array} \]

**Independent t-tests**

In order to determine if majoring in STEM versus non-STEM influenced how students rated their levels of engagement, an independent t-test was conducted on seven composite variables: (a) acquisition of knowledge and skill, (b) personal development, (c) communication with faculty/instructors, (d) higher-order thinking, (e) active and collaborative learning experiences, (f) overall institutional support, and (g) reading and writing expectations. A \( p \)-value less than .05 was established as the cutoff for statistical significance. Table 5 reports that students who majored in STEM have higher levels in the acquisition of knowledge and skills (\( t = -3.794, \text{df} = 2485, p < .05 \)) than students in non-STEM majors. Conversely, students in non-STEM majors reported higher levels in that areas of personal development (\( t = 3.455, \text{df} = 2492.263, p < .05 \)), communication with faculty/instructors (\( t = 2.235, \text{df} = 2500, p < .05 \)), and reading and writing expectations (\( t = \text{some value} \)).
4.960, df = 2505.584, p < .05) than STEM majors. The three remaining composite variables: higher-order thinking (t = -1.744, df = 2511, p > .05), overall institutional support (t = -0.356, df = 2500, p > .05), and active and collaborative writing (t = .542, df = 2500, p > .05) showed no statistically significance between students in STEM and non-STEM majors. In addition, Table 5 presents the mean, standard deviation (SD), t-test value (t), degrees of freedom (df), statistical significance (p), and 95% confidence intervals, both lower (LL) and upper limit (UL), for each student engagement experience.
<table>
<thead>
<tr>
<th>Construct Variable</th>
<th>STEM (n = 1236)</th>
<th>non-STEM (n = 1289)</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
</tr>
<tr>
<td>Acquisition of knowledge and skill&lt;sup&gt;a&lt;/sup&gt;</td>
<td>3.06</td>
<td>.594</td>
<td>2.97</td>
</tr>
<tr>
<td>Personal development&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2.33</td>
<td>.692</td>
<td>2.43</td>
</tr>
<tr>
<td>Communication with faculty/instructors&lt;sup&gt;b&lt;/sup&gt;</td>
<td>2.44</td>
<td>.533</td>
<td>2.48</td>
</tr>
<tr>
<td>Higher-order thinking&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2.98</td>
<td>.661</td>
<td>2.93</td>
</tr>
<tr>
<td>Overall institutional support&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2.32</td>
<td>.613</td>
<td>2.35</td>
</tr>
<tr>
<td>Active and collaborative learning experiences&lt;sup&gt;b&lt;/sup&gt;</td>
<td>2.85</td>
<td>.535</td>
<td>2.85</td>
</tr>
<tr>
<td>Reading and writing expectations&lt;sup&gt;c&lt;/sup&gt;</td>
<td>2.48</td>
<td>.622</td>
<td>2.61</td>
</tr>
</tbody>
</table>

Note.  *p < .05.  Bold font correspond to the group with the highest mean value.  <sup>a</sup>Scale: 1= Very little, 2 = Some, 3 = Often, 4 = Very much.  
<sup>b</sup>Scale: 1 = Never, 2 = Sometimes, 3 = Often, 4 = Very Often.  
<sup>c</sup>Scale: 1 = None, 2=1-4, 3 = 5-10, 4 = 11-20, 5 = More than 20
Multiple Regression Analysis

A multiple regression analysis was conducted to predict the educational experience satisfaction Iowa State University (ISU) seniors using a hierarchal regression model. A hierarchical regression model allows the researcher to specify the order the independent variables are entered one at a time or in blocks (Tabachnick & Fidell, 2007). According to Chen et al. (2009), regression allows a researcher to address questions by dummy-coding variables in the model to test for significant differences. Therefore, the researcher dummy-coded the following variables to assist in analysis: race/ethnicity, sex, enrollment and transfer status, and living arrangement. By substituting zeros for the dummy variables, the researcher was able to create separate regression equations for each subgroup, which has the same effect as fitting separate regression lines for each group (Chen et al., 2009).

The hierarchal regression model was built in three stages. The first stage has four variables associated with background characteristics such as gender, race/ethnicity, and parental education were entered into the regression. The second stage added four variables associated with college experiences such as enrollment and transfer status, living arrangement, and grades. Then the third stage added the seven composite variables: (a) acquisition of knowledge and skill, (b) personal development, (c) communication with faculty/instructors, (d) higher-order thinking, (e) active and collaborative learning experiences, (f) overall institutional support, and (g) reading and writing expectations into the equation. The adjusted coefficient of determination, $R^2$, was included to indicate how well the linear prediction fits the data and the standardized regression coefficients, $\beta$, to show the direct comparison of the relative strengths of the relationships between variables. The regression results are presented in three tables: Table 6 for STEM majors, Table 7 for non-
STEM majors, and Table 8 which compares the prediction models for STEM and non-STEM majors.

**Prediction results for STEM majors**

In model one for STEM majors, students who were female ($R^2 = .016, \beta = .059, p < .05$) and identified as white (non-Hispanic) ($R^2 = .016, \beta = .092, p < .01$) were predicted to have a positive association with overall satisfaction in their educational experience. The education level of the students’ father and mother had a positive association but were not statistically significant.

In model two for STEM majors, students who were female ($R^2 = .054, \beta = .081, p < .01$) remained a positive association with educational experience satisfaction. Interestingly, mother’s education ($R^2 = .054, \beta = .066, p < .05$) had a positive association with satisfaction. In terms of college experiences, grades ($R^2 = .054, \beta = .182, p < .001$) and being enrolled full-time ($R^2 = .054, \beta = .064, p < .05$) had a positive association with satisfaction for college experiences.

Surprisingly, the third model for STEM majors, predicted students who were female ($R^2 = .405, \beta = .059, p < .01$), white ($R^2 = .405, \beta = .052, p < .05$), and the highest level of their mother’s education ($R^2 = .405, \beta = .053, p < .05$) were predicted to have a positive association with educational experience satisfaction. Their grades ($R^2 = .405, \beta = .102, p < .01$) also had a positive association. Student engagement experiences referring to acquisition of knowledge and skill ($R^2 = .405, \beta = .405, p < .001$), personal development ($R^2 = .405, \beta = .070, p < .05$), communication with faculty/instructors ($R^2 = .405, \beta = .063, p < .05$), and overall institutional support ($R^2 = .405, \beta = .168, p < .001$) had a positive effect on the
satisfaction of STEM majors. Conversely, reading and writing expectations \((R^2 = .405, \beta = -.050, p < .05)\) had a negative effect on satisfaction for STEM majors.
Table 6: Hierarchal regression prediction model for STEM majors
n = 1236

<table>
<thead>
<tr>
<th>Variable</th>
<th>STEM Majors (n = 1236)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Model 1</td>
<td>Model 2</td>
<td>Model 3</td>
</tr>
<tr>
<td></td>
<td>Standardized β</td>
<td>Standardized β</td>
<td>Standardized β</td>
</tr>
<tr>
<td><strong>Background characteristics</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Race/ethnic:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>white (non-Hispanic)</td>
<td>.059*</td>
<td>.045</td>
<td>.052*</td>
</tr>
<tr>
<td>Sex: female</td>
<td>.092**</td>
<td>.081**</td>
<td>.059**</td>
</tr>
<tr>
<td>Father’s education</td>
<td>.018</td>
<td>-.011</td>
<td>.006</td>
</tr>
<tr>
<td>Mother’s education</td>
<td>.083</td>
<td>.066*</td>
<td>.053*</td>
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<tr>
<td><strong>College experiences</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grades</td>
<td>.182***</td>
<td>.101***</td>
<td></td>
</tr>
<tr>
<td>Enrollment status:</td>
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<tr>
<td>Full-time</td>
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<td>.025</td>
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<tr>
<td>Living arrangement:</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Off-campus</td>
<td>-.004</td>
<td>-.020</td>
<td></td>
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<tr>
<td>Transfer status:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Started at ISU</td>
<td>.030</td>
<td>-.016</td>
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<tr>
<td><strong>Student engagement experiences</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acquisition of knowledge and skill</td>
<td></td>
<td></td>
<td>.402***</td>
</tr>
<tr>
<td>Personal development</td>
<td></td>
<td></td>
<td>.079**</td>
</tr>
<tr>
<td>Communication with</td>
<td></td>
<td></td>
<td>.044</td>
</tr>
<tr>
<td>faculty/instructors</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Higher-order thinking</td>
<td></td>
<td></td>
<td>.058*</td>
</tr>
<tr>
<td>Active and collaborative learning experiences</td>
<td></td>
<td></td>
<td>-.018</td>
</tr>
<tr>
<td>Overall institutional support</td>
<td></td>
<td></td>
<td>.172***</td>
</tr>
<tr>
<td>Reading and writing expectations</td>
<td></td>
<td></td>
<td>-.046</td>
</tr>
</tbody>
</table>

| $R^2$              | .022 | .061 | .415 |
| Adj. $R^2$         | .019 | .055 | .408 |
| $\Delta R^2$       | .022 | .040 | .354 |

Note: *p < .05, **p < .01, ***p < .001
Prediction results for non-STEM majors

In the first model for non-STEM majors, students who identified themselves as female ($R^2 = .006$, $\beta = .058$, $p < .05$) were predicted to have a positive association with educational experience satisfaction. However, the remaining background characteristics had a positive association but were not statistically significant.

In the second model, female students ($R^2 = .050$, $\beta = .011$, $p < .05$) remained to have a positive association with educational experience satisfaction. The addition of college experiences predicted grades ($R^2 = .050$, $\beta = .215$, $p < .001$) had a positive association with educational experience satisfaction. Consequently, the second model accounted for 5% of the model.

Finally, the addition of student engagement experiences to the model predicted students who identified themselves as white ($R^2 = .402$, $\beta = .065$, $p < .01$) had a positive association with the satisfaction of sample’s educational experience as well as their father’s highest level of education ($R^2 = .402$, $\beta = .066$, $p < .05$). In terms of college experiences, grades ($R^2 = .402$, $\beta = .150$, $p < .001$) were predicted to have a positive association. Student engagement experiences referring to the acquisition of knowledge and skill ($R^2 = .402$, $\beta = .416$, $p < .001$), communication with faculty/instructors ($R^2 = .402$, $\beta = .069$, $p < .05$), and overall institutional support ($R^2 = .402$, $\beta = .203$, $p < .001$) had a positive effect on the satisfaction of educational experience for non-STEM majors. Conversely, there was a negative association with reading and writing expectations ($R^2 = .402$, $\beta = -.083$, $p < .001$).
Table 7: Hierarchical regression prediction model for non-STEM majors

\( n = 1289 \)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Non-STEM Majors ( (n = 1289) )</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Standardized ( \beta )</td>
<td>Standardized ( \beta )</td>
<td>Standardized ( \beta )</td>
<td></td>
</tr>
<tr>
<td><strong>Background characteristics</strong></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Race/ethnic: white (non-Hispanic)</td>
<td>.048</td>
<td>.049</td>
<td>.065**</td>
<td></td>
</tr>
<tr>
<td>Sex: female</td>
<td>.058*</td>
<td>.011*</td>
<td>.019</td>
<td></td>
</tr>
<tr>
<td>Father’s education</td>
<td>.052</td>
<td>.030</td>
<td>.066*</td>
<td></td>
</tr>
<tr>
<td>Mother’s education</td>
<td>.006</td>
<td>-.008</td>
<td>-.008</td>
<td></td>
</tr>
<tr>
<td><strong>College experiences</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grades</td>
<td>.215***</td>
<td>.150***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enrollment status: full-time</td>
<td>-.024</td>
<td>-.027</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Living arrangement:</td>
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<td>-.004</td>
<td></td>
<td></td>
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<tr>
<td>Off-campus</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Transfer status: Started at ISU</td>
<td>.029</td>
<td>.035</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Student engagement experiences</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acquisition of knowledge and skill</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Personal development</td>
<td>.007</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Communication with</td>
<td>.069*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>faculty/instructors</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Higher-order thinking</td>
<td>.036</td>
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</tr>
<tr>
<td>Active and Collaborative</td>
<td>.038</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>learning experiences</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall institutional support</td>
<td>.203***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reading and writing expectations</td>
<td>-.083***</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\[ R^2 \] \hspace{2cm} .009 \hspace{2cm} .056 \hspace{2cm} .410

\[ \text{Adj. } R^2 \] \hspace{2cm} .006 \hspace{2cm} .050 \hspace{2cm} .402

\[ \Delta R^2 \] \hspace{2cm} .009 \hspace{2cm} .047 \hspace{2cm} .353

Note: *\( p < .05 \), **\( p < .01 \), ***\( p < .001 \)
Comparison of prediction models by major in STEM and non-STEM

In the first block, background characteristics, students who identified themselves as white (non-Hispanic) were predicted to have a positive association with the overall satisfaction of their educational experience for both STEM ($R^2 = .408$, $\beta = .052$, $p < .05$) and non-STEM ($R^2 = .402$, $\beta = .065$, $p < .05$) majors. Female students ($R^2 = .408$, $\beta = .059$, $p < .05$) who majored in STEM were predicted to have a positive association with the overall satisfaction with their educational experience. However, father’s highest level of education ($R^2 = .402$, $\beta = .066$, $p < .05$) was a positive predictor for non-STEM majors while STEM majors had their mother’s highest level of education ($R^2 = .408$, $\beta = .053$, $p < .05$) as a positive predictor.

In the second block, college experiences, grades were the only statistically significant independent variable for both STEM ($R^2 = .408$, $\beta = .101$, $p < .001$) and non-STEM majors ($R^2 = .402$, $\beta = .150$, $p < .001$). The three remaining college experiences were not statistically significant.

In the third block, acquisition of knowledge and skill, was predicted to have a positive association with the overall satisfaction of their educational experiences for both STEM ($R^2 = .408$, $\beta = .405$, $p < .001$) and non-STEM ($R^2 = .402$, $\beta = .416$, $p < .001$) majors. In addition, overall institutional support was predicted to have a positive association for both STEM ($R^2 = .408$, $\beta = .172$, $p < .001$) and non-STEM majors ($R^2 = .402$, $\beta = .203$, $p < .001$). Interestingly, a positive association was predicted for personal development ($R^2 = .408$, $\beta = .079$, $p < .01$) and higher-order thinking ($R^2 = .408$, $\beta = .058$, $p < .05$) for STEM majors. However, students who did not major in STEM were predicted to have a positive association in the
communication with faculty/instructors \((R^2 = .402, \beta = .069, p < .05)\) and a negative association with reading and writing expectations \((R^2 = .402, \beta = -.083, p < .001)\).

Table 8: Comparison of hierarchal regression prediction models for STEM and non-STEM majors

<table>
<thead>
<tr>
<th>Variable</th>
<th>STEM Majors ((n = 1236))</th>
<th>non-STEM Majors ((n = 1289))</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Model 3 Standardized (\beta)</td>
<td>Model 3 Standardized (\beta)</td>
</tr>
<tr>
<td><strong>Background characteristics</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Race/ethnicity: white (non-Hispanic)</td>
<td>.052*</td>
<td>.065**</td>
</tr>
<tr>
<td>Sex: female</td>
<td>.059**</td>
<td>.019</td>
</tr>
<tr>
<td>Father’s education</td>
<td>.006</td>
<td>.066*</td>
</tr>
<tr>
<td>Mother’s education</td>
<td>.053*</td>
<td>-.008</td>
</tr>
<tr>
<td><strong>College experiences</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grades</td>
<td>.101***</td>
<td>.150***</td>
</tr>
<tr>
<td>Enrollment status: full-time</td>
<td>.025</td>
<td>-.027</td>
</tr>
<tr>
<td>Living arrangement: off-campus</td>
<td>-.020</td>
<td>-.004</td>
</tr>
<tr>
<td>Transfer status: started at ISU</td>
<td>-.016</td>
<td>.035</td>
</tr>
<tr>
<td><strong>Student engagement experiences</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acquisition of knowledge and skill</td>
<td>.402***</td>
<td>.416***</td>
</tr>
<tr>
<td>Personal development</td>
<td>.079**</td>
<td>.007</td>
</tr>
<tr>
<td>Communication with faculty/instructors</td>
<td>.044</td>
<td>.069*</td>
</tr>
<tr>
<td>Higher-order thinking</td>
<td>.058*</td>
<td>.036</td>
</tr>
<tr>
<td>Active and Collaborative learning experiences</td>
<td>-.018</td>
<td>-.038</td>
</tr>
<tr>
<td>Overall institutional support</td>
<td>.172***</td>
<td>.203***</td>
</tr>
<tr>
<td>Reading and writing expectations</td>
<td>-.046</td>
<td>-.083***</td>
</tr>
</tbody>
</table>

\(R^2\) | .415 | .410
\(\text{Adj. } R^2\) | .408 | .402
\(\Delta R^2\) | .354 | .353

Note: *\(p < .05\), **\(p < .01\), ***\(p < .001\)
CHAPTER FIVE: Discussion, Conclusion, and Implications

This chapter discusses the findings in relationship to existing studies, study limitations, implications for future research, and overall significance of the study. These results and conclusions were intended to provide useful information for a wide range of individuals who are directly involved with undergraduate students at a Research I institutions in terms of their engagement levels, learning, motivation, and success. This chapter has three parts: (a) a summary of the research findings, (b) a conclusion about students who major STEM and non-STEM, and (c) implications for research, policy, and practice.

Discussion

Descriptive Statistics

The results from the descriptive analysis of the data from the NSSE revealed valuable information about ISU seniors. Demographically, most of this population reported being traditional-college-aged students. More than 80% were 20-23 years old with 41.85% majoring in STEM and 40.06% non-STEM. Regarding the gender distribution, men (49.33%) and women (50.53%) were represented equally in the entire sample. However, a higher proportion of men (30.20%) reported majoring in STEM with women (31.76%) being more prominent in non-STEM majors. Over 80% of both STEM and non-STEM students identified themselves as white (non-Hispanic). In terms of enrollment status, a majority of the sample consisted of full-time students with 48.04% in STEM and 46.69% not in STEM. Almost all were domestic students followed by more two-thirds who began their postsecondary education at ISU. In terms of academic advising, 66.82% of the sample evaluated their academic advising as good or excellent, followed by 23.62% who reported their advising as being fair. When the senior students were asked if they could start their
educational experience all over again would they attend ISU, 42.24% of STEM and 40.39% non-STEM majors indicated they would definitely or probably attend ISU again. In summary, both STEM and non-STEM majors were represented equally in terms of demographics.

**Multivariate Results**

The hypothetical predictive model was developed using Astin’s I-E-O model as a conceptual framework using three conceptual blocks, which includes variables that were measured by observed variables and/or composite variables. A complete summary of the factor loadings of each construct variable and alpha coefficients are presented in Table 4. Included in the first block of the hypothetical predictive model, the input variable (background characteristics) were composed of four observed NSSE survey items. The environment consists of two separate blocks: college experiences and student engagement experiences. The second block, college experiences represents four observed variables: (a) enrollment and transfer status, (b) grades, and (c) living arrangement. It is important to note that the first and second blocks were controlled characteristics in the hypothetical predictive model. Included in the third block of the hypothetical model, student engagement experiences was defined by seven composite variables: (a) acquisition of knowledge and skills, (b) personal development, (c) communication with faculty/instructors, (d) higher-order thinking, (e) overall institutional support, (f) active and collaborative learning experiences, and (g) reading and writing expectations. Finally, it is important to note an alpha score of .70 as an acceptable minimum for creating scales (Gordon, Ludlum, & Hoey, 2008).
Acquisition of knowledge and skills

The first composite variable or construct, acquisition of knowledge and skills ($\alpha = .884$), was defined by nine survey items that asked students to report the extent ISU contributed to their knowledge, skills, and personal development. The first two survey items were associated with how clearly and effectively students communicated to others in the form of speaking and writing. The next three survey items asked students to use their critical thinking skills in the form of analyzing quantitative problems and solving complex real-world problems. In addition, applied knowledge was apparent with the survey items associated with (a) acquiring a broad general education, (b) acquiring job or work related skills, and (c) using computer and information technology. Finally, the ninth survey item within this construct, working effectively with others, requires students to consider their interpersonal relationships. In other words, this construct, acquisition of knowledge of skills, consists of a combination of communication and critical thinking skills as well as an awareness of applied knowledge and interpersonal relationships.

In 2004, Kuh and Umbach included six survey items within this construct as a composite factor to represent character development. Pike (2006c) identified two constructs using scalelets, which closely resembles this construct, acquisition of knowledge and skills, with the exclusion of the variables related to communication skills. In fact, the survey items within this construct that correspond to interpersonal relationships and critical thinking skills has been previously identified as its own construct by researchers Carini, Kuh, and Klien (2006). However, it is important to note that these survey items are not included in the NSSE benchmarks.
**Personal Development**

The composite variable, personal development ($\alpha = .851$), was defined as a composite of six survey items that asked students to report the extent ISU contributed to their knowledge, skills, and personal development. Two of these survey items were associated with a student confronting their awareness of people in their surroundings by being open to understanding people of other racial and ethnic backgrounds and the welfare of their community. The remaining four survey items asked students to analyze the structure of their belief system with (a) understanding of themselves, (b) learning effectively on their own, (c) developing a personal code of values and ethics, and (d) developing a deepened sense of spirituality. Interestingly, Kuh and Umbach (2004) defined five of the survey items identified within this construct to represent a composite factor to represent character development. However, it is important to note that these survey items are not included in the NSSE benchmarks.

**Communication with faculty/administrators**

The third composite variable, communication with faculty/instructors ($\alpha = .768$), was defined as a composite of seven survey items that asked students to express the frequency as well as how they interacted with faculty and instructors during the current school year. These survey items reflected three types of student-faculty interactions (a) functional, (b) personal, and (c) mentoring with the exception of one survey item. As defined by Cox and Orehovec (2007), functional interactions have a specific, institutionally related purpose such as asking questions and working on a research project. Within this construct, communication with faculty/instructors, the following three survey items can be classified as functional interactions: (a) discussing grades or assignments with an instructor, (b) asked questions in
class or contributed to class discussions, and (c) receiving prompt written or oral feedback from faculty on their academic performance.

The second type of student-faculty, personal interactions, was defined as professional interactions requiring personal interest from both the student and the faculty member, which makes the interaction more comfortable (Cox & Orehovec, 2007). One survey item was considered a personal interaction within this construct, which asked students to identify if they worked with a faculty member on activities other than coursework such as committees, orientation, student life activities, etc. Cox and Orehovec (2007) refer to mentoring as the most infrequent type of student interaction. Interestingly, mentoring was identified within this construct due to the survey item, which asked students if they talked about career plans with a faculty member or advisor. In addition, this survey item falls within one of the mentoring domains defined by researchers Cruz and Crisp. The sixth survey item, used email to communicate with instructors, may correspond to three of the five types of student-faculty interactions. However, the determining factor is the context and intended purpose of the email.

Finally, the seventh survey item does not align with the other themes due to the question referring to students, family, co-workers, etc. It asked students if they discussed ideas from their readings or classes with others outside of their class. Although, it could refer to faculty, the question leaves some ambiguity in how the survey participant may respond to the question. Interestingly, five survey items within this construct correspond to the NSSE benchmark, student-faculty interactions.
Higher-order thinking

The fourth composite variable, higher-order thinking (α = .817), was defined as a composite of four survey items that asked students to identify mental activities emphasized in their coursework over the current school year. The first survey items in this construct was synthesizing or organizing ideas, information, or experiences into new, more complex interpretations and relationships. Then the second survey item asked about the analysis of the basic elements of an idea, experience, or theory, such as examining a particular case or situation in depth and considering its components. The third item asked about making judgments about the value of information, arguments, or methods, such as examining how others gathered and interpreted their data and assessing the soundness of their conclusions. Finally, the fourth item asked students about applying theories or concepts to practical problems or in new situations.

An analysis of the literature identified higher-order thinking as a clearly defined, reproducible construct of four survey items. As a construct, higher-order thinking “focuses on the amount students believe that their courses emphasize advanced thinking skills such as analyzing the basic elements of an idea, experience, or theory and synthesizing ideas, information, or experiences into new, more complex interpretations” (Nelson Laird, T. F., Shoup, R., Kuh, G. D., & Schwarz, M. J., p. 477, 2008). The following three research groups were able to identify higher-order thing as an acceptable scale for both freshman and senior students: (a) Zhao and Kuh (2004) α = .80, (b) Carini, Kuh, and Klien (2006) α = .74, and (c) Pascarella et al. (2006) α = .81. In addition, two research groups were able to identify the construct for seniors: Kinzie, Thomas, Palmer, Umbach, and Kuh (2007) α = .81 and Nelson Laird et al. (2008) α = .82. In fact, the high-order thinking construct is part of the NSSE
benchmark, level of academic challenge. Thus, the reliability of the high-order thinking construct revealed in this study adds to the growing literature, which suggests it is as an acceptable scale or subscale to use in the analysis of NSSE data.

**Overall institutional support**

The fifth composite variable, overall institutional support ($\alpha = .801$), was defined as a composite of five survey items that asked students to identify the extent ISU supported them academically, emotionally, and socially. However, the items in this construct indentified the social aspects of the institution. The institution provides the physical space for students to engage with others (Bennett, 2006). Bennett (2006) used NSSE to assess the construction of learning spaces, which students indicated their preference towards an environment providing convenience and comfort while they study. Therefore, the space an institution provides to students promotes social interactions that are conducive to learning.

**Active and collaborative learning experiences**

The sixth composite variable, active and collaborative learning experiences ($\alpha = .688$), was defined as a composite of five survey items that asked students to identify activities that used active and collaborative learning techniques. It is important to note that the survey items used to define this construct are part of the NSSE benchmark, active and collaborative learning.

**Reading and writing expectations**

The seventh composite variable, reading and writing expectations ($\alpha = .623$), was defined as a composite of four survey items that asked students to identify the amount reading and writing assignments completed during the current term. It is important to note
that the survey items in this construct are part the NSSE benchmark, level of academic challenge.

**Dependent Variable**

The dependent variable of the hypothetical predictive model was an observed variable: “How would you evaluate your entire educational experience at this institution?” Students were asked to respond on a scale on a four-point scale: 1 = poor, 2 = fair, 3 = good, and 4 = excellent. Interestingly, Kuh (2009a) considers this dependent variable as one of the two survey items that can directly measure student satisfaction. Other researchers have tested the reliability of the satisfaction construct with Cronbach’s alpha (α) values above .72 (Umbach & Wawrzynski, 2005; Carini, Kuh, & Klien, 2006; Nelson Laird et. al, 2008; Zhao & Kuh, 2004). Thus, the dependent variable used in this study to predict educational experience satisfaction supports previous research findings.

**Independent t-test results**

To examine the statistical significance between of STEM and non-STEM majors, this study used independent t-tests to analyze student engagement experiences. Multivariate analysis identified seven student engagement experiences as composite variables: (a) acquisition of knowledge and skills, (b) personal development, (c) communication with faculty/instructors, (d) higher-order thinking, (e) overall institutional support, (f) active and collaborative learning experiences, and (g) reading and writing expectations. A $p$-value less than .05 was established as the cutoff for statistical significance. The results revealed four statistically significant construct variables with one favoring STEM majors and three favoring non-STEM majors.
**STEM majors**

There was one student engagement experiences construct, acquisition of knowledge and skills ($t = -3.794$, $df = 2485$, $p < .05$), that was statistically significant for students who majored in STEM. Students reported having quite a bit ($M = 3.06$, $SD = .594$) of experience with ISU contributing to their knowledge, skills, and personal development in the following areas: communication and critical thinking skills, awareness of applied knowledge, and interpersonal relationships. Although, the independent t-test results indicated a statistical significance favoring STEM students, the mean value for both groups was close in value. Students who did not major in STEM ($M = 2.97$, $SD = .628$) had quite a bit of experience with ISU in regards to the survey items contained within this construct. These research findings support previous research, which support STEM majors being encouraged to develop skills to promote quantitative reasoning and knowledge (Brint, Cantwell, & Hanneman, 2008).

**Non-STEM majors**

Three student engagement experiences were statistically significant for students who did not majors in STEM: (a) personal development ($t = 3.455$, $df = 2492.263$, $p < .05$), (b) communication with faculty/instructors ($t = 2.235$, $df = 2500$, $p < .05$), and (c) reading and writing expectations ($t = 2505.584$, $df = 2485$, $p < .05$). The research findings support previous research, which supports non-STEM majors being encouraged to discuss their learning in a formal setting (Brint, Cantwell, & Hanneman, 2008). In addition, this requires students to compose their discussion both orally and in writing.
Hierarchical Multiple Regression Results

To examine the factors that affect the satisfaction with educational experience among senior ISU students, this study analyzed the hypothetical predictive model. The $R^2$ and adjusted $R^2$ values were used examined the validity of the predictive model. Furthermore, the significance of regression coefficients were examined at a significance level of $p < .05$, .01, and .001.

Predictive Model for the educational satisfaction of STEM majors

The result from the analysis of the predictive model reveals $R^2$ did not identify significant change with the first two blocks: background characteristics and college experiences. After the third block was entered, with all the independent variables in the equation, $R^2 = .415$ with $p < .05$, $p < .01$, and $p < .001$ found. The adjusted $R^2$ value of .408 indicates that 40.8% of the variability of students’ who majored in STEM self-reported satisfaction with their education experience was predicted by background characteristics, college experiences, and student engagement experiences. From the background characteristics block, three independent variables were statistically significant: (a) race ($\beta = .052$) at $p < .05$, (b) female students were found statistically significant ($\beta = .059$) at $p < .05$, and (c) mother’s highest level of education ($\beta = .101$) at $p < .05$. Within the college experiences block, grades ($\beta = .101$) at $p < .001$ were found statistically significant independent variable. From the student engagement experiences block, four independent variables were found to be statistically significant predictors of educational experience satisfaction: (a) acquisition of knowledge and skill ($\beta = .402$) at $p < .001$, (b) personal development ($\beta = .079$) at $p < .05$, (c) higher-order thinking ($\beta = .058$) at $p < .05$, and (d) overall institutional support ($\beta = .172$) at $p < .001$. 
These findings support the use of Asin’s I-E-O model as a conceptual framework. Approximately, one third of the STEM majors were women that were predicted to benefit from a satisfying educational experience. As Brint, Cantwell, and Hanneman (2008) point out “the strength of the natural sciences/engineering culture of engagement is that it can generate hard work, collaborative study, and technically competent performances in demanding fields that do not give out rewards very easily” (p. 398).

**Predictive Model for the educational satisfaction of non-STEM majors**

The result from the analysis of the predictive model reveals $R$ squared did not identify significant change with the first two blocks: background characteristics and college experiences. After the third block was entered, with all the independent variables in the equation, $R^2 = .410$ with $p<.05$, $p<.01$, and $p<.001$ found. The adjusted $R^2$ value of .402 indicates that 40.2% of the variability of students’ who did not major in STEM self-reported satisfaction with their education experience was predicted by background characteristics, college experiences, and student engagement experiences. From the background characteristics block, two independent variables were found statistically significant, race ($\beta = .065$) at $p < .01$ and father’s highest level of education ($\beta = .066$) at $p < .05$. Within the college experiences block, grades ($\beta = .150$) at $p < .001$ was found to be a statistically significant independent variable.

Within the student engagement experiences block, four independent variables were identified as statically significant predictors of educational experience satisfaction: (a) acquisition of knowledge and skill ($\beta = .416$) at $p < .001$, (b) communication with faculty/instructors ($\beta = .069$) at $p < .05$, (c) overall institutional support ($\beta = .203$) at $p < .001$, and (d) reading and writing expectations ($\beta = -.083$) at $p < .001$. These findings support the
use of Asin’s I-E-O model as a conceptual framework. As Brint, Cantwell, and Hanneman (2008) point out “the humanities/social science culture generates interaction and discussion and can stimulate alert, insightful contributions” (p.398).

**Similarities between STEM and non-STEM majors**

This comparison study of STEM and non-STEM majors revealed distinct engagement experiences shared by both groups. Four independent variables were similar among STEM and non-STEM majors. For background characteristics, being white was positively association for both STEM and non-STEM majors. As far as college experiences, grades were a positive, statistically significant predictor for educational experience satisfaction. Within student engagement experiences, there were two independent variables that statistically significant among both majors: acquiring knowledge and skill and overall institutional support.

**Differences between STEM and non-STEM majors**

This comparison study of STEM and non-STEM majors revealed distinct engagement experiences not shared by both groups. For background characteristics, being female as well as their mother’s highest level of education was statistically significant for STEM majors as well as personal development and higher-order thinking. Conversely, father’s highest level of education was statistically for non-STEM as well as communication with faculty/instructors and reading and writing expectations. It is important to note the presence of multicollinearity or high correlation was present between two variables corresponding to the highest level of education for the students’ father and mother. Therefore, the highest level of education of a parent does contribute to the education satisfaction of ISU students.
but the high correlation between the two variables does not allow the investigator to predict the impact of each variable individually.

**Conclusions**

The hypothetical predictive model was used to better understand the complex factors that influence the educational experience of students who major in STEM and non-STEM by using secondary data from the National Survey of Student Engagement (NSSE). The results of this study suggest there is an association between background characteristics as well as college and student engagement experiences in regards to the students’ satisfaction with their educational experience. However, student engagement experiences accounted for the largest amount of variability (35%) in the model that would be congruent with the use NSSE.

In addition, this study builds on previous research regarding the experiences of college students. Research conducted by Biglan (1973a, 1973b) and Holland (1985a, 1985b, 1997) as well as Brint, Cantwell, and Hanneman (2008) in highlighting the impact of a student’s academic major on their undergraduate educational experiences. More specifically, Biglan (1973a, 1973b) focused on organizing majors into groups that facilitated a comparative study of STEM and non-STEM majors. Holland (1985a, 1985b, 1997) was able to elaborate on Biglan’s classification scheme by classifying majors into six groups, which was able to provide more variability for comparing groups. Unfortunately, the limitation of Biglan’s classification scheme and Holland’s theory was the fact that these frameworks cannot classify all majors/disciplines. Thus, the research conducted by Brint, Cantwell, and Hanneman (2008) that reported two distinct cultures of student engagement, social sciences/humanities and natural sciences, engineering and business, was insightful. This research study was able to quantify the use of STEM and non-STEM as reasonable
terminology for this type of research. Although, it is important to know that Brint, Cantwell, and Hanneman (2008) were focusing on degree aspirations after college. Therefore, it is logical for business majors to aspire similarly to natural scientists and engineers in terms of degree aspirations.

In regards to this research study, educational experience was the dependent variable so it would not be appropriate to group business majors with natural scientists and engineers due to their curricular programs being vastly different. Future research needs to examine the terminology used to define groups to provide a better understanding of the effects of an academic major in terms of retention, persistence, and curriculum design.

Limitations

There were several limitations to this study. First, secondary data were used and may not reflect educational experience satisfaction of current ISU seniors due to the data ranging from 2-5 years old. Second, the NSSE is a short questionnaire that cannot measure all the conditions and behaviors that many influence student engagement (Kuh G. D., 2009). Third, a cross-sectional study was used due to the inability to perform a longitudinal study. Fourth, the exploratory factor analysis (EFA) only reflects student included in this study and may not be applicable to students at another institution. Fifth, there were no direct measures of pre-college characteristics, such as GPA, ACT and SAT, included in the model.

Implications

The findings of this study provide implications for future research, policy, and practice. In addition, this study contributes to existing literature on the two cultures of student engagement by examining the influence of a students’ major on their perception of
their educational experience. The following will address how these findings can be useful to students, faculty, and administrators in the form of research, policy, and practice.

**Research**

As suggested by the findings in this study, more research needs to be conducted to examine more differences and similarities between STEM and non-STEM majors. Students need to be aware that taking surveys such as NSSE are a way for them to have a voice, which has the potential to influence the educational experience of others in the future. Faculty need to be encouraged to facilitate more research projects with existing survey data such as NSSE as a starting point in the development of future surveys. Administrators should to use data to inform their decisions as well as inform the campus community that data for surveys such as NSSE and internal surveys were compelling factors to facilitate change.

**Policy**

The results of this study will help inform policy that there need to be a consideration of the impact changes may incur on both STEM and non-STEM disciples/majors due to them being difference. It is well known that “most intuitions are awash in data, and it is up to busy administrators, institutional researchers, faculty members, and staff to use them effectively o guide improvement efforts” (Banta, Pike, and Hansen, 2008, p. 32). Therefore, more consideration needs to taken when decisions are made about the appropriate time, type, and intended audience. Faculty and staff need to be aware of institutional improvements as well as how they should implement change. Administrators should communicate with faculty and staff about policy before and after changes to reduce confusion when there is a change.
Practice

The results of this study suggest that a one-size fits all model of educational purposeful activities may not benefit all students. Faculty in different academic environments attributes different aspects of broad educational goals. The educational goals are a reflection of the institution’s mission. Therefore, students need different faculty for various academic majors/disciplines to challenge them to meet theses broad educational goals. Faculty and staff need to be encouraged to explore different pedagogy to reflect a diverse learning environment. Thus, administrators need to support faculty to explore and practice different pedagogy to meet the institution’s mission. In reference to data, administrators need to inform faculty about the data available through the Office of Institutional Research.
APPENDIX A: THE CLASSIFICATION OF INSTRUCTIONAL PROGRAMS

AGRICULTURE, AGRICULTURE OPERATIONS, AND RELATED SCIENCES

Instructional programs that focus on agriculture and related sciences and that prepare individuals to apply specific knowledge, methods, and techniques to the management and performance of agricultural operations.

- Agricultural and Horticultural Plant Breeding
- Agricultural Animal Breeding
- Agriculture, General
- Agronomy and Crop Science
- Animal Health
- Animal Nutrition
- Animal Sciences
- Dairy Science
- Food Science
- Food Technology and Processing
- Horticultural Science
- Livestock Management
- Natural Resources and Conservation
- Plant Protection and Integrated Pest Management
- Plant Sciences, General
- Poultry Science
- Plant Protection and Integrated Pest Management
- Range Science and Management
- Soil Chemistry and Physics
- Soil Microbiology
- Soil Science and Agronomy
- Agriculture, Agriculture Operations, and Related Sciences

BIOLOGICAL AND BIOMEDICAL SCIENCES

Instructional programs that focus on the biological sciences and the non-clinical biomedical sciences, and that prepare individuals for research and professional careers as biologists and biomedical scientists.

- Anatomy
- Animal Physiology
- Animal Behavior and Ethology
- Aquatic Biology/Limnology
- Animal Genetics
- Biochemistry
<table>
<thead>
<tr>
<th>Biological and Biomedical Sciences (continued)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biochemistry, Biophysics and Molecular Biology</td>
</tr>
<tr>
<td>Bioinformatics</td>
</tr>
<tr>
<td>Biology, General</td>
</tr>
<tr>
<td>Biology/Biological Sciences, General</td>
</tr>
<tr>
<td>Biomedical Sciences, General</td>
</tr>
<tr>
<td>Biometry/Biometrics</td>
</tr>
<tr>
<td>Biophysics</td>
</tr>
<tr>
<td>Biostatistics</td>
</tr>
<tr>
<td>Biotechnology</td>
</tr>
<tr>
<td>Botany/Plant Biology</td>
</tr>
<tr>
<td>Cardiovascular Science</td>
</tr>
<tr>
<td>Cell Biology and Anatomy</td>
</tr>
<tr>
<td>Cell Physiology</td>
</tr>
<tr>
<td>Cell/Cellular and Molecular Biology</td>
</tr>
<tr>
<td>Cell/Cellular Biology and Anatomical Sciences</td>
</tr>
<tr>
<td>Cell/Cellular Biology and Histology</td>
</tr>
<tr>
<td>Conservation Biology</td>
</tr>
<tr>
<td>Developmental Biology and Embryology</td>
</tr>
<tr>
<td>Ecology</td>
</tr>
<tr>
<td>Endocrinology</td>
</tr>
<tr>
<td>Entomology</td>
</tr>
</tbody>
</table>
### BIOLOGICAL AND BIOMEDICAL SCIENCES (continued)

<table>
<thead>
<tr>
<th>Subject</th>
<th>Subject</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neuroanatomy</td>
<td>Plant Physiology</td>
</tr>
<tr>
<td>Neurobiology and Neurophysiology</td>
<td>Population Biology</td>
</tr>
<tr>
<td>Neuropharmacology</td>
<td>Radiation Biology/Radiobiology</td>
</tr>
<tr>
<td>Oncology and Cancer Biology</td>
<td>Reproductive Biology</td>
</tr>
<tr>
<td>Parasitology</td>
<td>Structural Biology</td>
</tr>
<tr>
<td>Pathology/Experimental Pathology</td>
<td>Systematic Biology/Biological Systematics</td>
</tr>
<tr>
<td>Pharmacology</td>
<td>Toxicology</td>
</tr>
<tr>
<td>Pharmacology and Toxicology</td>
<td>Virology</td>
</tr>
<tr>
<td>Photobiology</td>
<td>Vision Science/Physiological Optics</td>
</tr>
<tr>
<td>Physiology</td>
<td>Wildlife Biology</td>
</tr>
<tr>
<td>Plant Genetics</td>
<td>Zoology/Animal Biology</td>
</tr>
<tr>
<td>Plant Molecular Biology</td>
<td>Biological and Biomedical Sciences, Other</td>
</tr>
<tr>
<td>Plant Pathology/Phytopathology</td>
<td></td>
</tr>
</tbody>
</table>

### ENGINEERING

*Instructional programs that prepare individuals to apply mathematical and scientific principles to the solution of practical problems.*

<table>
<thead>
<tr>
<th>Subject</th>
<th>Subject</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aerospace, Aeronautical and Astronautical Engineering</td>
<td>Civil Engineering</td>
</tr>
<tr>
<td>Agricultural/Biological Engineering and Bioengineering</td>
<td>Computer Engineering</td>
</tr>
<tr>
<td>Architectural Engineering</td>
<td>Computer Hardware/Software Engineering</td>
</tr>
<tr>
<td>Biomedical/Medical Engineering</td>
<td>Construction Engineering</td>
</tr>
<tr>
<td>Ceramic Sciences and Engineering</td>
<td>Electrical, Electronics and Communications Engineering</td>
</tr>
<tr>
<td>Chemical Engineering</td>
<td>Engineering Mechanics</td>
</tr>
</tbody>
</table>
### ENGINEERING (continued)

<table>
<thead>
<tr>
<th>Engineering Physics</th>
<th>Naval Architecture and Marine Engineering</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineering Science</td>
<td>Nuclear Engineering</td>
</tr>
<tr>
<td>Environmental/Environmental Health Engineering</td>
<td>Ocean Engineering</td>
</tr>
<tr>
<td>Forest Engineering</td>
<td>Operations Research</td>
</tr>
<tr>
<td>Geological/Geophysical Engineering</td>
<td>Petroleum Engineering</td>
</tr>
<tr>
<td>Geotechnical Engineering</td>
<td>Polymer/Plastics Engineering</td>
</tr>
<tr>
<td>Industrial Engineering</td>
<td>Structural Engineering</td>
</tr>
<tr>
<td>Manufacturing Engineering</td>
<td>Surveying Engineering</td>
</tr>
<tr>
<td>Materials Engineering</td>
<td>Systems Engineering</td>
</tr>
<tr>
<td>Materials Science</td>
<td>Textile Sciences and Engineering</td>
</tr>
<tr>
<td>Mechanical Engineering</td>
<td>Transportation and Highway Engineering</td>
</tr>
<tr>
<td>Metallurgical Engineering</td>
<td>Water Resources Engineering</td>
</tr>
<tr>
<td>Mining and Mineral Engineering</td>
<td>Engineering, Other</td>
</tr>
</tbody>
</table>

### MATHEMATICS AND STATISTICS

*Instructional programs that focus on the systematic study of logical symbolic language and its applications.*

<table>
<thead>
<tr>
<th>Algebra and Number Theory</th>
<th>Mathematical Statistics and Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analysis and Functional Analysis</td>
<td>Mathematics, General</td>
</tr>
<tr>
<td>Applied Mathematics</td>
<td>Statistics, General</td>
</tr>
<tr>
<td>Computational Mathematics</td>
<td>Topology and Foundations</td>
</tr>
<tr>
<td>Geometry/Geometric Analysis</td>
<td></td>
</tr>
</tbody>
</table>
**PHYSICAL SCIENCES**

Instructional programs that focus on the scientific study of inanimate objects and processes of matter as well as energy associated phenomena.

<table>
<thead>
<tr>
<th>Astronomy</th>
<th>Geophysics and Seismology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Astrophysics</td>
<td>Paleontology</td>
</tr>
<tr>
<td>Planetary Astronomy and Science</td>
<td>Hydrology and Water Resources Science</td>
</tr>
<tr>
<td>Atmospheric Sciences and Meteorology</td>
<td>Geochemistry and Petrology</td>
</tr>
<tr>
<td>Atmospheric Chemistry and Climatology</td>
<td>Oceanography, Chemical and Physical</td>
</tr>
<tr>
<td>Atmospheric Physics and Dynamics</td>
<td>Physics, General</td>
</tr>
<tr>
<td>Meteorology</td>
<td>Atomic/Molecular Physics</td>
</tr>
<tr>
<td>Chemistry</td>
<td>Elementary Particle Physics</td>
</tr>
<tr>
<td>Analytical Chemistry</td>
<td>Plasma and High-Temperature Physics</td>
</tr>
<tr>
<td>Inorganic Chemistry</td>
<td>Nuclear Physics</td>
</tr>
<tr>
<td>Organic Chemistry</td>
<td>Optics/Optical Sciences</td>
</tr>
<tr>
<td>Physical and Theoretical Chemistry</td>
<td>Solid State and Low-Temperature Physics</td>
</tr>
<tr>
<td>Polymer Chemistry</td>
<td>Acoustics</td>
</tr>
<tr>
<td>Chemical Physics</td>
<td>Theoretical and Mathematical Physics</td>
</tr>
<tr>
<td>Geology/Earth Science, General.</td>
<td>Physical Sciences, Other</td>
</tr>
<tr>
<td>Geochemistry</td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX B: DISCIPLINARY AREAS BY BLIGLAN CATEGORIES

<table>
<thead>
<tr>
<th>Pure-Life Biology (general)</th>
<th>Anthropology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biochemistry</td>
<td>Ethnic studies</td>
</tr>
<tr>
<td>Botany</td>
<td>Political science (incl. gov’t, int’l rel.)</td>
</tr>
<tr>
<td>Environmental science</td>
<td>Psychology</td>
</tr>
<tr>
<td>Microbiology or bacteriology</td>
<td>Sociology</td>
</tr>
<tr>
<td>Zoology</td>
<td></td>
</tr>
<tr>
<td>Kinesiology</td>
<td></td>
</tr>
<tr>
<td>Pure-Non-Life Astronomy</td>
<td>Art, fine and applied</td>
</tr>
<tr>
<td>Atmospheric science (incl. meteorology)</td>
<td>English (language and literature)</td>
</tr>
<tr>
<td>Chemistry</td>
<td>History</td>
</tr>
<tr>
<td>Earth Science</td>
<td>Language and literature (except English)</td>
</tr>
<tr>
<td>Mathematics</td>
<td>Music</td>
</tr>
<tr>
<td>Physics</td>
<td>Philosophy</td>
</tr>
<tr>
<td>Statistics</td>
<td>Theater or drama</td>
</tr>
<tr>
<td></td>
<td>Geography</td>
</tr>
<tr>
<td>Applied-life Speech</td>
<td>Theology or religion</td>
</tr>
<tr>
<td>Medicine</td>
<td>Business education</td>
</tr>
<tr>
<td>Dentistry</td>
<td>Elementary/middle school education</td>
</tr>
<tr>
<td>Veterinarian</td>
<td>Music or art education</td>
</tr>
<tr>
<td>Pharmacy</td>
<td>Elementary/middle school education</td>
</tr>
<tr>
<td>Agriculture</td>
<td>Physical education or recreation</td>
</tr>
<tr>
<td></td>
<td>Nursing</td>
</tr>
<tr>
<td></td>
<td>Allied health/other medical</td>
</tr>
<tr>
<td></td>
<td>Social work</td>
</tr>
<tr>
<td></td>
<td>Family studies</td>
</tr>
<tr>
<td></td>
<td>Criminal justice</td>
</tr>
<tr>
<td>Applied-Non-Life Aero-/astronautical engineering</td>
<td>Journalism</td>
</tr>
<tr>
<td>Civil engineering</td>
<td>Accounting</td>
</tr>
<tr>
<td>Chemical engineering</td>
<td>Business administration (general)</td>
</tr>
<tr>
<td>Computer science</td>
<td>Finance</td>
</tr>
<tr>
<td>Electrical or electronic engineering</td>
<td>Marketing</td>
</tr>
<tr>
<td>Industrial engineering</td>
<td>Management</td>
</tr>
<tr>
<td>Materials engineering</td>
<td>Architecture</td>
</tr>
<tr>
<td>Mechanical engineering</td>
<td>Urban Planning</td>
</tr>
<tr>
<td>General/other engineering</td>
<td>Economics</td>
</tr>
<tr>
<td></td>
<td>Communications</td>
</tr>
<tr>
<td></td>
<td>Public Administration</td>
</tr>
</tbody>
</table>

Note: Categorized based on Biglan (1973a, b), Malaney (1986), Stoecker (1993), Clark (2003), and Nelson Laird, Shoup, Kuh, & Schwarz (2008)
## APPENDIX C: LIST OF MAJORS WITH CODING VALUES

<table>
<thead>
<tr>
<th>Variable Group</th>
<th>Value</th>
<th>Label</th>
<th>Recoded Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Arts and Humanities</strong></td>
<td>1</td>
<td>Art, fine, and applied</td>
<td>“0” for non-STEM</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>English (language and literature)</td>
<td>“0” for non-STEM</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>History</td>
<td>“0” for non-STEM</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>Journalism</td>
<td>“0” for non-STEM</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>Language and literature (except English)</td>
<td>“0” for non-STEM</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>Music</td>
<td>“0” for non-STEM</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>Philosophy</td>
<td>“0” for non-STEM</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>Speech</td>
<td>“0” for non-STEM</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>Theater or drama</td>
<td>“0” for non-STEM</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>Theology or religion</td>
<td>“0” for non-STEM</td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>Other arts &amp; humanities</td>
<td>“0” for non-STEM</td>
</tr>
<tr>
<td><strong>Biological Sciences</strong></td>
<td>12</td>
<td>Biology (general)</td>
<td>“1” for STEM</td>
</tr>
<tr>
<td></td>
<td>13</td>
<td>Biochemistry or biophysics</td>
<td>“1” for STEM</td>
</tr>
<tr>
<td></td>
<td>14</td>
<td>Botany</td>
<td>“1” for STEM</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td>Environmental science</td>
<td>“1” for STEM</td>
</tr>
<tr>
<td></td>
<td>16</td>
<td>Marine (life) science</td>
<td>“1” for STEM</td>
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<tr>
<td></td>
<td>17</td>
<td>Microbiology or bacteriology</td>
<td>“1” for STEM</td>
</tr>
<tr>
<td></td>
<td>18</td>
<td>Zoology</td>
<td>“1” for STEM</td>
</tr>
<tr>
<td></td>
<td>19</td>
<td>Other biological science</td>
<td>“1” for STEM</td>
</tr>
<tr>
<td><strong>Business</strong></td>
<td>20</td>
<td>Accounting</td>
<td>“0” for non-STEM</td>
</tr>
<tr>
<td></td>
<td>21</td>
<td>Business administration</td>
<td>“0” for non-STEM</td>
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<td></td>
<td>22</td>
<td>Finance</td>
<td>“0” for non-STEM</td>
</tr>
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<td></td>
<td>23</td>
<td>International business</td>
<td>“0” for non-STEM</td>
</tr>
<tr>
<td></td>
<td>24</td>
<td>Marketing</td>
<td>“0” for non-STEM</td>
</tr>
<tr>
<td></td>
<td>25</td>
<td>Management</td>
<td>“0” for non-STEM</td>
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<tr>
<td></td>
<td>26</td>
<td>Other Business</td>
<td>“0” for non-STEM</td>
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<tr>
<td><strong>Education</strong></td>
<td>27</td>
<td>Business education</td>
<td>“0” for non-STEM</td>
</tr>
<tr>
<td></td>
<td>28</td>
<td>Elementary/middle school education</td>
<td>“0” for non-STEM</td>
</tr>
<tr>
<td></td>
<td>29</td>
<td>Music or art education</td>
<td>“0” for non-STEM</td>
</tr>
<tr>
<td></td>
<td>30</td>
<td>Physical education or recreation</td>
<td>“0” for non-STEM</td>
</tr>
<tr>
<td></td>
<td>31</td>
<td>Secondary education</td>
<td>“0” for non-STEM</td>
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<tr>
<td></td>
<td>32</td>
<td>Special education</td>
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</tr>
<tr>
<td></td>
<td>33</td>
<td>Other education</td>
<td>“0” for non-STEM</td>
</tr>
<tr>
<td>Variable Group</td>
<td>Value</td>
<td>Label</td>
<td>Recoded Value</td>
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</tr>
<tr>
<td><strong>Engineering</strong></td>
<td>34</td>
<td>Aero/astronautical engineering</td>
<td>“1” for STEM</td>
</tr>
<tr>
<td></td>
<td>35</td>
<td>Civil engineering</td>
<td>“1” for STEM</td>
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<tr>
<td></td>
<td>36</td>
<td>Chemical engineering</td>
<td>“1” for STEM</td>
</tr>
<tr>
<td></td>
<td>37</td>
<td>Electrical or electronic engineering</td>
<td>“1” for STEM</td>
</tr>
<tr>
<td></td>
<td>38</td>
<td>Industrial engineering</td>
<td>“1” for STEM</td>
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<tr>
<td></td>
<td>39</td>
<td>Materials engineering</td>
<td>“1” for STEM</td>
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<tr>
<td></td>
<td>40</td>
<td>Mechanical engineering</td>
<td>“1” for STEM</td>
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<tr>
<td></td>
<td>41</td>
<td>General/other engineering</td>
<td>“1” for STEM</td>
</tr>
<tr>
<td><strong>Physical Science</strong></td>
<td>42</td>
<td>Astronomy</td>
<td>“1” for STEM</td>
</tr>
<tr>
<td></td>
<td>43</td>
<td>Atmospheric science (including meteorology)</td>
<td>“1” for STEM</td>
</tr>
<tr>
<td></td>
<td>44</td>
<td>Chemistry</td>
<td>“1” for STEM</td>
</tr>
<tr>
<td></td>
<td>45</td>
<td>Earth science (including geology)</td>
<td>“1” for STEM</td>
</tr>
<tr>
<td></td>
<td>46</td>
<td>Mathematics</td>
<td>“1” for STEM</td>
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<tr>
<td></td>
<td>47</td>
<td>Physics</td>
<td>“1” for STEM</td>
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<tr>
<td></td>
<td>48</td>
<td>Statistics</td>
<td>“1” for STEM</td>
</tr>
<tr>
<td></td>
<td>49</td>
<td>Other physical science</td>
<td>“1” for STEM</td>
</tr>
<tr>
<td><strong>Professional</strong></td>
<td>50</td>
<td>Architecture</td>
<td>“1” for STEM</td>
</tr>
<tr>
<td></td>
<td>51</td>
<td>Urban planning</td>
<td>“0” for non-STEM</td>
</tr>
<tr>
<td></td>
<td>52</td>
<td>Health technology (medical, dental, laboratory)</td>
<td>“0” for non-STEM</td>
</tr>
<tr>
<td></td>
<td>53</td>
<td>Law</td>
<td>“0” for non-STEM</td>
</tr>
<tr>
<td></td>
<td>54</td>
<td>Library/archival science</td>
<td>“0” for non-STEM</td>
</tr>
<tr>
<td></td>
<td>55</td>
<td>Medicine</td>
<td>“0” for non-STEM</td>
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<tr>
<td></td>
<td>56</td>
<td>Dentistry</td>
<td>“0” for non-STEM</td>
</tr>
<tr>
<td></td>
<td>57</td>
<td>Veterinarian</td>
<td>“1” for STEM</td>
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<tr>
<td></td>
<td>58</td>
<td>Nursing</td>
<td>“0” for non-STEM</td>
</tr>
<tr>
<td></td>
<td>59</td>
<td>Pharmacy</td>
<td>“0” for non-STEM</td>
</tr>
<tr>
<td></td>
<td>60</td>
<td>Allied health/other medical Therapy (occupational, physical, speech)</td>
<td>“0” for non-STEM</td>
</tr>
<tr>
<td></td>
<td>61</td>
<td>Other professional</td>
<td>“0” for non-STEM</td>
</tr>
<tr>
<td><strong>Social Science</strong></td>
<td>62</td>
<td>Anthropology</td>
<td>“0” for non-STEM</td>
</tr>
<tr>
<td></td>
<td>63</td>
<td>Economics</td>
<td>“0” for non-STEM</td>
</tr>
<tr>
<td></td>
<td>64</td>
<td>Ethnic studies</td>
<td>“0” for non-STEM</td>
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<tr>
<td></td>
<td>65</td>
<td>Geography</td>
<td>“0” for non-STEM</td>
</tr>
<tr>
<td></td>
<td>66</td>
<td>Political Science (including government, international)</td>
<td>“0” for non-STEM</td>
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<tr>
<td>Variable Group</td>
<td>Value</td>
<td>Label</td>
<td>Recoded Value</td>
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<tr>
<td><strong>Social Science</strong></td>
<td>68</td>
<td>Psychology</td>
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<tr>
<td>(continued)</td>
<td>69</td>
<td>Social work</td>
<td>“0” for non-STEM</td>
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<tr>
<td></td>
<td>71</td>
<td>Gender studies</td>
<td>“0” for non-STEM</td>
</tr>
<tr>
<td></td>
<td>72</td>
<td>Other social sciences</td>
<td>“0” for non-STEM</td>
</tr>
<tr>
<td><strong>Other</strong></td>
<td>73</td>
<td>Agriculture</td>
<td>“1” for STEM</td>
</tr>
<tr>
<td></td>
<td>74</td>
<td>Communication</td>
<td>“0” for non-STEM</td>
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<tr>
<td></td>
<td>75</td>
<td>Computer Science</td>
<td>“1” for STEM</td>
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<tr>
<td></td>
<td>76</td>
<td>Family studies</td>
<td>“0” for non-STEM</td>
</tr>
<tr>
<td></td>
<td>77</td>
<td>Natural resources and conservation</td>
<td>“1” for STEM</td>
</tr>
<tr>
<td></td>
<td>78</td>
<td>Kinesiology</td>
<td>“1” for STEM</td>
</tr>
<tr>
<td></td>
<td>79</td>
<td>Criminal justice</td>
<td>“0” for non-STEM</td>
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<tr>
<td></td>
<td>80</td>
<td>Military science</td>
<td>“0” for non-STEM</td>
</tr>
<tr>
<td></td>
<td>81</td>
<td>Parks, recreation, leisure studies</td>
<td>“0” for non-STEM</td>
</tr>
<tr>
<td></td>
<td></td>
<td>management</td>
<td></td>
</tr>
<tr>
<td></td>
<td>82</td>
<td>Public administration</td>
<td>“0” for non-STEM</td>
</tr>
<tr>
<td></td>
<td>83</td>
<td>Technical/vocational</td>
<td>“0” for non-STEM</td>
</tr>
<tr>
<td></td>
<td>84</td>
<td>Other field</td>
<td>“0” for non-STEM</td>
</tr>
<tr>
<td></td>
<td>85</td>
<td><strong>Undecided</strong></td>
<td>“0” for non-STEM</td>
</tr>
</tbody>
</table>
APPENDIX D: NSSE BENCHMARKS

The benchmarks are based on forty-two key questions from the National Survey of Student Engagement (NSSE) that capture many of the most important aspects of the student experience (Kuh, 2009b).

LEVEL OF ACADEMIC CHALLENGE
- Preparing for class (studying, reading, writing, rehearsing, etc., related to academic program)
- Number of assigned textbooks, books, or book-length packs or curse readings
- Number of written papers or reports of twenty pages or longer; number of written papers or reports of between five and nineteen pages; and number of written papers or reports of fewer than five pages
- Coursework emphasizing analysis of basic elements of a idea, experience or theory
- Coursework emphasizing synthesis and organizing of idea, information, or experiences into new situations
- Coursework emphasizing the making of judgments about the value of information, arguments, or methods
- Coursework emphasizing application of theories or concepts to practical problems or in new situations
- Working harder than you thought you could to meet an instructor’s standards or expectations
- Campus environment emphasizing time studying and on academic work

ACTIVE AND COLLABORATIVE LEARNING
- Asked questions in class or contributed to class discussions
- Made a class presentation
- Worked with other students on projects during class
- Worked with classmates outside of class to prepare class assignments
- Tutored or taught other students
- Participated in community-based projects as part of a regular course
- Discussed ideas from your readings or classes with others outside of class (students, family members, co-workers, etc.)

STUDENT-FACULTY INTERACTION
- Discussed grades or assignments with an instructor
- Talked about career plans with faculty members outside of class
- Worked with faculty members on activities other than coursework (committees, orientation, student-life activities, etc.)
- Received prompt feedback from faculty on your academic performance (written or oral)
- Worked with a faculty member on a outside research project
ENRICHING EDUCATION EXPERIENCES

- Participating in co-curricular activities (organizations, publications, student government, sports, etc.)
- Practicum, internship, field experience, co-op experience, or clinical assignment
- Community service or volunteer work
- Foreign language coursework
- Study abroad
- Independent study or self-designed major
- Culminating senior experience (comprehensive exam, capstone course, thesis project, etc.)
- Serious conversations with students of a different race or ethnicity
- Using electronic technology to discuss or complete an assignment
- Campus environment encouraging contact among students from different economic, social, and racial or ethnic backgrounds
- Participate in a learning community or some other formal program where groups of students take two or more classes together

SUPPORTIVE CAMPUS ENVIRONMENT

- Campus environment provides the support you need to help you succeed academically
- Campus environment helps you cope with your non-academic responsibilities (work, family, etc.)
- Campus environment provides the support you need to thrive socially
- Quality of relationships with other students
- Quality of relationships with faculty members
- Quality of relationships with administrative personnel and offices
APPENDIX E: IRB APPROVAL LETTER

IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

Date: September 10, 2009

To: Emerald C. Wilson
N243 Lagomarcino

CC: Dr. Frankie Santos Laanan
N243 Lagomarcino

From: Roxanne Bapka, IRB Coordinator
Office for Responsible Research

Project Title: Analysis of Iowa State University Students and their engagement as Science, Engineering, and Math (SEM) majors versus non-SEM majors using the National Survey of Student Engagement (2005-2008)

IRB ID: 09-382

The Co-Chair of the ISU Institutional Review Board has reviewed the project noted above and determined that the project:

- Does not meet the definition of research according to federal regulations.

X Is research that does not involve human subjects according to federal regulations.

Accordingly, this project does not need IRB approval and you may proceed at any time. We do, however, urge you to protect the rights of your participants in the same ways you would if IRB approval were required. For example, best practices include informing participants that involvement in the project is voluntary and maintaining confidentiality as appropriate.

Please also know that any change to this project must be communicated to the IRB to determine if the project has become research with human subjects requiring IRB approval.
APPENDIX F: NSSE 2008 ON_LINE SURVEY

National Survey of Student Engagement 2008
The College Student Report

Help | Contact Us | Frequently Asked Questions | Save & Exit

Study # 08-11005

What it's about—
Please tell us about your college experiences. The information from this National Survey of Student Engagement (NSSE) is used by faculty and administrators at your institution and by other higher education leaders to improve the collegiate experiences of undergraduates.

Students from hundreds of colleges and universities are also being asked these same questions—about how they spend their free time, what they feel they have gained from classes, and their interaction with faculty and other students. Filling out the questionnaire takes about 15 minutes. Your participation is completely voluntary.

Things you should know—
This survey is conducted on behalf of your institution by the Indiana University Center for Postsecondary Research; we will send your identified responses to your school for institutional assessment. Your school and the Center will keep your responses confidential and no information associated with your name will ever be released publicly. No one will use the information in any way that could cause problems for you. If you have questions at any time about the study or the procedures, you may contact the National Survey of Student Engagement at nsse@indiana.edu or by calling 812-855-5524.

If you feel you have not been treated according to the descriptions in this form, or your rights as a participant in this research have not been respected, you may contact the office for the Human Subjects Committee, Indiana University, Carmichael Center 103, 530 E. Kirkwood Ave., Bloomington, IN 47406, 812-855-3067, by e-mail at hub༄s@indiana.edu.

On to the survey—
If you have read this form and agree to take part in this survey, click the “Proceed to the survey” button.

Proceed to the survey
I do not wish to participate
Print this Page
In your experience at your institution during the current school year, about how often have you done each of the following?

<table>
<thead>
<tr>
<th>Activity</th>
<th>Very Often</th>
<th>Often</th>
<th>Sometimes</th>
<th>Never</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asked questions in class or contributed to class discussions</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Made a class presentation</td>
<td></td>
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</tr>
<tr>
<td>Prepared two or more drafts of a paper or assignment before turning it in</td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>Worked on a paper or project that required integrating ideas or information from various sources</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Included diverse perspectives (different races, religions, genders, political beliefs, etc.) in class discussions or writing assignments</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Come to class without completing readings or assignments</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Worked with other students on projects during class</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Worked with classmates outside of class to prepare class assignments</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

[Continue button]
In your experience at your institution during the current school year, about how often have you done each of the following?

<table>
<thead>
<tr>
<th>Activity</th>
<th>Very Often</th>
<th>Often</th>
<th>Sometimes</th>
<th>Never</th>
</tr>
</thead>
<tbody>
<tr>
<td>Put together ideas or concepts from different courses when completing assignments or during class discussions</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tutored or taught other students (paid or voluntary)</td>
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</tr>
<tr>
<td>Participated in a community-based project (e.g., service learning) as part of a regular course</td>
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</tr>
<tr>
<td>Used an electronic medium (listserv, chat group, Internet, instant messaging, etc.) to discuss or complete an assignment</td>
<td></td>
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<tr>
<td>Used e-mail to communicate with an instructor</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Discussed grades or assignments with an instructor</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Talked about career plans with a faculty member or advisor</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Discussed ideas from your readings or classes with faculty members outside of class</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

[Continue button]
In your experience at your institution during the current school year, about how often have you done each of the following?

<table>
<thead>
<tr>
<th>Activity</th>
<th>Very Often</th>
<th>Often</th>
<th>Sometimes</th>
<th>Never</th>
</tr>
</thead>
<tbody>
<tr>
<td>Received prompt written or oral feedback from faculty on your academic performance</td>
<td></td>
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</tr>
<tr>
<td>Worked harder than you thought you could to meet an instructor’s standards or expectations</td>
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</tr>
<tr>
<td>Worked with faculty members on activities other than coursework (committees, orientation, student life activities, etc.)</td>
<td></td>
<td></td>
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<tr>
<td>Discussed ideas from your readings or classes with others outside of class (students, family members, co-workers, etc.)</td>
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<tr>
<td>Had serious conversations with students of a different race or ethnicity than your own</td>
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<td></td>
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</tr>
<tr>
<td>Had serious conversations with students who are very different from you in terms of their religious beliefs, political opinions, or personal values</td>
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</tr>
</tbody>
</table>

[Continue button]
National Survey of Student Engagement 2008  
The College Student Report

During the current school year, about how much reading and writing have you done?

Number of assigned textbooks, books, or book-length packs of course readings
- None
- 1-4
- 5-10
- 11-20
- More than 20

Number of books read on your own (not assigned) for personal enjoyment or academic enrichment
- None
- 1-4
- 5-10
- 11-20
- More than 20

Number of written papers or reports of 20 pages or more
- None
- 1-4
- 5-10
- 11-20
- More than 20

Number of written papers or reports between 5 and 19 pages
- None
- 1-4
- 5-10
- 11-20
- More than 20

Number of written papers or reports of fewer than 5 pages
- None
- 1-4
- 5-10
- 11-20
- More than 20

Continue
During the current school year, how much has your coursework emphasized the following mental activities?

<table>
<thead>
<tr>
<th>Mental Activity</th>
<th>Very much</th>
<th>Quite a bit</th>
<th>Some</th>
<th>Very little</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Memorizing</strong></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>facts, ideas, or methods from your courses and readings so you can repeat them in pretty much the same form</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td><strong>Analyzing</strong></td>
<td></td>
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</tr>
<tr>
<td>the basic elements of an idea, experience, or theory, such as examining a particular case or situation in depth and considering its components</td>
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</tr>
<tr>
<td><strong>Synthesizing</strong></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>and organizing ideas, information, or experiences into new, more complex interpretations and relationships</td>
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</tr>
<tr>
<td><strong>Making judgments</strong></td>
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<tr>
<td>about the value of information, arguments, or methods, such as examining how others gathered and interpreted data and assessing the soundness of their conclusions</td>
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</tr>
<tr>
<td><strong>Applying</strong></td>
<td></td>
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<tr>
<td>theories or concepts to practical problems or in new situations</td>
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<td></td>
</tr>
</tbody>
</table>

[Continue]
In a typical week, how many homework problem sets do you complete?

Number of problem sets that take you more than an hour to complete:
- None
- 1-2
- 3-4
- 5-6
- More than 6

Number of problem sets that take you less than an hour to complete:
- None
- 1-2
- 3-4
- 5-6
- More than 6

Continue
Select the circle that best represents the extent to which your examinations during the current school year have challenged you to do your best work.

Very little
1  2  3  4  5  6  7

Very much
During the current school year, about how often have you done each of the following?

<table>
<thead>
<tr>
<th>Activity</th>
<th>Very Often</th>
<th>Often</th>
<th>Sometimes</th>
<th>Never</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attended an art exhibit, play, dance, music, theater, or other performance</td>
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<tr>
<td>Exercised or participated in physical fitness activities</td>
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<tr>
<td>Participated in activities to enhance your spirituality (worship, meditation, prayer, etc.)</td>
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<tr>
<td>Examined the strengths and weaknesses of your own views on a topic or issue</td>
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<tr>
<td>Tried to better understand someone else’s views by imagining how an issue looks from his or her perspective</td>
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<tr>
<td>Learned something that changed the way you understand an issue or concept</td>
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</tbody>
</table>

Continue
### National Survey of Student Engagement 2008
#### The College Student Report

Which of the following have you done or do you plan to do before you graduate from your institution?

<table>
<thead>
<tr>
<th>Activity</th>
<th>Done</th>
<th>Plan to do</th>
<th>Do not plan to do</th>
<th>Have not decided</th>
</tr>
</thead>
<tbody>
<tr>
<td>Practicum, internship, field experience, co-op experience, or clinical assignment</td>
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<tr>
<td>Community service or volunteer work</td>
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<tr>
<td>Participate in a learning community or some other formal program where groups of students take two or more classes together</td>
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<tr>
<td>Work on a research project with a faculty member outside of course or program requirements</td>
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<tr>
<td>Foreign language coursework</td>
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<tr>
<td>Study abroad</td>
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<tr>
<td>Independent study or self-designed major</td>
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<tr>
<td>Culminating senior experience (capstone course, senior project or thesis, comprehensive exam, etc.)</td>
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</tbody>
</table>

[Continue]
Select the circle that best represents the quality of your relationships with people at your institution.

**Relationships with other students**
- Unfriendly, Unsupportive, Sense of alienation
- Friendly, Supportive, Sense of belonging

**Relationships with faculty members**
- Unavailable, Unhelpful, Unsympathetic
- Available, Helpful, Sympathetic

**Relationships with administrative personnel and offices**
- Unhelpful, Inconsiderate, Rigid
- Helpful, Considerate, Flexible

Continue
National Survey of Student Engagement 2008  
The College Student Report

About how many hours do you spend in a typical 7-day week doing each of the following?

PREPARING FOR CLASS (studying, reading, writing, doing homework or lab work, analyzing data, rehearsing, and other academic activities)

<table>
<thead>
<tr>
<th>Hours per week</th>
<th>0</th>
<th>1-5</th>
<th>6-10</th>
<th>11-15</th>
<th>16-20</th>
<th>21-25</th>
<th>26-30</th>
<th>More than 30</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 Hours per week</td>
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WORKING FOR PAY ON CAMPUS

<table>
<thead>
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<th>Hours per week</th>
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<th>1-5</th>
<th>6-10</th>
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<th>21-25</th>
<th>26-30</th>
<th>More than 30</th>
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<td>0 Hours per week</td>
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WORKING FOR PAY OFF CAMPUS

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</tbody>
</table>

PARTICIPATING IN CO-CURRICULAR ACTIVITIES (organizations, campus publications, student government, fraternity or sorority, intercollegiate or intramural sports, etc.)

<table>
<thead>
<tr>
<th>Hours per week</th>
<th>0</th>
<th>1-5</th>
<th>6-10</th>
<th>11-15</th>
<th>16-20</th>
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</tbody>
</table>
### National Survey of Student Engagement 2008

**The College Student Report**

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About how many hours do you spend in a typical 7-day week doing each of the following?

#### Relaxing and Socializing (watching TV, partying, etc.)

<table>
<thead>
<tr>
<th>Hours per week</th>
<th>0</th>
<th>1-5</th>
<th>6-10</th>
<th>11-15</th>
<th>16-20</th>
<th>21-25</th>
<th>26-30</th>
<th>More than 30</th>
</tr>
</thead>
</table>

#### Providing care for dependents living with you (parents, children, spouse, etc.)

<table>
<thead>
<tr>
<th>Hours per week</th>
<th>0</th>
<th>1-5</th>
<th>6-10</th>
<th>11-15</th>
<th>16-20</th>
<th>21-25</th>
<th>26-30</th>
<th>More than 30</th>
</tr>
</thead>
</table>

#### Commuting to class (driving, walking, etc.)

<table>
<thead>
<tr>
<th>Hours per week</th>
<th>0</th>
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<th>11-15</th>
<th>16-20</th>
<th>21-25</th>
<th>26-30</th>
<th>More than 30</th>
</tr>
</thead>
</table>

[Continue]
National Survey of Student Engagement 2008
The College Student Report

To what extent does your institution emphasize each of the following?

<table>
<thead>
<tr>
<th>Activity</th>
<th>Very much</th>
<th>Quite a bit</th>
<th>Some</th>
<th>Very little</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spending significant amounts of time studying and on academic work</td>
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<tr>
<td>Providing the support you need to help you succeed academically</td>
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</tr>
<tr>
<td>Encouraging contact among students from different economic, social, and racial or ethnic backgrounds</td>
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<tr>
<td>Helping you cope with your non-academic responsibilities (work, family, etc.)</td>
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<tr>
<td>Providing the support you need to thrive socially</td>
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<tr>
<td>Attending campus events and activities (special speakers, cultural performances, athletic events, etc.)</td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>Using computers in academic work</td>
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</tbody>
</table>

Continue
To what extent has your experience at this institution contributed to your knowledge, skills, and personal development in the following areas?

<table>
<thead>
<tr>
<th>Area</th>
<th>Very much</th>
<th>Quite a bit</th>
<th>Some</th>
<th>Very little</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acquiring a broad general education</td>
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<tr>
<td>Acquiring job or work-related knowledge and skills</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Writing clearly and effectively</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Speaking clearly and effectively</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thinking critically and analytically</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Analyzing quantitative problems</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Using computing and information technology</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Working effectively with others</td>
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<td></td>
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</tr>
</tbody>
</table>

Continue
To what extent has your experience at this institution contributed to your knowledge, skills, and personal development in the following areas?

Voting in local, state, or national elections
Learning effectively on your own
Understanding yourself
Understanding people of other racial and ethnic backgrounds
Solving complex real-world problems
Developing a personal code of values and ethics
Contributing to the welfare of your community
Developing a deepened sense of spirituality

Very much | Quite a bit | Some | Very little
--- | --- | --- | ---

Continue
Overall, how would you evaluate the quality of academic advising you have received at your institution?

- Excellent
- Good
- Fair
- Poor

How would you evaluate your entire educational experience at this institution?

- Excellent
- Good
- Fair
- Poor

If you could start over again, would you go to the same institution you are now attending?

- Definitely yes
- Probably yes
- Probably no
- Definitely no

Continue
Select your year of birth:
- 1990
- 1989
- 1988
- 1987
- 1986
- 1985
- 1984
- 1983
If other year, enter here: 

Your sex:
- Male
- Female

Continue
Are you an international student or foreign national?
- Yes
- No

What is your racial or ethnic identification? (Select only one.)
- American Indian or other Native American
- Asian, Asian American, or Pacific Islander
- Black or African American
- White (non-Hispanic)
- Mexican or Mexican American
- Puerto Rican
- Other Hispanic or Latino
- Multiracial
- Other
- I prefer not to respond

Continue
What is your current classification in college?
- Freshman/first-year
- Sophomore
- Junior
- Senior
- Unclassified

Did you begin college at your current institution or elsewhere?
- Started here
- Started elsewhere

Since graduating from high school, which of the following types of schools have you attended other than the one you are attending now? (Select all that apply.)
- Vocational or technical school
- Community or junior college
- 4-year college other than this one
- None
- Other

Continue
Thinking about this current academic term...

How would you characterize your enrollment?
- Full-time
- Less than full-time

Are you taking all courses entirely online?
- Yes
- No

Continue
Are you a member of a social fraternity or sorority?
- Yes
- No

Are you a student-athlete on a team sponsored by your Institution's athletics department?
- Yes
- No
On what team(s) sponsored by your institution's athletics department are you an athlete? (Select all that apply.)

- Baseball
- Basketball
- Bowling
- Cross Country
- Fencing
- Field Hockey
- Football
- Golf
- Gymnastics
- Ice Hockey
- Track & Field
- Lacrosse
- Rifle
- Rowing
- Skiing
- Soccer
- Softball
- Swimming & Diving
- Tennis
- Volleyball
- Water Polo
- Wrestling
- Other, specify:

Continue
What have most of your grades been up to now at this institution?

- A
- A-
- B+
- B
- B-
- C+
- C
- C- or lower

Which of the following best describes where you are living now while attending college?

- Dormitory or other campus housing (not fraternity/sorority house)
- Residence (house, apartment, etc.) within walking distance of the institution
- Residence (house, apartment, etc.) within driving distance of the institution
- Fraternity or sorority house
What is the highest level of education that your father completed?
- Did not finish high school
- Graduated from high school
- Attended college but did not complete degree
- Completed an associate's degree (A.A., A.S., etc.)
- Completed a bachelor's degree (B.A., B.S., etc.)
- Completed a master's degree (M.A., M.S., etc.)
- Completed a doctoral degree (Ph.D., J.D., M.D., etc.)

What is the highest level of education that your mother completed?
- Did not finish high school
- Graduated from high school
- Attended college but did not complete degree
- Completed an associate's degree (A.A., A.S., etc.)
- Completed a bachelor's degree (B.A., B.S., etc.)
- Completed a master's degree (M.A., M.S., etc.)
- Completed a doctoral degree (Ph.D., J.D., M.D., etc.)
Please enter your major(s) or your expected major(s).

Primary major (Enter only one): 

If applicable, second major (not minor, concentration, etc.): 

Continue
THANKS FOR SHARING YOUR RESPONSES!

Your responses to the survey were successfully submitted.

Questions or comments? Contact us.

For security purposes, please close your browser window to exit the survey.
REFERENCES


