What matters to student-athletes in college experiences

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WHAT MATTERS TO STUDENT-ATHLETES IN COLLEGE EXPERIENCES

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Signature Page

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By Yan Zhao

Henry Braun, Ph.D., Chair

Abstract

Informed by Astin's Input-Environment-Outcome (I-E-O) model and Pascarella's general model, this study explored the nature of student-athletes' engagement in educationally purposeful activities, described their engagement patterns, and revealed the relationships between student engagement factors and college outcomes by class and gender for 2596 student-athletes from 30 Division-I institutions. This research demonstrated that the NSEE Five Benchmarks constructed for the general population did not fit student-athletes. Therefore, engagement factors for student-athletes were constructed based on a subset of component items from the Five Benchmarks. Hierarchical Linear Models (HLM) were then applied to National Survey for Student Engagement (NSSE) 2006 and the aggregated school level data from the NCAA. The research results reveal that the association patterns between engagement factors and college outcome variables Satisfaction (SA), General Education and Personal Competence (GEPC), and Personal and Social Development (PSD) across all class and gender subgroups are very similar, but differ from those for GPA. This research concludes that engagement in educationally purposeful activities is the best predictor for student-athletes' college outcomes (except GPA). The analyses also reveal that what students do on campus contributes more to their college outcomes than who they were at matriculation and which school they attend. In particular, for all outcomes, the fraction of

the total variance due to between-school differences was very small and the relationships between the coefficients of school-level equations and school-level characteristics were inconsistent. The results of this study, along with other related studies, can help colleges devise strategies to better fulfill their primary obligation to create genuine educational opportunities for their student-athletes through fostering their holistic development.

DEDICATION

I dedicate this doctoral dissertation to staff and faculty who believe higher education should provide all students opportunities to learn and to pursue success by providing unwavering and tireless support. May all of you find joy in knowing that you not only foster students' academic development, but also teach lessons and provide a role model with your believes and enthusiasm in higher education and attitudes in life. All of these make up the building blocks for students' evolution in their professional field and personal lives.

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[Note: NSSE data was used with permission from The Indiana University Center for Postsecondary Research (CPR)]

Background and the Problem

Creating genuine educational opportunities for all students and fostering their holistic development are primary obligations of higher education. Athletics, as an integral part of educational institutions (Melendez, 2008), are expected to help fulfill these obligations as are all other departments within a college or university. Traditionally it has been asserted that athletics provides positive value to both the students and the university including fostering moral, physical, social and educational development for the students, promoting the reputation and visibility of universities, and building a strong bond with alumni (Despres, Brady, & McGowan, 2008). However, concerns regarding student-athletes' actual college experiences and their desired outcomes have increased and the traditionally well-accepted benefits of intercollegiate athletics participation on students' experiences have been questioned.

Researchers have investigated numerous aspects of student-athletes' college experiences and attempted to provide answers to how athletics participation affects students' lives. Some areas of concern have generated great scholarly interest, including studies of students' involvement, satisfaction, academic motivation, academic performance, career planning and maturity, college and post-college outcomes, psychosocial and non-cognitive development (Adelman, 1990; Adler & Adler, 1985, 1987; Astin, 1993; Howard-Hamilton & Sina, 2001; Martin, 2009; Miller & Kerr, 2002; Pascarella & Terenzini, 1991, 2005; Sedlacek & Adams-Gaston, 1992; Sedlacek, 2004).

Research interests in the early days were focused on comparing academic performance, mainly GPA and graduation rates, between student-athletes and their non-athletes peers. This research was typically explored separately by gender and by sport played (Purdy & Others, 1981). Later research utilized advanced research methods by including control variables (such as race) and adding indicators to control for students' pre-college experiences, both academic and life (Comeaux, 2005; Pascarella & Others, 1991; Pascarella et al., 1999). In addition to the earlier comparison of revenue-generating sports vs. other sports (Adelman, 1990; Purdy & Others, 1983), research has expanded to include diversity of student-athlete groups (ethnicity and gender), NCAA categories (Division-I, II, and III), two-year colleges, and first-year students (Melnick & Others, 1992; Sellers & Kuperminc, 1997; Steinfeldt, Reed, & Steinfeldt, 2010; Wilson, 2008). Recent research has explored topics related to students' holistic development, the integration of intellectual, social, and emotional aspects, and investigated these areas by student-athletes' subpopulations (Adler & Adler, 1987; Cove & Love, 1996; Kissinger & Miller, 2009).

While there is already long history of studies on student-athletes' college experiences and successes, much of this research has focused on the influence of intercollegiate athletics on student-athletes' lives. There is a lack of emphasis on how student-athletes are involved in educationally purposeful activities and how and to what degree these activities contribute to their success.

The study of student-athletes' academic performance has over 80 years of research history (Curtis & McTeer, 1990). During such a long period of investigation, research studies have provided mixed results in a number of areas. Some research has supported the positive effects of intercollegiate athletics on college outcomes, while other research based on different data and/or different research methods, has shown evidence to the contrary. This has led to intense debates over the merits of athletics participation. Adelman's (1990) paper cites two references to student-athletes' graduation rates, a popular indicator of academic performance, which illustrates the heated arguments and contradictory results in the research field:

> [. . .] for football players to earn degrees in many of the most athletically successful programs is appallingly rare. Graduation rates for football (and basketball) players are often less than half those for the student body as a whole. —Donald Kennedy, president, Stanford University, New York Times, January 28,1990 (Kennedy, 1990)

> Student-athletes, in general, have very high graduation rates, usually higher than non-athletes. Based on data from NCAA, the student-athletes from all sports combined who were enrolled as freshmen in 1980-1981 posted a median graduation rate of 66.6% compared with 59% for all students at those particular schools. — Richard Lapchick, director, Center for study of Sport and Society, Northeastern University (Lapchick, 1990)

Contradictions such as these have repeatedly appeared in the media and have contributed to the confusion. It has been difficult to get a clear picture of whether intercollegiate athletics participation has negative effects on student-athletes' college experiences and to what extent academics and athletics have been driven apart.

Researchers have suggested reasons that may have caused the conflicting results regarding student-athletes' college experiences. Some are said to be derived from "anecdotal information" and "outright popular mythology" (Adelman, 1990). Very often these inconsistent results are drawn from studies which are based on unrepresentative samples of a student-athlete population or a small segment of the population: studies based on one single university, a small number of institutions, and NCAA conference schools, Ivy League institutions, institutions from certain demographic areas, and samples of small numbers of students or student subgroups (Adelman, 1990; Ferris, Finster, & McDonald, 2004; Umbach, Palmer, Kuh, & Hannah, 2004). Out-of-date data and overly simplistic (or inappropriate) research and analytical methods also contribute to this profusion of confusion. Importantly, as the scope of research interest broadens, less research has been conducted on the student-athlete body as a whole. Research based on a specific population of student-athletes will only provide partial information for the big picture. Even though the differences between athletes need to be understood, researchers must realize that student-athletes share common experiences, challenges and problems (Watt & Moore III, 2001).

To provide a complete picture of student-athletes' experiences in college, research will need to do the following:

Focus on the fundamental question of what student-athletes do and how these activities are associated with their desired college outcomes. For institutions, this knowledge is very important as it will help them to identify the specific problems and needs of their student-athletes.

Focus on the overall student-athlete body, covering a large number of institutions and samples that best represent student-athletes. This will help the general population and higher education to get a clearer picture of the nature and impact of student-athletes' college experiences.

Focus on contemporary and comprehensive data. Research with current data which contains up-to-date information on various aspects of student's lives will help to gain an understanding of the issues students are facing today along with their current circumstances which have changed dramatically over years.

Lastly, research should apply appropriate analytical methods, which take into account the heterogeneous nature of athletics. This type of research offers insights into student-athletes' college experiences and provides information to assist institutions in fulfilling their educational missions. Furthermore, such research will illuminate the complex relationship between student-athletes' involvements and their college success, broadly defined.

Research studies with all these characteristics are surprisingly rare. Those focusing on the fundamental question of how student-athletes spend their time and energy in educationally related activities are even harder to find. This is truly unfortunate as studying how student-athletes engage in educational purposeful activities is so crucial to higher education. Umbach and Others (2004) have emphasized the importance of studying student-athletes' educational engagement:

> [. . .] it is incumbent on colleges and universities to learn more about the experiences of their student-athletes and determine whether they are taking part in educationally sound activities and benefiting in desired ways from college at levels commensurate with their non-athlete peers (Umbach et al., 2004)[P.18].

As concerns for student-athletes' academic and social development increase, researchers and institutions have put more effort into seeking ways to foster student-athletes' learning and to provide conditions that promote desirable college outcomes. Student-athletes not only play sports, they are also college students, and their student identity comes first (Wolverton, 2008). It is important to acknowledge the impact of intercollegiate participation on their college lives and the differences between them and the general population. However, getting to know how they live their academic lives is also important. As more studies focus on the athletics' influence on student-athletes, less is investigates with respect to what they do and how well they do on campus. In addition, while attention is paid to the general population in regard to how students take part in the educational opportunities their universities provided, student-athletes as a subgroup of the college student body need to be considered as well.

Higher education is in need of research that explores the nature of student engagement in educationally purposeful activities for student-athletes. This type of research should better articulate their engagement patterns and the relationships between engagement indictors and desired college outcomes. Without such research, we don't know exactly how students spend their time and effort on activities that are related to the desired college success. Furthermore, without this information it would be difficult for higher education to provide programs and policies that improve student-athletes' college experiences.

In order to provide a complete picture of student-athletes' experiences in college, it is necessary to conduct a study that considers all the aspects listed above. This study responds to these needs by providing answers to the basic questions: what do student-athletes do in college and how do their engagement indicators relate to their colleges outcomes.

The Purpose of the Study

In response to the paucity of studies examining student-athletes engagement in educationally purposeful activities and their relationship to college outcomes, the purpose of this study is to explore the nature of student-athletes' engagement, to better describe their engagement patterns, and to investigate the statistical associations between engagement factors and desired college outcomes. This study focuses on exploring the engagement patterns of both freshman and senior year student-athletes enrolled in Division-I (D-I) institutions. Furthermore, it explores engagement patterns by student-athletes gender.

The research presented in this paper utilizes three data sets: The National Survey for Student Engagement (NSSE) 2006, aggregated school level data from NCAA and admissions data from online resources. This data set contains information regarding student engagement activities, student profile information, and school characteristics. The results of this study could help student services and universities understand student-athletes' engagement so that they are able to provide support that will maximize students' educational and personal development.

The theoretical framework of this research is derived from the college impact models of student change that is presented in detail in the following chapter. The model utilized is based on Astin's (1970) Input-Environment-Outcome (I-E-O) model, Pascarella's (1985) general model for assessing desired college outcomes, and Chickering and Gamson's (1987) Seven Principles for Good Practice in Undergraduate Education. This study specifically uses Hierarchical Linear Models (HLM) to examine the complex relationships between students' characteristics, school characteristics, engagement behaviors and perceptions, and outcome variables.

Research Questions

The following research questions guide this research:

1. Which model best describes the statistical associations among the engagement factors and college outcomes?
    a. How does the best-fitting model vary by class and by gender?
    b. To what extent do the engagement factors account for the variations in college outcomes?
2. How do the statistical relationships in #1 change when student profile and college outcome variables (as predictors) are introduced in the models?
3. To what extent do school characteristics account for between-school variation in college outcomes?

The answers to these research questions should help higher education raise awareness of the unique needs that are associated with student-athletes. It could help institutions and athletics departments create an environment that fosters student-athletes' holistic development and helps to fulfill the institutions' educational missions.

Significance of the Study

The results of this study advance our knowledge of the factors and contingencies associated with college outcomes. It provides helpful information for student services and universities in improving student-athletes' learning and personal development.

This study provides more up-to-date research results than has been available in the past. It also provides more accurate results due to its use of advanced modeling methods. Enhanced accuracy is achieved by addressing a number of difficulties that have commonly caused errors in other models used to study complex data structures.

Specifically, the application of HLM allows overcoming some of these errors. Applying HLM addresses the research interests related to the hierarchical structure of the data, of which students are nested in schools.

This study develops a new set of engagement factors that reflect current college practices and activities for student-athletes as reported by students themselves. The results describe student-athletes' engagement patterns and the relationships between engagement factors and desired college outcomes by class and by gender. They also offer some sense of how student-athletes spend their time and effort on activities that are related to important college outcomes. They constitute a starting point for discussions of what student-athletes do, how well they do, and what might be changed. The results of this study have implications for higher education athletic programs with respect to policies to improve student-athletes' college experiences. This research along with other related studies could inform college administrators on how to better fulfill their primary obligations of creating genuine education opportunities for their student-athletes and fostering their holistic development.

Definition of Terms

The terms used in this research are defined specifically for the nature of the study and to provide clarity for the reader.

Student-athlete: A student-athlete refers to a full-time student who is enrolled at a university while at the same time he/she receives one or more athletic awards or letters, or is training with a varsity team and represents that varsity team by playing competitive intercollegiate sports.

Student engagement: Student engagement refers to the time and energy that students devote to educationally purposeful activities (including active learning, interacting with peers and faculty, time on task and so on) and their perceptions of the environment that their institutions provide to support and facilitate their learning.

Holistic development of students: Holistic development of students refers to students' intellectual, emotional, and social (interchangeable with cognitive, affective, and interpersonal) development. This term can also be extended to students' spiritual, career, and physical development.

College outcomes: For this study, college outcomes are defined as students' Satisfaction (SA), General Education and Personal Competence (GEPC), Personal and Social Development (PSD), and GPA.

Organization of the Dissertation

This dissertation contains five chapters. Chapter One presents the background of the problem. It reviews the educational trends, unresolved issues, and social concerns related to the problem. It introduces the research methods that will be employed to answer the research questions regarding student-athletes' college experiences and established the significance of the study.

Chapter Two is the Literature Review. It describes the differences between college sports and intercollegiate athletics. It also briefly introduces the development of intercollegiate athletics and student-athletes' culture. It summarizes and discusses literature of student-athletes' educational engagement and their college outcomes in higher education from both historical and current perspectives. This chapter also introduces theories regarding student engagement and constructs a theoretical framework to answer the research questions of this study.

Chapter Three describes data sources, data structure, and variables for data analyses. It provides important information regarding to the appropriateness of using the datasets for the purpose of this research. It describes the data structure and units in each level. It elaborates the analytical methods and strategies that would be used to answer the research questions.

Chapter Four carries out the descriptive analyses and model based analyses described in Chapter 3.

Chapter Five presents a summary of the study, a discussion of the findings and their implications. This chapter concludes the limitations of the study and offers some recommendations for further research.

CHAPTER TWO: LITERATURE REVIEW

This chapter reviews the relevant literature about the development of intercollegiate athletics and student-athletes' culture. It summarizes and discusses the literature on student-athletes' educational engagement and their college outcomes in higher education from both historical and current perspectives. It summarizes major theories regarding student engagement and their applications in student-athletes studies. It also includes the theoretical framework that guides this study.

Development of Intercollegiate Athletics

To elucidate the relationship between student-athletes' college experiences, specifically their engagement in educationally purposeful activities and desired college outcomes, requires an understanding of the development and culture of intercollegiate athletics. This section starts with a discussion that distinguishes between college sports and athletics, which helps readers understand the special characteristics, responsibilities, and life styles of student-athletes. It also provides a brief introduction to the historical development of today's intercollegiate athletics. This provides educators and student affairs professionals a picture of the constant conflicts in student-athletes' lives between psychosocial, academic, and athletic development. Higher education professionals who have a deeper understanding of the historical and current perspectives of intercollegiate athletics will be better equipped to help student-athletes with their everyday life and foster their success in both academics and athletics.

Understanding the Athletics

Intercollegiate athletics originated from college sport clubs. Athletics and sports have certain degrees of similarities; however, there are fundamental differences between these two terms. Understanding the differences between sports and athletics will help readers to be aware of the influences that athletics participation has on student-athletes' experiences. This understanding will also help students, staff, and educators to understand that student-athletes are a non-traditional student group which has its own culture and problems in relation to the broader landscape of higher education (Sedlacek & Adams-Gaston, 1992).

The term "athlete" originates in the 1520s from a Greek term *āthlētes*, meaning "contestant in the games", which was derived from a family of Greek words: *âthlos* (a contest), *āthlon* (a prize), and *āthleîn* (to compete for a prize) (Athlete, n.d.; Tenenbaum & Eklund, 2007). Tenenbaum and Eklund (2007) specify the nature of athletics as competitive activities which involve extraordinary amount of effort in training, some level of personal sacrifice, and commitment in pursuing the goal of victory or winning a desired prize by demonstrating superiority over others.

The term "sport" is derived from a French word *desporter* (to divert, amuse, please, play), meaning to carry away the mind from serious matters after work (Sport, n.d.). Sport has a cooperative nature with the direct and immediate purpose to maximize the pleasure for all players (Tenenbaum & Eklund, 2007). While Keating (1964) characterizes athletics as a spirit of "dedication", "sacrifice", and "intensity", sport is generally interpreted as spontaneous, moderate and generous. Sport participation doesn't necessarily need preparation or training; sport is moderate rather than intense since the purpose of sport is not to excel; and players are generous to each other, especially to their opponents.

Most individuals should be aware of the obvious similarities between sports and athletics since both terms refer to forms of physical entertainment that involve skills, strength, endurance, and competition. However, the distinctions between these two terms may not be as clear, especially when they are referred to as college sports and intercollegiate athletics, which leads to an interchangeable use or misuse of the two terms.

As mentioned above athletics and sports have fundamental differences with respect to the purpose of participation, players' attitude, and preparation of activities. People who don't study intercollegiate athletics may not realize how differently college sports and intercollegiate athletics affect students. Athletics participation requires a great amount of time commitment (sometimes over 40 hours per week (Wolverton, 2008)), leads to physical fatigue and injury, creates pressure and problems, and affects students' motivation and attitude in learning. However, these factors are not necessarily applicable to college sports participants and students who don't play sports, which distinguish these two groups from student-athletes.

Institutionalization of College Sports

The institutionalization of college sports is very important in the history of intercollegiate athletics development. The transition from student-run college club sports to the intercollegiate athletics started in the mid 19th century. According to Shulman and Bowen (2001), the first intercollegiate athletic game was a boat race between Harvard and Yale on Lake Winnipesaukee in New Hampshire in 1852. The race was sponsored by a real estate promoter. It showed evidence that the special relationship between intercollegiate athletics and commercial entities existed from the very beginning of the institutionalization of college sports rather than being a modern phenomenon of current intercollegiate games.

Intercollegiate athletics developed very quickly. Since the first intercollegiate game between Harvard and Yale, more prestigious educational institutions started to become more involved in intercollegiate athletics. In addition to crew races, intercollegiate athletics has grown to include many more sports. Amongst all sports, football developed very rapidly in the 1870s as a thrilling venue for the energy and passions of participants and fans (Shulman & Bowen, 2001). In the early 1900s, football became a “larger than life” legend. As interest in football increased, competitions have become more aggressive and severe. Lacking strict rules and regulations, serious injuries and even death occurred on the football field. In 1906, President Theodore Roosevelt demanded meetings with the presidents of five major institutions and their football coaches to discuss rule changes for the game. These meetings have historical significance in that they led to major football reform along with the formation of the Intercollegiate Athletic Association of the United States (IAAUS), which became the NCAA in 1910 (Benford, 2007; Shulman & Bowen, 2001).

As the interest in intercollegiate athletics dramatically increased, more stadiums were built and more major sports events were covered by the media. Intercollegiate athletics became more important to institutions and society throughout the rest of the century. Institutions benefited from intercollegiate athletics in numerous ways: improved holistic development of students, enhanced visibility of the universities, increased enrollment, improved university reputation, greater alumni support, and increased campus spirit (Despres, Brady, & McGowan, 2008; Watt & Moore III, 2001).

The institutionalization of college club sports has been very influential. When institutions took ownership of their athletic programs, it marked a significant change in intercollegiate athletics history. Athletic clubs were no longer student run events as they had been. The initial idea was to have faculty take control of club sports in order to provide oversight, even though later coaches and directors were commonly non-faculty, whose interests and primary concerns were athletics, not academics. Over time athletics has become an integrated part of the university. Institutions have integrated the goals, values, and norms of athletics programs into their educational missions (Shulman & Bowen, 2001). Intercollegiate athletics has changed from being incidental to the purpose of education to being an accepted part of the college experience, and from having marginal influence on higher education to being associated with the core mission of institutions (Hathaway, 2005).

Athletics departments have formed their own culture and found their position in the structure of universities. They have developed a uniquely different environment from the other departments on campus because of their special needs of commercialization, media attention, emotional bonds with alumni, responsibilities of rules and regulations, and self-supportive nature. Traditionally, athletics culture has been viewed to have positive effects on the social and educational development of students (Despres et al., 2008). Commonly proposed benefits of athletics participation include fostering ambition, increased academic performance, and encouraging social integrity. Additionally, athletics participation has acted as a tool for students to advance social mobility (Loy, 1978).

Contrary to these benefits, studies have shown that the athletics environment has encouraged student-athletes to prioritize athletic life over academic life, that athletics culture is harmful to students' identity development, and that it hinders student-athletes' personal and social development (Bowen & Levin, 2003; Shulman & Bowen, 2001).

The fit of intercollegiate athletics with school structure has been changing over the years. A number of factors have influenced these changes including societal modification, specialization within athletics, commercialization of athletics and admissions competition (Shulman & Bowen, 2001). The size and influence of intercollegiate athletics is continuing to grow but the connection between athletics and the mission of higher education has weakened (Hathaway, 2005). As passions and underlying principles of intercollegiate athletics have remained unchanged since the 19th century, concerns regarding the student-athlete's holistic development have become increasingly prominent.

Many questions have been raised since the marriage of higher education and intercollegiate athletics. The author of one of the earliest reports, The Carnegie Foundation for the Advancement of Teaching of 1929, pointed out that commercialization and professionalization were threats to intercollegiate athletics (Benford, 2007; Shulman & Bowen, 2001). In the 21st century, similar threats still concerned the higher education and the public. Today, we are still seeking answers to the questions raised 80 years ago: "whether an institution in the social order whose primary purpose is the development of the intellectual life can at the same time serve as an agency to promote business, industry, journalism, and organized athletics on an extensive commercial basis? " and "can it [the university] concentrate its attention on securing teams that win, without impairing the sincerity and vigor of its intellectual purpose? ” (Cowley, 1999, p. 495). Issues related to athletics participation related and challenges to student-athletes have raised the concerns about the quality of student-athletes' educational experiences (Purdy, Eitzen, & Hufnagel, 1982; Symonds, 2009; Thelin, 1994). Thelin (1994) described college and university athletics as "American higher education's 'peculiar institution'. Their presence is pervasive, yet their proper balance with academics remains puzzling" (p. 1).

Gaining an Understanding of Student-Athletes

The culture and the development of athletics and the interaction between athletics and academics have made student-athletes different from all other students. Student-athletes live in an environment where academic, athletic, and social lives have been intricately interwoven. The combination of academic and social life alone can be complicated to any college student. Adding the extra layer of athletics further complicates students' lives and can have a profound impact on their college experiences and success (Etzel, Ferrante, & Lantz, 1996). Because of this added complexity, there have been concerns about the effects of intercollegiate athletics participation on student-athletes' college experiences (Astin, 1993a; Harper & Quaye, 2009; Pascarella & Terenzini, 2005; Pascarella et al., 1999; Shulman & Bowen, 2001). This section starts with a search for the answer to the question: Who are student athletes? Most people would simply say that they are students who play sports. This general understanding differentiates students who have sports participation from those who don't. However, the differences between student-athletes, students who play intramural sports, and the general college population are not as simple as they may seem. College club sports and intercollegiate athletics differ in many ways that lead to different experiences for their participants.

Shulman and Bowen (2001) have defined student athletes as "all students who received one or more athletic awards or "letters" while in college" (Shulman & Bowen, 2001, p. 31). This definition differentiates student athletes who participate in intercollegiate athletics from those who play intramural or club sports and those who don't play any sport at all. Watt and Moore III (2001) further define student-athletes as college students who live with an everyday routine just like their non-athlete peers: participating in educationally related activities and joining in social events on and off campus. Simultaneously student-athletes are involved in intercollegiate sports and sport-related activities. Sports-related activities may include intense practices and workouts, injury treatment, studying team films in addition to playing games, and traveling during the sport season.

It is necessary to acknowledge the differences between student-athletes and their non-athlete peers; however, it is also important to understand that student-athletes are college students as well. Just as their non-athlete peers do, most student-athletes start their college lives with optimistic cognitive, social, and affective goals and attitudes toward their future (Adler & Adler, 1985; Watson, 2003). They also share the same ambitions and concerns with the general college population. However, the additional influence of intercollegiate athletics participation is what sets these two groups apart.

Intercollegiate athletic participation and athletic related activities complicate student athletes' lives, which makes them a special population on college campuses. Compared to the general college population, student-athletes experience a higher level of stress from the double demands of athletics and academics (G. Wilson & Pritchard, 2005). Student-athletes face unique challenges besides considerable social adjustment, career exploration and intellectual growth challenges that non-athletes experience (Watt & Moore III, 2001). They face pressure to perform well both academically and athletically, and struggle to balance intercollegiate athletics, academic programs and other college experiences in order to meet the goals of higher education. G. Wilson and Pritchard (2005) study has summarized unique athletic status related stressors from past research, pressure to win, injuries, extensive time demands, responsibility to rules and regulations, relationships with coaches and teammates and so on. The same study also has offered evidence that high levels of stress were more likely to affect students' mental and emotional health, to create bad health habits and psychological problems.

Student-athletes have long been criticized for having low academic performance, low motivation to learn, low graduation rates, and low levels of engagement in educationally effective activities (Bowen & Levin, 2003; Hanks & Eckland, 1976; Harrison, 1976; Henschen & Fry, D., 1984; Shulman & Bowen, 2001). It also has been brought to the public's attention that student-athletes have been discriminated against and negatively stereotyped by their non-athlete peers and college faculty (Bowen & Levin, 2003; Engstrom, Sedlacek, & McEwen, 1995; Engstrom & Sedlacek, 1991). This creates anxiety that negatively affects their behaviors (Dee, 2009). Dee (2009) and Engstrom et al. (1995) have shown evidence that this stereotype has contributed substantially to student-athletes' academic underperformance and devastated their self-image by creating a self-fulfilling prophecy which resulted in lowered chances for their college success. Bowen and Levin (2003) have also expressed concerns that stereotyping has exacerbated the divide between academics and athletics. They indicate that it is important to address the issues of student-athletes as a whole to diminish any basis that may be causing negative stereotypes.

In addition to the differences between student athletes and non-athletes there is variation among individual student athletes. Differences such as background, race, gender, sports played, division classification and other factors distinguish one athlete from another. These differences are supported by studies of student-athlete subgroups that show that indeed not all student-athletes are alike. Inevitably, these differences add another layer of complexity to the understanding of student-athletes' experiences in college.

Watt2001 pointed out that even thought there are differences among student-athletes subgroups, student-athletes as a whole share similar experiences and face common challenges. Therefore, a study exploring the similarities of student-athletes as a whole, as well as the differences of student-athlete subgroups, should provide additional insights.

Current Perspectives on Student Athletes

This study is inspired by the raging debate over the effects of intercollegiate athletics on student-athletes. The purpose of this study is to explore the nature of student-athlete's educational engagement, to depict student-athletes' engagement patterns, and to describe the relationships between the engagement activities and college outcomes. Perceptions of student-athletes have changed over time: The relationship between the holistic development of student-athletes and intercollegiate participation has been a center of discussion over the past several decades. The traditionally well-accepted benefits of intercollegiate athletics participation on students' experiences have been questioned. Much criticism has focused on the possibly negative effects of intercollegiate participation on student-athletes' college success. Very often media portrays negative images of student-athletes' college outcomes (Gaston-Gayles & Hu, 2009; Wooten & Ray, 1994). This has driven the NCAA and higher education institutes to become increasingly concerned with the college success of all student-athletes. An additional response to this concern has been an increase in research regarding the educational experiences for this student population.

Current studies have explored many aspects of student-athletes' lives, from athletic development to their academic development (mainly focused on GPAs and graduation rate), and from social development to their personal development. Research has increasingly employed sophisticated designs and applied advanced analytical methods in studies of student-athletes related issues. Researchers have extended their analytical methods by including variables like race, gender, and adding students' pre-college experiences (both academic and life experiences) in the studies (Comeaux, 2005; Pascarella & Others, 1991; Pascarella et al., 1999). Research interests have expanded from the narrow focus of comparison studies between student-athlete and non-athlete groups to comparisons amongst student subgroups, categorized by sports, ethnicity, gender, NCAA Divisions, academic year, and by college programs (2-year vs. 4-year) (Adelman, 1990; Melnick & Others, 1992; Purdy & Others, 1983; Sellers & Kuperminc, 1997; Steinfeldt, Reed, & Steinfeldt, 2010; T. M. Wilson, 2008). Conflicting results become increasingly evident as more research is examined. Controversies over student-athletes' college experiences have been repeatedly reported in journals articles and newspapers. Studies have provided conflicting results on college outcomes across demographic regions, universities, sports, academic years, and student backgrounds. It is hard for the general population, those who don't study intercollegiate athletics, to get a clear picture of student-athletes' holistic development. The following section introduces perspectives of student-athletes that are related to this study. The section is organized by the perspectives of student-athletes' holistic development, by their background, and by the three constructs related to this study.

Perspectives of Holistic Development of Student-Athletes

Holistic development of students refers to students' intellectual, emotional, and social development, which are interchangeable with cognitive, affective, and interpersonal development in some of the literature. This term can also be extended to students' spiritual, career, and physical development. Holistic development is a term that basically covers every aspect of students' development in college.

Adler and Adler (1985) summarized literature that focuses on the relationship between athletics participation and academic performance from the early 1970s to the early 1980s. During that time period, studies of the impact of intercollegiate athletics participation were mainly focused on students' academic development. Therefore, as major indicators of academic development, student-athletes' GPAs, graduation rates, and attrition rates have been the center of the studies. Not surprisingly, both positive and negative relationships have been shown in these studies.

Later studies have expanded the research interests beyond the focus of student-athletes' academic performance. Some studies have concentrated on students' mental health, psychosocial development, career preparation, identity development, and other important aspects of their college experiences. Again, these studies continued to show conflicting results.

Commonly cited positive effects of athletics participation on college success were: athletics participation improved academic performance, increased graduation rates, helped the development of interpersonal relationships, and improved stress management skills (Astin, 1993a; Melendez, 2006; Miller & Kerr, 2003; Ting, 2009). There is also research that has controlled for students' precollege backgrounds, demographic factors, academic ability, and social factors. This research suggests that athletic activities have had a positive impact on college experience, improved students' satisfaction with their college lives, motivated students to stay in the program and working towards the degree, and improved gains in internal locus of attribution for academic success (Astin, 1993a; Gaston-Gayles & Hu, 2009; Pascarella, Edison, Hagedorn, Nora, & Terenzini, 1996; Ryan, 1989)

In contrast to these positive links, when compared to general college students, student-athletes as a specific population have been criticized for having lower academic performance, lower graduation rates, lower satisfaction level with the college experience, lower career maturity, lower educational involvement, higher attrition rates, and higher stress levels (Adler & Adler, 1985; Bowen & Levin, 2003; Eitzen, 2009; Gaston-Gayles & Hu, 2009; G. Wilson & Pritchard, 2005). Research studies also argued that participating in sports leads to socially segregation from the general student population (Adler & Adler, 1985; Leach & Conners, 1984; Umbach et al., 2004).

There are still other studies which showed no significant difference in cognitive development, by comparing the general skills for example, between student-athletes and general college population (Pascarella et al., 1999; Pascarella, Bohr, L., Nora, & Terenzini, 1995). Similarly, graduation rate averages over 10 years for Division I-A universities were the same for student-athletes as their non-athlete peers (Ferris et al., 2004). Research focused on effective educational practices for the student-athlete population based on a large number of schools and students has shown evidence that, on average, there is no significant difference between student-athletes and non-athletes in terms of their participation in educational purposeful activities (Umbach et al., 2004). This is contrary to many well-cited publications.

Researchers have acknowledged that student engagement in institution-provided activities plays a significant role in their holistic development and desired college outcomes (Astin, 1985, 1993b; Chickering & Gamson, 1987; Kuh, 2003a; Pascarella & Terenzini, 2005; Terenzini, 1987). Models and theories reflecting this concept include Astin1970a' theory of involvement, Tinto1987's theory of student departure, and Pascarella1985' general model to assess student change. These college impact models look at the origins and the process of development, specifically concerning how the environment of the institution, students' background, their pre-college experiences, and their relationship with other students and college personnel affect their progress in college (Pascarella & Terenzini, 2005). Chickering and Gamson (1987) have further defined important institutional practices in Seven Principles for Good Practice in Undergraduate Education that are directly associated with the quality of students' learning and personal development.

A good application of the college impact models is the NSSE instrument. It is designed to measure the extent to which students are engaged in good educational practices and their gains in college (Kuh, 2001). NSSE's theoretical foundation is based on several decades of research exploring conditions which promote student learning, including works from Astin (1993a), Pascarella and Terenzini (1991), and Chickering and Gamson (1987). Data collected by the NSSE instrument is used to construct five benchmarks of effective educational practices: (1) Level of academic challenge; (2) Active and collaborative learning; (3) Student-faculty interaction; (4) Enriching educational experiences; and (5) Supportive campus environment. These benchmarks display the relationship between good educational practices and collegiate quality.

The five benchmarks line up with the components of Pascarella (1985) model, Quality of Student Effort, Interactions with Agents of Socialization, and the Institutional Environment. The significance of these components and the relationships amongst them has been explored extensively and has been shown to be positively related to college success (Arnold & Others, 1993; Astin, 1993b; Kuh, Pace, & Vesper, 1997; Pascarella, Edison, Nora, Terenzini, & Hagedorn, 1996; Pascarella & Terenzini, 1991). More details on the components of Pascarella's model and the five benchmarks of NSSE, and how these two work together to serve the purpose of this study will be introduced in the Theoretical Framework section. Following are summaries on the perspectives of student-athletes organized by these three constructs.

Quality of Student Effort

Quality of student effort is the key component of Pascarella's general model. A large body of literature concurs that student success is associated with the quality of their involvement in educational activities. Pace (1982) believes that students are active participants in their own learning process and responsible for the quantity and quality of effort they invest in their college experiences. The more time and energy students put into academically purposeful activities, the more likely they will be successful in college (Astin, 1993a; Chickering & Gamson, 1987; Pace, 1984; Pascarella & Terenzini, 1991).

Two NSSE benchmarks, Level of Academic Challenge and Active and Collaborative Learning, are good indicators for measuring the quality of student effort. Institutions develop challenging courses and set high expectations to promote students' effort in learning and to improve performance (Kuh, Kinzie, Schuh, & Whitt, 2005). An active engagement in educational purposeful activities is essential to the learning process and is positively associated with the learning outcome (Astin, 1993a). Students retain more when they are intensively engaged in learning and apply what they have learned in practice. Additionally, collaborating with others on school work and other projects helps prepare them with skills to deal with problems and situations they will encounter daily both during and after college (National Survey of Student Engagement, 2000). However, student-athletes' engagement activities measured by these two benchmarks have been questioned: do student-athletes take as challenging courses as do non-athletes, and do they participate in active and collaborative learning activities at the same level as their non-athlete peers?

Concerning Level of Academic Challenge, several different research studies attempted to address this question, with some conflicting results. Maloney and McCormick (1993) point out that student-athletes frequently come to college with poor academic backgrounds. This, together with the impact of athletics-related issues (such as time demands), may influence them to take less challenging classes in order to improve their performance. There is evidence that student-athletes tend to enroll in majors and courses which are less challenging than others (Pascarella & Terenzini, 1991). Maloney and McCormick (1993) study conclude that football players took easier classes than all other student-athletes based on data from one D-I school of 12,000 students. National Survey of Student Engagement (2005) reported that first-year high-profile students (refers to students who play football and men's basketball in this research) were less challenged than their peer student-athletes. Compared to the lower-profile students who spent 16 or more hours a week preparing for classes, Division-II (D-II) males and D-I females were less likely to put the same amount of time into their studies. A study conducted by Kuh, Kinzie, Buckley, Bridges, and Hayek (2007) also shows a similar pattern. In contrast, a study based on one D-I university with 101 student athletes showed no difference between student-athletes and non-athletes in their level of academic challenge (Hathaway, 2005). The study of Umbach et al. (2004), with 395 schools (across all three divisions) and over 57,000 students, suggests that on average, both male and female student-athletes are as academically challenged as their non-athlete peers. Concerning Active and Collaborative Learning it has been shown that on average student-athletes participate active and collaborative learning activities just as often as do non-athletes, with females showing a higher intention of participation than male athletes (Umbach & Kuh, 2004). The same research examined this benchmark by academic year and found that, on average, both first year and senior year athletes are more likely to participate in active and collaborative learning activities than non-athletes.

Interactions with Agents of Socialization

Agents of socialization include faculty members, staff, administrators, and peers that students interact with on a daily basis (Pascarella, 1985). The extent of interactions with faculty is one of the commonly used factors to measure student engagement. Chickering and Gamson (1987) have pointed out in their Seven Principles For Good Practice in Undergraduate Education that frequent student-faculty interaction is the "most important factor in student motivation and involvement" (p. 3). It helps students to build positive perceptions of supportive campuses and to have a higher satisfaction with the campus environment. Other researchers have also stated student-faculty interactions occurring inside and outside of the classroom are strongly associated with student learning (Astin, 1993a; Pascarella & Terenzini, 2005; Tinto, 1993, 2000; Umbach, Palmer, Kuh, & Hannah, 2006). These researchers have concluded that both formal and informal student-faculty interactions enhance the degree of student engagement, improve student learning, increase social integration, and enhance intellectual development. Umbach and Wawrzynski (2004) suggested that the NSSE benchmark Student Interaction With Faculty is the best predictor of student persistence.

How do student-athletes do in terms of interactions with faculty? NSSE items describe different forms of student-faculty interactions, including discussing grades or assignments with faculty, talking about career plans with faculty and advisors, discussing ideas related to the class, receiving prompt feedback from faculty, and working with faculty on activities and projects other than coursework. The results of student-faculty interaction are moderated by students' race and gender after taking into account their background characteristics (Comeaux & Harrison, 2011). Marx, Huffmon, and Doyle (2008) found male and female student-athletes have different socialization experiences. According to an earlier study by Meyer (1990), when compared with male student-athletes, female athletes have more interaction with faculty. A later study by Umbach et al. (2004) has shown more supportive evidence: male student-athletes interact with faculty as frequently as their non-athlete peers; when compared to female non-athlete student, female student-athletes interact with faculty more often. Additionally, the same study showed that there was no difference in the frequency of student engagement across institutions. NSSE (2005) also supports that all student-athletes from D-I institutions are more satisfied with the quality of academic support than their non-athlete peers. Comeaux and Harrison (2007)) found there is not much difference across different form of interactions for male and female student-athletes in D-I schools. However, the nature and the content of the interaction matter. Faculty's contributions towards student-athletes' academic and professional goals (e.g. writing recommendation letters and encouragement for graduate school) have strong positive effects on academic success for both male and female student-athletes (Comeaux & Harrison, 2007; Comeaux, 2005).

Comeaux and Harrison (2011) suggest that the explanation of the relationship between educational involvement and student-faculty interaction should be done with caution. The same article suggested that Black student-athletes' involvement is significantly lowered than that of other students and provided explanations based on well documented studies of the experiences of Black student-athletes enrolled in predominantly White institutions.

Some types of student-faculty interactions may negatively affect students' college experiences. Examples are stereotyping and discrimination. As pointed out in the previous section, student-athletes have been discriminated against and negatively stereotyped by their institution faculty (Bowen & Levin, 2003; Engstrom et al., 1995). This may have negatively affected the frequency of student-athletes' interaction with faculty, especially for male athletes, who have shown less intention to interact with faculty than female student-athletes.

Interacting with the peer group has been viewed as "The single most powerful source of influence on the undergraduate student's academic and personal development", which plays a significant role in almost all aspects of students' development (Astin, 1993b). Peer interactions take form of discussing class related topics, cooperate with others for projects, tutoring others, working with people with diverse backgrounds, participating in activities such as co-curricular activities, community services, and internships, being a member of fraternity or sorority, and spending time socializing with others. In the same study, Astin has summarized that interacting with peer students "has its strongest positive effects on leadership development, overall academic development, self-reported growth in problem-solving skills, critical thinking skills, and cultural awareness". Gaston-Gayles and Hu (2009) research provides evidence to support Astin's conclusion that interacting with other students had lead to positive impacts on personal self-concept, learning, and communication skills. Peer interaction provides opportunities to mutually help each other and communicate academic and social issues. The NSSE benchmark Enriching Educational Experiences is measured by items that related peer interacting aspects mentioned early. Research has also shown that senior high-profile student-athletes in general are more likely to participate in community services and culminating senior experiences, and to take foreign language courses when compared with their non-athlete peers. Senior female student-athletes from D-I schools have reported participating in more enriching educational activities (Kuh, Kinzie, Buckley, Bridges, & Hayek, 2006; National Survey of Student Engagement, 2005). It is important to know that student-athletes take part in fewer extracurricular activities and campus services because of the extra time demand of the athletics (Eitzen, 2009; Wolverton, 2008).

In summary, interacting with faculty and peers has direct effects on student-athletes' academic success.

Institutional Environment

Institutional environment in this study refers not only to the physical environment institutions provide, but also includes programs and opportunities for student learning. The two benchmarks of NSSE, level of Supportive Campus Environment and the Enriching Educational Experiences, can be indictors for measuring the construct of Institutional Environment of Pascarella's general model.

It is important to acknowledge that students' satisfaction with college life and environment is viewed as a function or indicator of college success (Melendez, 2006). Students tend to have a high level of satisfaction when they feel the environment their institution provides is supportive of their academic and social needs (National Survey of Student Engagement, 2005). Umbach et al. (2004) have reported that both male and female student-athletes feel their colleges provide more academic and social support than their non-athlete peers reported. However, male and female athletes didn't show the same level of satisfaction when compared with their peers: Female student-athletes were more satisfied than female non-athletes, and male student-athletes were less satisfied than their male peers.

There are concerns that athletics participation may isolate student-athletes from interacting with other students and activities both in an academic and social context.

Some early studies, however, have shown that athletes were often more satisfied and involved than their non-athlete peers (Astin, 1993a; Pascarella & Terenzini, 1991). Astin1993 has also pointed out that intercollegiate athletics participation has been positively associated with overall satisfaction with the college experience, motivation in learning, and interpersonal and personal development. National Survey of Student Engagement (2004) backed up Astin's statement with evidence that student-athletes perceive the campus environment as more supportive compared to their non-athlete peers. Furthermore, Umbach and Kuh (2004) have shown female athletes reported a higher level of satisfaction with their college environment than males. Similarly, National Survey of Student Engagement (2005) reveals that senior female students in D-I schools think their campuses are supportive both academically and socially.

Enriching Educational Experiences serve as a means to complement an institution's educational goals. It enriches learning opportunities and activities both inside and outside of the classroom to integrate and apply knowledge and skill (Gonyea, 2005a). The activities include experiencing interactions with people with diversity, participating in internships, co-curricular activities, and others.

Hathaway's (2005) study shows that there is no difference between student-athletes and their non-athlete peers with regards to engagement in enriching educational experiences. However, senior woman are more engaged in enriching educational experiences than others in D-I schools NSSE (2005). Crawford's (2007) research, which is focused on student-athletes alone, has shown that female student-athletes are more engaged in Enriching Educational Experiences than male student-athletes. This study has also provided evidence that student-athletes who play non-revenue generating sports tend to be more engaged than those who are on revenue generating teams. Furthermore, there are differences when compared by academic years and when controlled for gender and academic year (Crawford, 2007).

Perspective on Student-Athlete Subgroups

Much published research has examined the similarities and differences in students' college experiences and outcomes by gender, ethnicity, and academic year enrolled. For studies pertaining to student-athletes, the engagement studies related to the characteristics of academic years, student-athlete's gender, and sports played have attracted the most attention.

Class and Gender

Research results from the existing literature have shown that, for the general student population, freshmen and seniors engaged in college experience differently and have shown different gains in college outcomes (Bridges, Cambridge, Kuh, & Leegwater, 2005; Hu & Kuh, 2003; Kuh et al., 2006; National Survey of Student Engagement, 2005; Pike, Kuh, & Gonyea, 2003). For the non-athlete population, the freshmen-senior differences have shown in critical thinking, interaction with peers, integration, and college outcomes (Hu & Kuh, 2003; Pike et al., 2003; Winter, McClelland, & Stewart, 1981). Even though the total number of studies on student-athletes is growing, the research focusing on differences between freshmen and senior student-athletes is still scarce. Therefore, whether the revealed differences of academic year for the general college population can be applied to student-athletes is understudied.

An early study by Pascarella et al. (1995) showed negative consequences of athletics participation on students' cognitive development. These consequences are significant for both male and female freshmen student-athletes. A later study of freshmen student-athletes has reported a high level of academic challenge and time spending on school works (Umbach & Kuh, 2004). Yet the (2005) has shown that the percentage of freshmen student-athletes who would like to spend necessary time (25 hours per week) to do well in college is less than 20%. Furthermore, Crawford (2007) has also indicated that freshmen and sophomore year student-athletes tend to use fewer student services than higher year student-athletes.

Studies focusing on senior student-athletes are rare. The NSSE (2005) reported that senior student-athletes, across divisions and gender, participate in extra-curricular and career-related courses and opportunities to a greater extent than all other seniors. This report has also explored the engagement patterns for senior student-athletes by gender and divisions. High-profile senior female student-athletes in Division I schools consider their campus more supportive than other female athletes (Kuh et al., 2006; National Survey of Student Engagement, 2005). They also participate in educationally purposeful activities and interact with people more often than non-athletes.

Sports

Revenue-generating sports (or revenue sports, high-profile sports) and its counterpart, the non-revenue generating sports, are the commonly used categories when examining the differences in college outcomes for student-athletes.

Revenue-generating sports in general refers to men's football and basketball (National Survey of Student Engagement, 2005). A review of literature has shown significant differences in cognitive development and college experience between students who play revenue-generating sports and those do not (Kuh et al., 2006; Pascarella & Terenzini, 2005; Pascarella et al., 1999, 1995; Umbach et al., 2004). Some reports show male revenue-generating athletes have significantly lower scores in mathematics and reading comprehension than either male non-revenue-generating athletes or male non-athletes (Pascarella et al., 1995; Pascarella & Others, 1991). In particular, male football and basketball players have lower scores in reading comprehension and math skills during their freshman year while students in other sports and non-athletes showed higher gains (Pascarella & Others, 1991).

The differences between these two categories have also shown in other aspects of student experiences. Graduation rate and Graduate Success Rate (GSR) for revenue-generating sports athletes are lower than their counter group (Denhart, Villwock, & Vedder, 2009; National Collegiate Athletic Association, 2009). The racial and identity problems can be more pronounced for students who play revenue-generating sports (Steinfeldt et al., 2010). However, revenue-generating athletes are engaged in effective educational practices at a similar level as all other students (National Survey of Student Engagement, 2005). They also have reported utilizing the services their universities provided more than students who are on non-revenue generating sport teams (Crawford, 2007).

The summary of the current perspectives of student-athletes above shows the inconsistency of the findings and the incomplete picture of student-athletes' college experiences. This study will contribute to the research field by providing information to enrich the literature of the three constructs of student engagement, five effective educational practices and two student-athlete subgroups. This is done by applying a sound theoretical framework, appropriate data, and advanced analytical methods.

Theoretical Framework

This section introduces involvement theories in student engagement studies. It specifically focuses on the application of Astin's I-E-O model and Pascarella's general model. This study constructs a theoretical framework by combining these two theories with student-athletes' engagement indicators, which serve as the guideline for this study.

Introduction of Involvement Theories

It is essential for colleges to construct conditions that promote student success in postsecondary education. Based on extensive research in student success, Kuh et al. (2006) have synthesized and defined student success as "academic achievement, engagement in educationally purposeful activities, satisfaction, acquisition of desired knowledge, skills and competencies, persistence, attainment of educational objectives, and post-college performance" (p. 1). Student engagement, in particular, is one of the most important factors in student learning and personal development during college. Student engagement refers to the quality of effort, including both time and energy, students themselves devote to educationally purposeful activities that contribute directly to desired outcomes (Astin, 1993a; Pascarella & Terenzini, 2005). This concept is reflected in Astin's theory of involvement, which essentially suggests "students learn by becoming involved" (Astin,1985, p. 133).

The study of student engagement has provided crucial information for colleges and universities about a wide range of educational practices, students' behaviors, and institutional performance as perceived by students. This information has helped institutions focus their efforts on improving the undergraduate experience, and consequently to foster student success.

Early studies of student engagement often focused on the relationship between time-on-task behaviors and student achievement (Brophy, 1979, 1983; Fisher et al., 1980; Frederick & Walberg, 1980; Karweit & Slavin, 1981). However, more recent studies have focused on a broader concept of student engagement, which includes a greater range of educational practices and conditions. These studies defined student engagement as a two-fold relationship between students and the institutional environment, which depicted a more complete picture of students' behaviors and college experience (Astin, 1985, 1991a; Chickering & Gamson, 1987; Chickering & Reisser, 1993; Kuh, Schuh, Whitt, & Associates, 1991; Pascarella & Terenzini, 2005; Tinto, 1993). This two-fold concept was presented as early as 1936 by Lewin (1936). Lewin has used a formula to illustrate the relationship between an individual's behavior and this person's environment: an individual's behavior is a function between a person and his/her environment: $B=f(P*E)$, where behavior (B) is defined as a function of a person (P) and the environment (E). Both students and the environment they were exposed to are important components in studies of student behaviors in college. This concept has not only served as a foundational idea for the development of student affair professionals, but also has been applicable in studies of student-athletes (Watt & Moore III, 2001).

The first component of the two-fold relationship, student input, represents "the amount of time and effort students put into their studies and other educationally purposeful activities" (Kuh et al., 2006, p. 31). Chickering and Gamson (1987) highlighted categories of effective educational practices, which are directly associated with student learning and the quality of their college experiences. As Alexander and Murphy (1994, p. 12)) stated "learning is strongly influenced by the degree to which an individual is invested in the learning process" (p. 12). The more time and effort students put into these educationally purposeful activities, the more they engaged, and more likely they are to have better college outcomes.

The second component of the relationship is the institutional environment (Kuh et al., 2006; Kuh, 2001). The concept of the institutional environment is meant to define more than just a physical environment of natural resources, gathering places, residences, and surrounding communities. It is also a psychological environment that provides resources, services, opportunities, supports and challenges to get students involved in learning and educationally related opportunities. Kuh emphasizes that it is very important to understand how students use the resources their institutions provided for learning (Kuh, 2001). Pascarella and Terenzini (2005, p. 602)) conclude “the impact of college is largely determined by individual effort and involvement in the academic, interpersonal, and extracurricular offerings on a campus” (p. 602). A supportive campus environment enriches student experiences, meets their expectations and maximizes student development both academically and socially (Astin, 1991, 1993a; Kuh et al., 2005, 2006; Pascarella & Terenzini, 2005).

The concept of the two-fold student engagement relationship has been used to study the connections among educational practices, student behaviors, and institutional performance as introduced earlier. In particular it is interesting to use it in the exploration of engagement in student-athletes. Being college students and participating in intercollegiate athletic programs have profoundly affected student athletes. The effects are manifested in areas of academic issues, social challenges, career development, peer and faculty interaction, identity development, behaviors and perceptions, and satisfaction of college experience (Astin, 1993a; Martin, 2009; Pascarella & Terenzini, 2005). Unlike non-athlete students, student athletes have extensive time demands in their sports related activities on top of their regular college life. Constant mental and physical exhaustion along with trauma recovery cause student athletes to have limited time to devote to academically related activities (Carodine, Almond, & Gratto, 2001). Together with the clustered enrollment in the same program and living in the same residential hall, athletics participation may have contributed to the disconnection of student-athletes with their institutional environment.

As a result, athletics related characteristics may lead to a negative experience for this population (Carodine et al., 2001). Kuh (2001) has stated that it is essential to know how students spend their time in order to construct connections between educational activities and college outcomes. However, a review of the literature indicates that there has not been sufficient research done about the extent to which student athletes allocate time and energy to educationally related activities towards the desired outcomes in college (Bowen & Levin, 2003; Shulman & Bowen, 2001). Therefore, it is meaningful to explore the nature of student athletes' engagement, to investigate how student athletes use the resources their universities provide in learning, and to find direct and indirect statistical effects of student engagement factors on desired college outcomes. The following two families of research questions guide this research:

1. Which model best describes the statistical associations among the engagement factors and college outcomes?
    a. How does the best-fitting model vary by class and by gender?

   b. To what extent do the engagement factors account for the variation in college outcomes?

2. How do the statistical relationships in Question #1 change when student profile and college outcome variables (as predictors) are introduced in the models?
3. To what extent do school characteristics account for between-college variation in college outcomes?

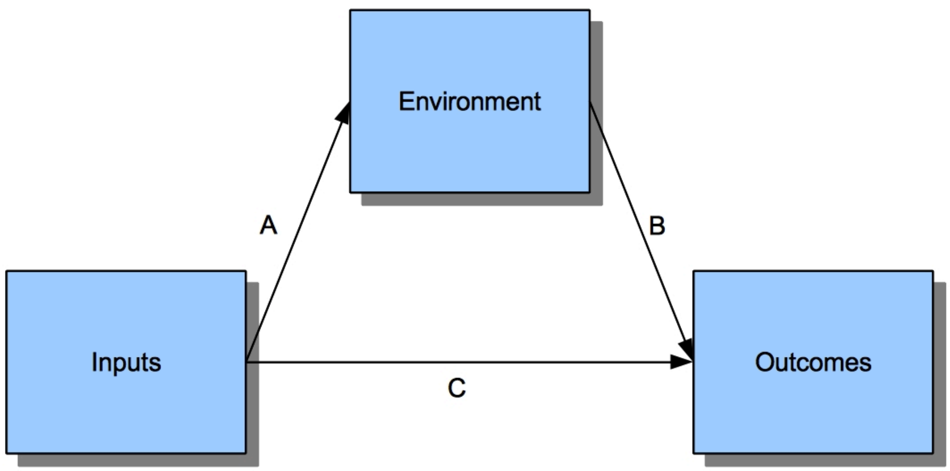
This study explores engagement factors in relation to college outcomes to determine the best fitting engagement models that best describe the engagement patterns for student-athletes by class and gender.

Astin's I-E-O Model

Astin (1985) Input-Environment-Outcome (I-E-O) model addressed the complexities of interdependence between individuals, environment and college outcomes. Beyond the relationship between environmental variables and outcomes, this model highlights the interaction between student background characteristics and the college environment. Astin emphasizes that "the relationship between environment and student outcomes cannot be understood without also taking into account student inputs" (Astin, 1991b, p. 19). Astin made the argument that combining input, environment, and outcome components is necessary for adequate modeling. Figure 1 shows the interrelationship of the three factors of I-E-O model. Astin's I-E-O model is "one of the first and most durable and influential college impact models" (Pascarella & Terenzini, 2005, p. 53). It functions as a conceptual framework and methodological guideline for this research.

Inputs in I-E-O model refer to the characteristics of the student at the time of initial entry into the institution. This information helps institutions monitor students' progress over time and also reveals the fact that college environments are affected by the kinds of students who enrolled, shown by relationship "A" (I →E) in Figure 1. In this research students' inputs are defined by their gender, race, parents' education levels, SAT Total score (SATT), and sports played (shown in Figure 2).

Figure 1: Astin's I-E-O Model



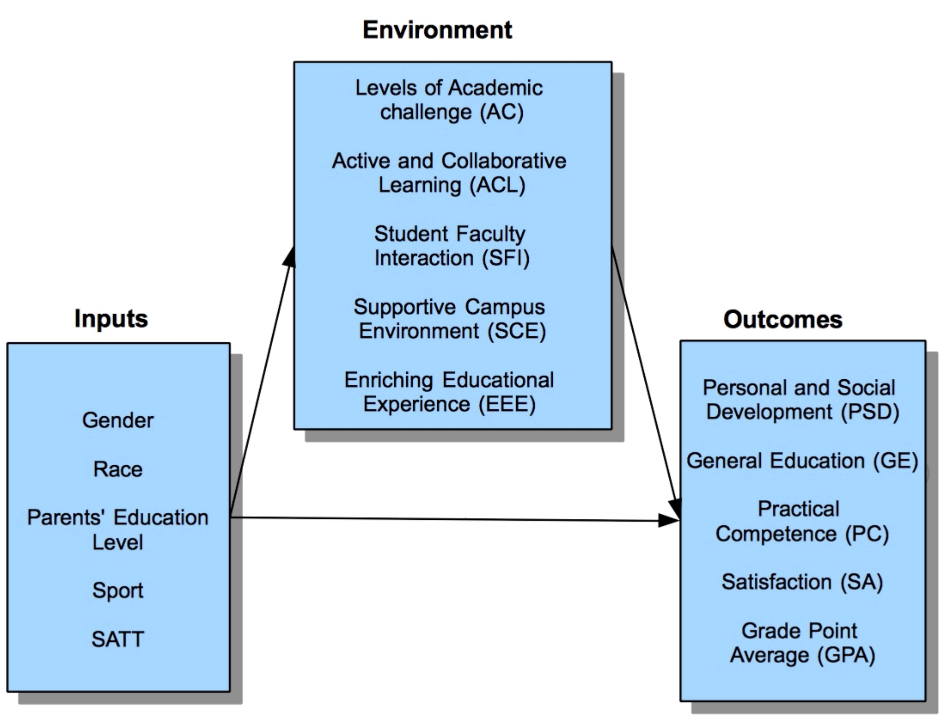
Astin, A. W. (1991b) p. 18

Environment refers to the various programs, policies, faculty and peers students interact with, and educational experiences that are designed to promote outcomes (Astin, 1993a). The main focus of research of college impact is to measure the effects of college environment on students' outcomes, shown as relationship "B" (E →O) in Figure 1. The five engagement benchmarks of NSSE, which will be introduced later in this chapter, serve as the environmental variables in this research as shown in Figure 2.

Outcomes refer to all the intended outcomes of college, including both cognitive and affective outcomes at the time students exit college. In the I-E-O model, college outcomes are not only related to the environment students exposed to, but also affected by students' inputs, shown as relationship "C" (I →O) in Figure 1. In this research, achievement in Personal and Social Development, Practical Competence, General Education, Satisfaction, and Grade Point Average (GPA) are used as outcome variables (see Figure 2).

In addition to the main relationships "A", "B", and "C", Astin, 1970 (p. 224) also suggested interactive effect ("AB" and "AC") of inputs on output with the media of institutional environment, see Figure 1. The interaction effect "AC" (I→E→O) represents "the effect of input on output is different in different environment", and "AB" (E→I→O) represents "the effect of college environment is different in different types of students". Of all relationships, the relationship "AB" attracts the most research interest.

Figure 2: Application of Astin's I-E-O Model with Variables



The parsimonious, yet not simple, structure of Astin's I-E-O model provides the guidelines for constructing the model of this research. Astin's model represents the dynamics and impacts that college experiences on students' development. It specifies that students' background and experiences have both direct and indirect effects on outcomes. However, this model is insufficient to interpret the complicated interrelationships among the various input, environment, and outcome variables. One of the later models, Pascarella's General Model (Pascarella, 1985), continues the idea of I-E-O model in which it maintains the elements of student input, institution structural characteristics and its environment, and their relationship with college outcomes. At the same time, Pascarella's General Model also adds several additional components into the model, as well as specifies relationships amongst them. This unique contribution of Pascarella's general model is a good supplement for Astin's I-E-O model, which serves as a conceptual foundation for this study.

Pascarella's General Causal Model

Pascarella (1985) has extended the simple structure of I-E-O model by constructing the General Causal Model for Assessing the Effects of Differential College Environments on Student Learning and Cognitive Development, which explicitly includes influences of institutions' structure/organization characteristics and their general environment, and the quality of student effort on outcomes. This model assesses student change and considers the direct and indirect effects of both institution's structural characteristics and its environment. Figure 3 shows the comprehensive relationships of Pascarella's general model.

Pascarella (1985) synthesized five sets of components for the general model and suggested direct and indirect effects among the five main sets of variables:

Set 1: Student Background/Precollege Traits

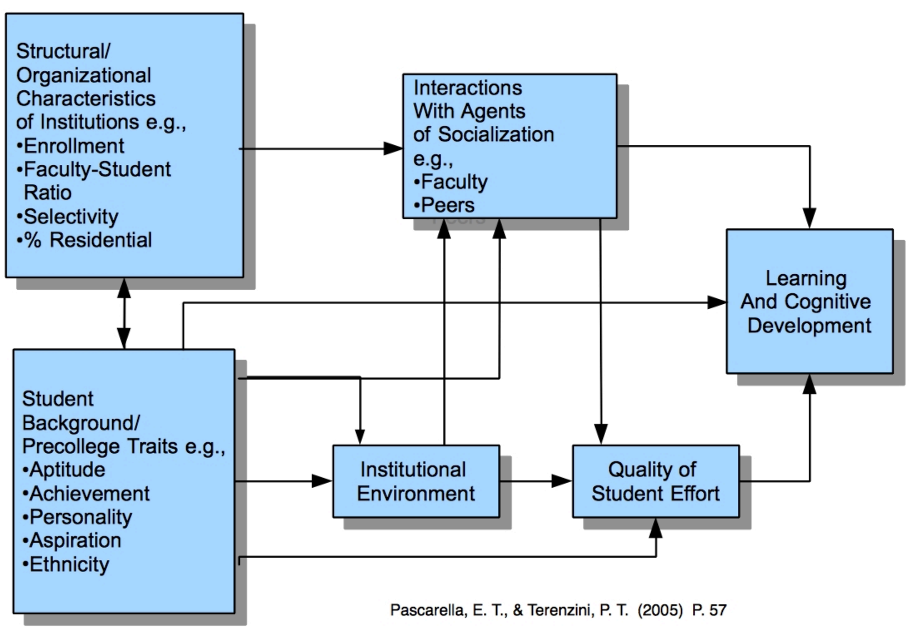
Set 2: Structural/Organizational Characteristics of Institution

Set 3: Institutional Environment

Set 4: Interactions with Agents of Socialization

Set 5: Quality of Student Effort

Figure 3: A General Model for Assessing the Effects of Differential Environment on Student Learning and Cognitive Development



Pascarella's general model serves as a conceptual foundation for this study. Pascarella theorized that Student Background/Precollege Traits (set 1) and Structural/Organizational Characteristics of Institution (set 2) variables mutually affect each other and both sets have an effect on the Institutional Environment (set 3).

Furthermore, all three sets affect Interactions with Agents of Socialization (set 4), which includes students' interactions with faculty and their peers. The link between students' development in college and students' interaction with faculty and peers are crucial. The more students interact with faculty, both inside and out side of the classroom, the more growth students have in college (Pascarella & Terenzini, 1991).

Pascarella also believes that college impacts are not only affected by the degree of student interaction with faculty and peers, but also directly affected by the quality of student effort (Davis & Murrell, 1994). Quality of Student Effort (set 5) is the key component in Pascarella's general model, and it is one of the factors that have been specifically emphasized in this model, besides institutional characteristics. In Pascarella's general model, Quality of Student Effort is influenced by students' background traits (set 1), by the institutional environment (set 3), and by the interactions with faculties and peers (set 4).

Pascarella's general model depicts that the college outcomes as a function of student background, interaction with socialization agents, and quality of student effort. Research has demonstrated that college outcomes were greatly determined by the quality of students' effort: time and effort that student put into their work and the level of the involvement in campus life, both academic and non-academic activities (Davis & Murrell, 1994; Pascarella & Others, 1991). There are also indirect effects on outcomes from structure features of institutions (set 2) and institutional environment (set 3), mediated by set 4 and set 5, respectively (see Figure 3). Pascarella's model has been applied in numerous research studies and the relationships among the factors have been confirmed (Arnold & Others, 1993; Astin, 1993b; Kuh et al., 1997; Pascarella, Edison, Hagedorn, et al., 1996; Pascarella & Terenzini, 1991).

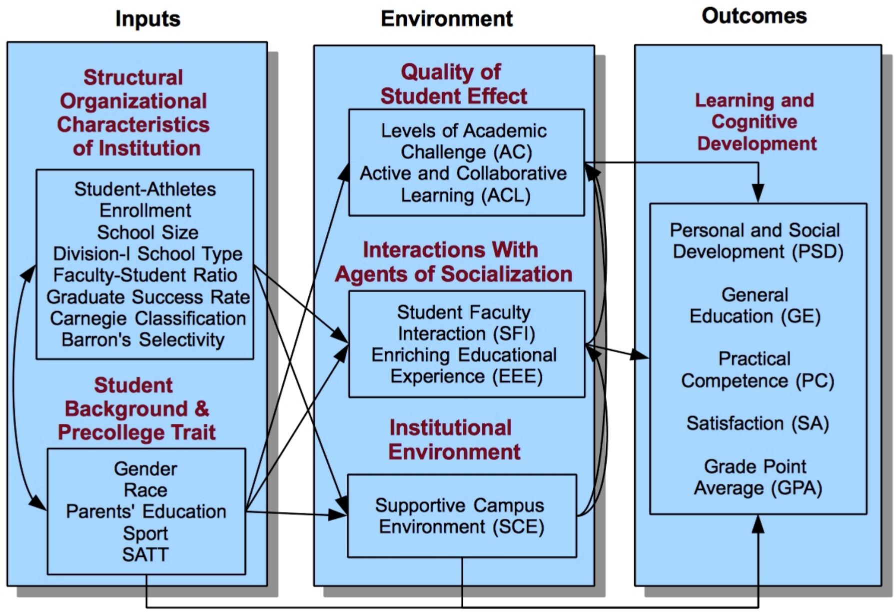
As shown in Figure 3, most of the direct and indirect effects were assumed to be uni-directional in Pascarella's general model due to the complexity and difficulties of measuring learning. However, Gonyea (2005b) suggests that there exists a possibility that the interrelationship might be two-directional.

Initial Model

The initial model (see Figure 4) of this study is the analytical basis for this research study, which is based on the I-E-O model, Pascarella's general causal model, and Chickering's concept of good practices for student learning. This initial model illustrates the relationships among the factors that are crucial for studying college success. It also serves as a starting point for this research study.

Astin's I-E-O model works as a conceptual framework for this study. It simplifies the complex nature of college impact into three constructs: individual inputs, college environment, and college outcomes; and depicts the interdependence among them. Instead of explaining in a theoretical way a student's changes in college, Astin's I-E-O model works as a conceptual and methodological guide for the studies of college impacts (Pascarella & Terenzini, 2005).

Figure 4: Initial Model for Student Engagement of Student-Athletes



Adopting Astin's I-E-O model and his theory of involvement allows this study to focus on the quality of student effort and the critical role of institutional environment on college outcomes. One shortcoming of the I-E-O model is that it only provides a general guide for a study such as this one. It cannot determine which individual input indicators and environmental variables are important to use in a research study of college impact. A supplemental model is needed.

Pascarella's general model is a good supplement to Astin's I-E-O model for this research study. It specifically takes into account both institutional structural characteristics and individual's input which provides a conceptual foundation for this multi-institutional study of student engagement (Pascarella1985). Pascarella's general model also defines the variables that are important aspects of the organizational characteristics of institutions, student background and precollege traits, quality of student effort, interactions with agent of socialization and institutional environment, and college outcomes. It further illustrates the relationships among all these factors. Very importantly, the groups of variables that have been defined by Pascarella's model are a good fit for the data that is used in this study.

The initial model of this study is the combination of these two models. The solid theoretical grounding of Astin's I-E-O model together with the well applied conceptual foundation of Pascarella's general model strengthen the theoretically correctness of this study. In addition, the seven principles of good practice for undergraduate students specify the content areas that fit in with the constructs defined in Astin and Pascarella's models.

The initial model keeps the structure of the three constructs from I-E-O model: Inputs, Environment, and Outcomes. Students' background/precollege traits (Student-Inputs) are represented by student's gender, race, parents' education, sports played and SATT scores. In addition, the initial model expands the Inputs to take into account the initial organizational characteristics of the institutions (Institutional-Inputs), including variables such as school size, faculty-student ratio, selectivity, and Graduate Success Rate. Generally speaking, Institutional Inputs are a part of institutional environment. Categorizing Institutional Inputs as part of the Environment component, however, would not properly reflect the relationship "A" described in I-E-O model: college environment is affected by different kinds of students enrolled. Further more, as shown in Pascarella's model the two components Institutional Inputs and Student Inputs mutually affect each other and they both affect Institutional Environment component, as illustrated in Figure 3. Yet, enrolling different types of students would not change the faculty-student ratio or the selectivity of the school and other facts. Therefore, it is theoretically correct to keep Institutional Inputs as a component of Inputs in the initial model.

Environment in I-E-O model contains a range of educational experiences students encountered during college. The three major components of Pascarella's model, Quality of Student Effort, Interactions with Agents of Socialization, and Institutional Environment, best represent the contents of the Environment. Inclusion of Pascarella's components and using the five benchmarks of NSSE to measure these components are based on the literature previously reviewed. This literature suggests the variables and constructs most relevant to student engagement and college outcomes for student-athletes, as shown in Figure 4. The NSSE Code Book 2006 provides clear descriptions of the five NSSE benchmarks and the component items of each benchmark (National Survey of Student Engagement, 2006a), see Appendix II.

Quality of Student Effort is measured by two of the NSSE benchmarks: Level of Academic Challenge (AC) and Active and Collaborative Learning (ACL). AC, which contains 11 component items of NSSE 2006 instrument, measures time spent on preparing for class, amount of reading and writing, deep learning and institutional expectations for academic performance. ACL measures the extent of class participation, working collaboratively with other student inside and outside of class, tutoring and involvement with community-based projects.

Interactions with Agents of Socialization is measured by the NSSE benchmarks Student-Faculty Interaction (SFI) and Enriching Educational Experiences (EEE). Based on six observed variables, SFI measures the extent to which students interact with faculty and staff, including discussing ideas, getting prompt feedback, and working with faculty on research projects. EEE is based on twelve 12 items, including interactions with students with diverse background and experiences, using electronic technology, and participating in activities such as internships, community service, study abroad, co-curricular activities, and culminating senior experience.

Institutional Environment is measured by Supportive Campus Environment (SCE). SCE is an index that measures the extent to which students perceive the campus helps them success academically and socially, assist them in coping with non-academic responsibilities, and promotes supportive relations among students and their peers, faculty members, and administrative personnel and offices [1].

Outcomes is measured by gains in Personal and Social Development (PSD), General Education (GE), Practical Competence (GEPC), Satisfaction (SA), and Grade Point Average (GPA). There are NSSE scales of self-reported gains, measured by 16 items in total, as suggested in National Survey of Student Engagement [NSSE] (2010). They explore the extent to which the gains reported by students in a variety of personal, social, practical, and general education competency areas as a result of their undergraduate education. Satisfaction contains 3 items that measures the quality of academic advising received, the entire experience at school, and the possibility of attending the same school if students could start over again.

PSD scale measures the gains in personal development of value, ethics, spirituality, efficiency, social involvement, and understanding and working with people from diverse background. The GE and PC scales evaluate gains in writing, speaking, analytical skills, and some aspects of general education. It also includes gains in

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1 The above descriptions of the five benchmark scales were taken from the College Student Report, 2006 Codebook (2006) developed by NSSE

computer and information technology, quantitative skills, and knowledge and skills needed for work (Pike, 2006).

Grades have been used as an important predictor of ability and college performance and it is a single most important factor in predicting students' persistence in college (Tinto, 1975). The NSSE instrument also collected GPA information, which is utilized as one of the outcome variables in this study. Students responded to the NSSE 2006 survey giving their most typical grade at this university.

The items and item characteristics for benchmarks and outcome variables are shown in Appendix II.

The initial model also depicts the relationships among all the components in the model. It adopted the relationships suggested in Astin and Pascarella's models. As mentioned previously, most of the relationships are represented as unidirectional, however, there is possibility that some of the relationships might be bi-directional.

This initial model provides a starting point for exploring the nature of student-athletes' engagement patterns. HLM analyses are applied to analyze this initial model. It provides information regarding the overall model fit and statistical significance of path represented in the model.

CHAPTER THREE: RESEARCH METHOD

This chapter describes the research methodology and approaches that will be employed in this research study. It provides information about the data and defines the variables of interests. It also describes the analytical strategy and how it is applied to the initial model in the HLM framework to answer the research questions.

Data Sources

This study constitutes a secondary data analysis. The data utilized comes from three primary sources: self-reported survey data of National Survey for Student Engagement 2006 (NSSE2006) *The College Student Report*, aggregated school level data from NCAA, and school level admissions data from online resources.

NSSE 2006 Data

The main data set for this research study is the National Survey for Student Engagement (NSSE) conducted in 2006. NSSE annually surveys freshmen and senior year students in four-year colleges and universities nationwide. The Indiana University Center for Survey Research, as a third party, employs standardized survey administration procedures and sends surveys directly to randomly sampled first-year and senior year students.

Using NSSE data to explore the pattern of student-athletes' engagement in this research is essential as NSSE instruments are specifically designed to measure both the extent to which students are engaged in good educational practices and the focal college outcomes (Kuh, 2001). NSSE data is especially well suited to the theoretical foundation of this study, which is that students make more significant gains when they are highly engaged in a variety of educationally purposeful activities offered by their universities. Very importantly, NSSE instruments are widely recognized as reliable and valid and have various strengths that are valuable to institutions (Pascarella, Seifert, & Blaich, 2010).

Instrument

NSSE is funded by Pew Charitable Trusts and the Carnegie Foundation for the Advancement of Teaching. The NSSE instruments were developed and piloted by National Center for Higher Education Management Systems (NCHEMS) and the Indiana University Center for Survey Research in 1998 (Kuh et al., 2001). NSSE has been evolving since its first administration in 2000. In spring 2006, nearly 260,000 first year and senior year students from 523 U.S. four-year colleges and universities who have reported their college activities and experiences (National Survey of Student Engagement, 2006b).

NSSE was constructed with the intention of shifting public perception of college quality from media-generated college rankings, which focus on university resources and reputation, to empirically derived conceptions of institutional effectiveness that emphasize students' learning and successful educational practices (Kuh, 2003b, 2009; Kuh et al., 2001). NSSE is rooted in educational practices and conditions that promote students' learning. Chickering's Seven Principles is one of the most influential theoretical foundations of the NSSE instrument (Kuh, 2001). Chickering and Gamson (1987) have synthesized evidence regarding college impact on students and defined "Seven Principles for Good Practice in Undergraduate Educations". The "seven principles" have been widely cited as the best known set of engagement indicators, which have directly influence on the quality of students' learning and their overall educational experience

(Kuh, 2001; Pascarella, 2001). NSSE has identified five clusters of benchmarks of effective educational practices:

1. Level of Academic Challenge: Index that measures time spent preparing for class, amount of reading and writing, deep learning, and institutional expectations for academic performance.
2. Active and Collaborative Learning: Index that measures extent of class participation, working collaboratively with other students inside and outside of class, tutoring and involvement with a community-based project.
3. Student-Faculty Interaction: Index that measures extent of talking with faculty members and advisors, discussing ideas from classes with faculty members outside of class, getting prompt feedback on academic performance, and working with faculty on research projects
4. Enriching Educational Experiences: Index that measures extent of interaction with students of different racial or ethnic backgrounds or with different political opinions or values, using electronic technology, and participating in activities such as internships, community service, study abroad, co-curricular activities, and culminating senior experience
5. Supportive Campus Environment: Index that measures extent to which students perceive the campus helps them succeed academically and socially, assists them in coping with non-academic responsibilities, and promotes supportive relations among students and their peers, faculty members, and administrative personnel and offices (Kuh et al., 2001; NSSE, 2006, p. 14)

These benchmarks capture some important factors that relate to the undergraduate experience. NSSE instruments are constructed based on these benchmarks. NSSE measures the level of student engagement in educationally purposeful practices that are highly associated with learning and personal development; it also measures institutional factors that are generally accepted as related to student learning and college outcomes (Astin, 1993a; Chickering & Gamson, 1987; National Survey of Student Engagement, 2005; Pascarella & Terenzini, 2005). Even though NSSE does not measure student learning outcomes directly, it provides important information for universities and colleges to focus on the improvement of undergraduate experiences (Kuh, 2001). A study with data based on these five benchmarks would provide evidence of the relative quality of undergraduate education among the institutions participating in the survey. The NSSE2006 instrument has two parts. There are 42 questions and over 85 content items in the first part. These items ask students about their college activities, experiences, and gains, including their participation in educationally purposeful activities, institutional requirements for them, their perceptions of the college environment, and their educational and personal growth. All items use the selected response format. Responses to most of the content items employ a 4-point Likert scale, ranging from “Very Often”, “Often”, “Sometimes”, to “Never”, and other similar 4-point Likert scale statements. There are several exceptions that ask students to mark the frequencies and to rate their feelings about certain statements.

The second part of the NSSE2006 instrument collects information about students’ backgrounds, including students’ birth year, gender, race/ethnicity, academic classification, residence status, enrollment status, first-generation status, etc.. All the items in this part have multiple choice answers with the exception of three questions: student’s birth year and major, and student-athletes’ sports. Students need to check one or more of the choices that apply to them.

Survey Administration

NSSE2006 is administrated by Indiana University Center for Postsecondary Research incorporated with the Indiana University Center for Survey Research. NSSE randomly samples half of the freshmen and half of the seniors from participating four-year universities based on an enrollment database these universities provided.

In spring semester a survey invitation and a copy of NSSE instrument is sent directly to the sampled students. It takes about 15 to 20 minutes to complete the survey. After finishing the survey, students submit their responses directly to NSSE.

NSSE2006 is available in both paper and web versions. Universities choose the administration method (paper, web + paper, and web only) before the starting of the process. In 2006, the average institutional response rate was 39%. The Web-only mode response rate (41%) exceeded that of the paper administration mode (37%) (National Survey of Student Engagement, 2006b). More freshmen choose to respond via the web version than seniors.

The Reliability And Validity of The Instrument

The reliability, validity, and psychometric properties of the NSSE instruments and individual items have been extensively tested and examined, as well as the credibility of self-reported nature of the NSSE data (Kuh, 2009). Based on a good amount of evidence NSSE instruments are said to be accurate, the face validity is strong, and the psychometric properties of the instrument and items are adequate (Kuh, 2003b, 2009; Kuh et al., 2001).

<u>Reliability</u>

The reliability of NSSE instruments is reflected in the consistency of the items which “measure the same thing across respondents and institutional settings”, and by the stability of the instrument that “students respond in similar ways at two different points of time”(Kuh, 2003b, p. 5). An instrument with high reliability means that data and results collected with this instrument are reproducible.

The internal reliability (internal consistency) has been tested for NSSE2006 by calculating Cronbach’s alpha. The internal reliability measures the homogeneity of the items: how well the items measure the same construct. A value of Cronbach's alpha above .7 is considered acceptable. Reliability test for NSSE2006 shows that three benchmarks out of five have quite high reliability (>.7): Level of Academic Challenge, Student-Faculty Interaction, and Supportive Campus Environment; the other two benchmark have slightly lower reliability, Active and Collaborative Learning (.65 for freshmen, .66 for seniors) and Enriching Educational Experiences (.58 for freshmen, .65 for seniors), which suggests caution in the use of these two benchmarks (National Survey of Student Engagement, 2010a). The same report also suggests that the reliability for seniors is consistently higher than that of freshmen across all five benchmarks, but reliability tests by gender, major and institution type have only shown trivial differences among subgroups.

NSSE has applied test-retest approach to measure the stability of the instruments at student level based on data from 2000 to 2002. The overall stability is very high, and the evidence agrees with the other instruments used for measuring attitude and experiences (Kuh, 2003b). For school level stability, a correlation test is conducted for schools that have participated the NSSE program for two successive years. Pearson's r correlation has been calculated for schools that have participated the survey in both 2006 and 2007. All five benchmark score correlations are above .70. However, Pearson's r correlations vary a little bit by school type and by class (National Survey of Student Engagement, 2007). Overall, NSSE data are relatively stable from year to year (Kuh, 2003b; National Survey of Student Engagement, 2007).

As a summary, NSSE items consistently measure the same constructs, and the NSSE instruments are stable from year to year at both student level and school level.

Validity

The validity issue of self-reported data is one of the biggest concerns in using NSSE data, especially since several outcomes are measured by the self-reported gains. It is very important to acknowledge that the NSSE instrument design follows the five general conditions for high validity. Self-reported data tends to be valid if the instruments satisfies these five general conditions: (1) the information requested is known to the respondents; (2) the questions are phrased clearly and unambiguously; (3) the questions refer to recent activities; (4) the respondents think the questions merit a serious and thoughtful response; and (5) answering the questions does not threaten, embarrass, or violate the privacy of the respondent or encourage the respondent to respond in socially desirable ways (Kuh, 2003b, p. 3). NSSE instruments are designed to meet these conditions. There is much evidence showing that respondents have accurately and credibly reported their activities and gains from their college experiences (Kuh, 2003b, p. 3).

The instrument construction team, staffed by national assessment experts, has allocated much time to make sure that items on the survey are well-stated and questions asked are clearly defined (Kuh, 2003b, p. 3). Furthermore, most of the items NSSE instruments used are from other "long-running", "well-regarded" college student research programs, for example, about two-thirds of the original NSSE items were the same or similar to questions on the College Student Experiences Questionnaire (CSEQ) from the 1970s (Kuh, 2009, p. 8). Additionally, NSSE surveys students in the spring semester so that each respondent has enough experience to answer the questions. NSSE also asks questions of common experiences and the frequencies of participating in these activities in a typical week or with the reference period of the current academic year (Kuh, 2001, 2003b). Multiple groups and authorities have reviewed the results of the survey as well. NSSE instruments appear to have substantial face and content validity.

NSSE also has strong external validity since it randomly samples half of the students from a clearly defined population, the freshmen and senior year students, based on the registration data provided by the participating institutions. All surveys are administered following a standard administration procedure in the spring semester. As a summary, NSSE instruments are valid that they measure what they are designed to measure.

NCAA Data

The second data set is aggregated school level data provided by National Collegiate Athletic Association (NCAA) website. It includes overall enrollment, student-athletes enrollments, Student-Athlete Graduation Success Rate (GSR), and the number of student-athletes receiving athletics aid. These variables were commonly used in educational attainment of college athletes (Astin, 1962; Melendez, 2009; Purdy et al., 1982; Watt & Moore III, 2001).

The GSR was developed to provide more accurate graduation data by taking into account the high mobility of student-athletes. This graduation rate indictor shows the proportion of student-athletes graduate with a college degree. GSA is calculated differently from the Federal Graduation Rate (FGR) that it allows Division-I (D-I) institutions to include transfer students and subtract student athletes who leave their institutions before graduation (National Collegiate Athletic Association, 2009).

Admissions Data

The third data set is from the online resources of college admission information. Student-Faculty Ration is collected from *about.com* and universities' websites for all D-I universities that participated NSSE 2006 survey. This information is used to adjust for self-selection bias. It is worth to note that the accuracy of the admission data collected from online resources is unknown.

The Data

Data structure

The NSSE database is used with permission from the Indiana University Center for Postsecondary Research (CPR). This data set includes three parts:

1. Self-reported Individual level data collected with the NSSE2006 instrument. This data set contains all the survey items and students' responses to these items.
2. School reported individual level data, including students' SAT and ACT scores, gender, race/ethnicity, class rank, and enrollment status.
3. School level institutional characteristics variables, such as Barron's selectivity, Carnegie Classification, enrollment size, school type (public/private), locale and region.

Subject of the Data

This study focuses on student-athletes who enrolled in NCAA D-I member schools who have taken the NSSE2006 survey. This student body is a small fraction of the total population of students who participated NSSE2006. A student is identified as a student-athlete if he or she has answered YES to the survey question 24 of NSSE2006

(See appendix I): “Are you a student-athlete on a team sponsored by your institution’s athletics department?” Student-athletes also need to fill in the blank to specify on what team(s) they are athletes (e.g., football, swimming).

There are more than one hundred NCAA D-I schools that have participated in NSSE in 2006. Considering the required sample size for the multi-level and multi-school analysis of this study, only the 30 schools with the largest sample sizes sorted by senior student-athlete respondents are included in this study. The reason why the schools are ranked by senior respondents is because there are fewer senior than freshmen respondents and this study tries to include as many seniors as possible in the data set.

There are a total of 2596 student-athletes from 30 schools included in this data set. Table 1 lists the summary of the data by Gender, Race, Class, and Sports. The NSSE2006 student-athlete data included in this research is compared with the overall respondents of NSSE2006, the NSSE2006 population of the schools participated, the national wide population, and the Division-I institution population.

Gender

Of these 2596 student-athletes in this research, 47% of them are male and 53% are female. This is the same proportion as the average number of undergraduate student-athletes for Division I schools in academic year 2005-2006 (DeHass, 2008). Therefore, this sample adequately represents the overall student-athlete population for Division I schools with respect to gender.

Race/Ethnicity

White student-athletes made up more than four-fifth (81%) of the sampled student-athletes respondents compared with 65% of white student-athletes in D-I institutions and 75% of overall NSSE2006 respondents (Vicente, 2006). The high proportion of White students overly represents the proportion of Division-I White student population. On the other hand, the 6% of Black student-athletes in this research is significantly under represented compared with 20% in D-I institutions, but it well represented the NSSE2006 respondents.

Table 3-1: Characteristics of NSSE2006 Student-Athlete Respondents, NSSE2006 Overall Respondents, NSSE Population, and National Population[2]

Category	NSSE2006 Student-Athletes Respondents	NSSE2006 All Respondents	NSSE2006 Overall Population	National	Division-I
Male	47%	36%	44%	43%	47%
Female	53%	64%	56%	57%	53%
White	81%	75%	67%	64%	65%
Black	6%	7%	10%	11%	20%
Freshmen	58% (63% of all Athlete Respondents)	51%			
Senior	42% (37% of all Athlete Respondents)	49%			
Revenue Sports	15%				22%
Non-Revenue Sports	85%				78%

Class

There are 58% of the respondents are freshman student-athletes and 42% are senior year student-athletes in this 50 school samples. According to the report from NSSE2006 this is slightly biased presentation of the overall student-athlete respondents (63% freshmen and 37% senior) and overall NSSE2006 respondents (51% freshmen and 49% seniors). However, no statistics is found for the D-I population. Therefore, whether the sample is well presented for D-I student-athlete by class is uncertain.

[2] Data from (DeHass, 2008; National Survey of Student Engagement, 2006c; Vicente, 2006).

Sports

Amongst all student-athletes in the sampled 30 schools, 15% play revenue-generating sports, men's basketball and football. Woman's basketball is not considered a high-profile sport in this study because of the small number of respondents in the data set. The remaining 85% of student-athletes are on non-revenue generating sport teams. For year 2005-2006, there are about 22% of student-athletes on average who are on revenue-generating team for D-I schools (Vicente, 2006). Therefore, this data set under-represents the high profile student-athlete population.

In summary, student-athlete respondents from these 30 schools are either very similar to the overall respondents by Race and Class to the overall respondents of NSSE2006, or are good representations of D-I population with respect to Gender. The discrepancies between different populations might be caused by the selection of the data set. This data set only contains samples of respondents who are from the 30 schools that have the highest number of senior student-athletes respondents, which is not a random sampling. These institutions might be bigger than the average of the NCAA institutions. Therefore, they may have different characteristics from the average. It may affect the generalizability of the results.

Variables

The variables investigated in this research study include three categories: the institutional characteristic variables and students' background/precollege traits variables (Inputs), environmental variables (Environment), and college outcome variables (Outcomes). For simplicity of organization and communication, variables are described at student and school-level.

Student-Level Variables

This NSSE2006 student-athlete dataset contains all the responses to the survey items from student-athletes. It not only contains item responses for measuring the five benchmarks, it also includes students' responses to the items which collect student background information, including students' age, gender, race/ethnicity, GPA, major, class, sports, parents education and so on.

Furthermore, this dataset also contains school reported student-level SAT total (SATT) and/ or ACT total scores (ACTT), which is one of the important student input variables in this research. ACTT are converted into SATT by using the conversion table: Concordance between ACT Composite Score and Sum of SAT Critical Reading and Mathematics Scores (see appendix III). The strategy of handling missing value of SATT score will be introduced in the next section.

Table 3-2: Description of Student Profile Variables

Student Profile Variables	Scale	Description	Coding
Mother's Education	Dichotomous	Mother's Education Level	1 = "College degree and higher" 0 = "Lower than college degree"
Father's Education	Dichotomous	Father's Education Level	1 = "College degree and higher" 0 = "Lower than college degree"
High Profile	Dichotomous	Student who play high profile sports (men's basketball and football)	1 = "High Profile" 0 = "Non-high Profile"
Race	Dichotomous	Institution reported: Race or ethnicity	1 = "Black" 0 = "Otherwise"
Class	Dichotomous	Institution reported: Class rank	1 = "Freshmen" 0 = "Senior"
Gender	Dichotomous	Institution reported: Gender	1 = "Male" 0 = "Female"
SATT	Continuous	SAT total score (Z-score)	N/A

This dataset contains students' gender and class information reported by institutions in addition to student self-reported gender and class information. The discrepancies between student self-reported and school reported information are very small, 0.4% for gender and 5% for class. The school reported information is used in this study. Table 3-2 listed the descriptions of student profile variables.

School-Level Variables

There are 30 schools in this dataset and each school has been given a unique identifier. These schools have the highest number of senior respondents out of the 110 participating D-I member schools in 2006. All student-athletes from these schools who completed the NSSE2006 instrument are included in this data set.

Table 3-3:Description of School-Level Variables

School Characteristics	Scale	Description	Coding
Private	Dichotomous	School type	1 = "Private schools" 0 = "Public schools"
FBS	Dummy	D-I School Type with "General D-I school" as the reference Category	1 = "FBS (Football Bowl Subdivision) " 0 = "Otherwise"
FCS	Dummy	D-I School Type with "General D-I school" as the reference Category	1 = "FCS (Football Championship Subdivision)" 0 = "Otherwise"
Classification	Dichotomous	Collapsed Carnegie: 2005 Basic Classification	1 = "Research, Doctoral/Research and Master (larger program)" 0 = "Master (Medium or Smaller programs) and Baccalaureate"
Selectivity	Dichotomous	Collapsed Barron's Selectivity Ratings From 26th Edition 2005	1 = " Highly competitive, Highly competitive plus or Most competitive; and Very competitive or Very competitive plus" 0 = "Less competitive; and Competitive or Competitive plus"
SAGSA	Continuous	Student-Athlete Graduate Success Rate (Z-score)	N/A
Aid	Continuous	Percentage of students receiving aid (Z-score)	N/A
SA Enroll	Continuous	Full-time student-athlete enrollment 2005-2006 (Z-score)	N/A
S-F Ratio	Continuous	Student-Faculty ratio (Z-score)	N/A
School Size	Continuous	All full-time students enrolled Fall 2005-06 (Z-score)	N/A
Mean SATT	Continuous	School mean SATT (Z-score)	N/A
Mean GPA	Continuous	School mean GPA (Z-score)	N/A

The average number of respondents of all 30 schools is 87, with a range of 54 to 171. There are only a small number of schools that have fewer than 30 respondents when categorized students by class and by gender. The school sizes are sufficient to support multilevel analysis.

All school level variables are categorized in the way that at least five institutions would fall in each category. This ensured that no institution could be identified, according to the CPR requirement. The categories have been recoded into a fewer number of categories to simplify the data analysis. The descriptions of the school-level variables are presented in Table 3-3.

Missing Data

The NSSE follows the 3/5 rule that students have to response to at least 3/5 of the survey items to be considered as having completed the survey. The variable "Completion Status" provided by NSSE has shown that all 2596 student-athletes in this data set have met this criterion.

A student's benchmark scores are calculated only when this student has responded at least 3/5 of the component items for each benchmark. For example, for a benchmark measured by 6 component items, a student needs to answer at least 4 items to have a valid benchmark score calculated. In this dataset, there is no missing value for all five benchmark scores and school level variables mentioned above. There exist a small proportion (less than 0.7%) of missing value for the component items of gains in PSD, GE, and PC, and Satisfaction.

The missing SATT scores will be replaced by the sum of the SAT Verbal (SATV) and SAT Math (SATM), or the converted ACTT scores. The conversion is done by the

ACT-SAT Concordance chart (ACTSAT). The SATV, SATM and ACTT are school reported variables, which are contained in the dataset. If there is still missing data, school mean or grand mean SATT will be applied depends on whether it is a partial missing at a school or missing data for the whole school.

There are six students who have not reported their GPAs. Since the data set is very close to normal distribution (mean=5.62, median=6, mode=6), the missing data is replaced by the mode, value 6 (6 =“B+"), of the data set. In summary, missing data in this study is not severe.

Analytic Strategy

Applying proper statistical models to address research questions has many benefits. Commonly used models and analytical methods applied to intercollegiate athletics participation and college experience studies include: descriptive analysis, ANOVA/MANOVA, factor analysis, linear regression, and Structure Equation Modeling. These models and analytical methods, however, have limitations. Inaccuracies are introduced when data has missing values, has an unbalanced design, is multileveled in nature, or contains categorical indicators. This study will contribute to the field by applying an appropriate model to overcome some of the difficulties with real-world data.

This study explores student-athletes’ educational engagement patterns and the relationships between engagement activities with desired college outcomes. Data analyses will be comprised of three phases.

In the first phase, Factor Analysis will be employed to identify the underlying latent constructs of student-athletes’ engagement factors and college outcome variables. This is required due to the misfit of the five-benchmark model to a single university and multiple universities studies (Gordon, Ludlum, & Hoey, 2008; LaNasa, Cabrera, & Trangsrud, 2009; LaNasa, Olson, & Alleman, 2007). Since student-athletes are different from the general population in multiple ways, it is reasonable to question whether a model built for the general population is suitable for student-athletes as well. Developing constructs with high reliability and validity is the key to sound research. The application of both Exploratory and Confirmatory Factor Analysis (EFA and CFA) will suggest reasonable constructs and provide evidence of reliability and validity.

The second phase involves descriptive analyses that examine the basic characteristics of the data, e.g. item distribution, as well as the correlations between inputs, environment, and outcome variables. Analysis of Variances (ANOVA) and Multivariate Analysis of Variances (MANOVA) are applied to compare differences in Engagement Factor scores and college outcomes, given student and school-level covariates.

The third phase comprises the model-based analyses. Ordinary Least Squares (OLS) regression and Multivariate Linear Models (MLM) are applied at this stage. These models provide a starting point for estimating the effects of variables and the effects of variables between different levels of the data structure. The Hierarchical Linear Model (HLM) approach is applied to the initial model based on the theoretical framework shown in Figure 4. In this phase of analysis, HLM is used to address the research interests in studying student and school-level effects on college outcomes in a multilevel structure of the data. Two-level HLM models are implemented to test the hypotheses and to answer the research questions.

The following section provides detailed description of how analyses are done for each phase. Several steps of data analyses take place during each phase and the purpose of each step is explained.

There are 42 component items for the five benchmarks (National Survey of Student Engagement, 2006a). There are 20 items that are related to the college outcome variables. Item # 11 from NSSE2006 contains 16 sub-items (See Appendix I: National Survey of Student Engagement 2006 Instrument). These 16 sub-items are the suggested component items for college outcome variables (National Survey of Student Engagement, 2010b). Further more, items # 12, 13 and 14 are the component items for students' Satisfaction, as suggested by (Umbach et al., 2006). In addition, the students respond to item # 25 about their GPA scores. From now on, the term "NSSE items" mentioned in the following sections refers to the 62 items only for the simplicity of statement.

Each item has a selected response format. Most of the content items are based on 4-point Likert scale, ranging from "Very Often", "Often", "Sometimes", to "Never", or similar statements. There are several exceptions that require students to mark the frequencies and to rate their feelings about certain statements. However, some of the choices, especially the options at the two ends of the spectrum with extreme low/high options, have very low percentage of responses. These choices have been combined and recoded into 4-point Likert scale to simplify the analysis.

Descriptive Analyses

One important question to answer first is whether student-athletes respond to NSSE2006 in a similar way as their non-athletes peers. Based on the literature review these two groups of students are different in multiple ways. The assumption is if student-athletes are the same as the non-athletes, they should have more or less similar response pattern to the NSSE survey items, which makes it reasonable to apply the five-benchmark model for student engagement on student-athletes. Otherwise, appropriate engagement factors should be suggested before continuing this research study. This is important because the benchmarks, or engagement factors, are one of the most important research interests for this study. A research question in this regard is: Do student-athletes respond to the NSSE items similarly to the general population for year 2006?

Given the available data, this question is answered by comparing the observed frequency distributions from student-athletes with the observed frequency distributions from the general population. The frequency distributions for the general population are collected from NSSE 2006 reports (National Survey of Student Engagement, 2006d, 2006e, 2006f). This step of analyses focuses on verifying whether student-athletes respond to NSSE2006 in a similar way as the general population. This is based on the assumption that if the student-athletes respond to NSSE2006 in a way similar to the general population, it is possible that the Five-benchmark Model would fit student-athlete data as well.

This assumption is first tested by comparing the item mean differences between student-athletes and the general population. A series of one-sample t-tests are applied to the benchmark and college outcome items (a total of 61 items, excludes GPA) using the item means from the general population as the test values. Results are shown in Chapter Four.

Additional evidence is provided by comparing the response patterns of item choices between the two populations for all 61 items mentioned above. The percentages of students' responses to each of the item choices are compared and Chi-square statistics are estimated for each item.

The comparisons between student-athletes and their sub-groups are also investigated. This study compared the response patterns of item choices between student-athlete subgroups by class and by gender, and also by class and gender.

The preliminary data analyses have concluded that student-athletes respond to NSSE2006 survey items (the observed variables) differently from the general population (see Chapter Four). It provides additional supporting evidence that student-athletes have different college experiences from the general population. It also suggests that there may be better-fitted models for student-athletes than the traditional five-benchmark model.

The second phase comprises descriptive analyses that examine the basic characteristics of the data and correlation between inputs, environment, and outcomes variables. MANOVA is used to compare the differences between the engagement scores and outcome scores by class and by gender.

<u>Distributions</u>

The distribution of students profile variables, school characteristics, college outcome information, and the distribution of the engagement factors are described in this section.

Compare Means

In response to the question:

1. What differences exist between students' SATT scores by class and by gender?
2. What differences exist in engagement factor scores based on student/school

characteristics and by class and by gender?

3. What differences exist in college outcomes based on student/school characteristics and by class and by gender?

ANOVA is applied to answer question 1 since the SATT score is an interval dependent variable and the independent variables, class and gender, are categorical data. ANOVA will test the mean SATT score differences breakdown by student subgroups.

MANOVA, which is like ANOVA except that there are two or more dependent variables, will be applied to answer questions 2 and 3. Students' mean outcome variables (SA, GEPC, PSD, and GPA [introduced in detail in Chapter Four]) and engagement factor (see Chapter Four) scores will be compared by school/student characteristics and by class and by gender.

<u>Association Test</u>

To answer the question:

1. What are the associations between student characteristics and students' class and gender?

2. What are the associations between school characteristics and students' class, and gender?

3. What are the associations between student and school characteristics?

4. What are the associations between engagement factor scores and college outcomes by class and by gender?

A chi-square test is used when the goal of the research is to see if there is a relationship between two categorical variables. Student and school background variables are all categorical variables; students' subgroup variables are categorical variables as well. Chi-square tests will be appropriate for the association test to answer the first 3 questions listed above. The Chi-square tests are not applied to parents' education level with students' gender and class.

The last two questions are answered by applying Multivariate Multiple Regression models, which is used when there are two or more dependent variables that are to be predicted by two or more independent variables. The dependent variables are the three sets of gain scores and GPA, which will be predicted by the engagement factor scores and by student subgroup indicators.

These descriptive analyses present more details of the data, give a clearer picture of how input, environment, and outcome variables are correlated with each other. In addition, they provide information about the differences between student subgroups. The descriptive analyses provide a baseline for the following model-based analyses.

Factor Analysis

As shown in the initial model in Figure 4, the NSSE five play a significant role in this study, in that they serve as the indictors of the Environment components. Evidence has shown that these factors are appropriate indicators for student engagement for the general population. However, there is no research regarding whether the same benchmarks will be appropriate when they are applied to student-athletes. As discussed in the previous chapter, student-athletes differ from their non-athlete peers in many ways. They also have different experiences and perceptions of the institutional environment, faculty and peers, and other educational opportunities their institutions provide. It is reasonable to inquire whether the same factor structure (five benchmarks) will emerge with student-athlete data, as has been reported with the general population. It is meaningful to test whether the 42 NSSE2006 items load on the five benchmarks the same way when applied to student-athlete data.

In addition, recent studies, based on a single and multiple university data rather than an aggregated national level data set, have suggested different ways of decomposing the five benchmarks and reconstituting them into new engagement factors, with deleting and/or adding items. These new engagement factors have shown higher construct validity, better fit to the data, and improvement in predictions of student outcomes (Gordon et al., 2008; LaNasa et al., 2009, 2007; Pike, 2006).

The main purpose of this section is to test the reliability and construct validity of the NSSE benchmarks, to explore the data factor structure, and to suggest the best fitting factor structure models for student-athletes. It will employ a two-stage process, applying Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA), to accomplish these goals. The factors suggested by the data analysis will be called engagement factors here to distinguish them from the NSSE Five Benchmarks.

The traditional NSSE benchmark scores are calculated based on the five benchmarks and their component items. There are 6 to 11 component items for each benchmark, which make a total of 42 items for all five benchmarks. This section of data analysis focuses only on these 42 items. However, not all the items are appropriate for the factor analysis. Items that are not appropriate for the data analysis will be eliminated as the research goes on. It will follow the rule listed below.

EFA is a common analytical method used to explore the underlying structure of a relatively large set of variables. This study will adopt Principal Components Analysis (PCA) with oblique rotation (Oblimin with Kaiser normalization rotation) as analytical method, which has been used in many major studies of NSSE and applications of NSSE data (Kuh, 2003b; National Survey of Student Engagement, 2010c; Nelson Laird, Shoup, & Kuh, 2005). PCA takes into account all the variances and put the common variances on the first a few factors (Child, 2006), which is commonly accepted for the pragmatic purposes of data reduction. It also controls for multicollinearity of the items. The oblique rotation is appropriate to use since the factors of student engagement are assumed to be correlated. This analysis will be done separately for freshmen and seniors, and for male and female students. In addition, the same method will also be conducted to extract three components (outcome variables) from responses to the 16 items of Question 11 in NSSE2006. Model adjustment may apply during the process of applications across both EFA and CFA. Items will be eliminated from the model if items are/have:

- Inappropriate for a student subgroup (e.g., items of senior experiences to freshmen students)
- Highly skewed distribution
- Very low inter-item correlation with other items
- Low communality (fails to load highly on any factor)
- Small factor loading on proper factor (e.g., an item from the Academic Challenge doesn't load on the Academic Challenge).
- Large factor loadings on the wrong factor (e.g., item from the Academic Challenge loads highly on the Collaborative Learning).

The first stage of the EFA starts with extraction method of the fixed number of factors of 5. In this case 5 factors will be extracted in order to answer the question: Do the component items of the NSSE instrument load on the five benchmarks in the same way as suggested by NSSE for student-athletes data? Reliability of each engagement factor will be calculated after the tests.

A null hypothesis will be rejected under the following condition:

- The pattern of how items load on the extracted five engagement factors is conceptually ambiguous (the way items loaded on the engagement factors could not be explained);
- The total variance explained by the five engagement factors is too low;
- The factor loadings are too small or there are too many cross-loading items; and
- The reliability of each benchmark is low or too high (represents redundancy).

The preliminary data analysis rejected the null hypothesis and supported the alternative hypothesis that the component items of the NSSE instrument load on the five benchmarks in a different way from what has been suggested by NSSE for student-athlete data. Therefore, an EFA with factor extraction method based on eigenvalues greater than 1 will be applied to answer the second question: Are there better factor structure models for student-athlete by class and gender? This method explores the data factor structure and suggests the best fitted factor structure models for student-athletes. The same PCA with oblique rotation will be applied as in the previous step. It may require several adjustments in order to increase the model fit.

The traditional five-benchmark model and the EFA results will provide the construct structures for the four student-athlete subgroups, by class and by gender. The above two steps of EFA may suggest different number of engagement factors with different component items and factor loadings from the five benchmarks.

The second stage is the application of the Confirmatory Factor analysis to answer the question whether the NSSE five-benchmark model fits student-athlete data. CFA is a theory-testing model, which is based on strong theories or hypotheses. This approach allows researchers to test the existence of a hypothesized relationship between observed variables and the underlying latent constructs. Cronbach and Meehl (1955, p. 282) pointed out "construct validity must be investigated whenever no criterion or universe of content is accepted as entirely adequate to define the quality to be measured". The structural equation modeling provides a approach to test the construct validity, which includes testing the hypothesized number of factors, evaluating the interdependencies of the constructs, and examining the significance of items that loaded on the proper the construct they purport to measure (Kline, 2005).

CFA tests are conducted using AMOS 8.8 statistical software program to verify the data structure suggested by the EFA. CFA tests will confirmed the existence of new factor structure and loadings, and the new engagement factors and scale scores for each student will be calculated. This study adopts the same the calculation methods and criterion as what had been used for NSSE2006 report. These new engagement factors/scale scores will be used for the following data analysis.

The CFA is conducted based on several assumptions according to National Survey of Student Engagement (2000):

- Responses to all the items will be explained by the number of engagement factors suggested by the EFA results,

- Each item has a nonzero loading on the engagement factor if it was designed to measure, and zero loading on all other factors,
- All engagement factors are correlated, and
- The error/uniqueness terms associated with the item measurements are uncorrelated.

For example, the first CFA tests the plausibility and statistical appropriateness of the traditional five-engagement factor model for student-athletes. The traditional model suggested that the five benchmarks account for the inter-correlations of all 42 items. It also assumes that the five benchmarks are correlated and defined by unique items. The evidence of poor construct validity will be indicated by poor Goodness-of-Fit indices, highly correlated constructs, cross-loading items, and high error in the variance of the items (LaNasa et al., 2009).

Rather than depending on a single indictor to decide how well the data fit the hypothesized model, multiple indices are introduced. There are several indictors of goodness-of-fit that are commonly used in judging whether the data fits models or not. In this study only the related indices are considered [3]:

CMIN and P-value

CMIN is equivalent to Chi-square, which represents the Likelihood Ratio Test statistics. CMIN represents the discrepancy between the unrestricted sample covariance matrix and the restricted covariance matrix of the population. Therefore, the smaller and insignificant Chi-square is preferred.

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3 Indictors of goodness-of-fit are cited from (Byrne, 2009)

CMIN/DF

CMIN/DF is an adjusted goodness-of-fit index of CMIN that addresses the sensitivity of the Chi-square test to sample size. As a rule of thumb, CMIN/DF values of 3.0 or less signify a good fit of the model.

CFI

Comparative Fit Index, a value of .95 or higher is considered a good fit.

GFI & AGFI

GFI is a measure of the relative amount of variance and covariance in sample matrix that is jointly explained by population matrix. AGFI is adjusted by degree of freedom. Both indices with values above .95 are indicative of good fit.

PGFI

The parsimony goodness of fit index, taking into account the complexity of the hypothesized model in the assessment of overall model fit. The values of PGFI indices have lower values than the other normed indices of fit. It has suggested that non-significant Chi-Square and goodness of fit indices in the .90s, accompanied by parsimonious-fit indices in the 50s, are not unexpected.

RMSEA

The root mean square error of approximation has been recognized as one of the most informative criteria in covariance structure modeling. It measured the discrepancies between the sample covariance matrix with the population covariance matrix. Values less than .05 indicate good fit; values as high as .08 represent reasonable errors of approximation in the population.

CFA tests are applied to the traditional five-benchmark model and all the models suggested by EFA for student-athlete subgroups by class and by gender. A set of CFA tests may suggest different number of engagement factors with different items from what had been suggested from the previous EFA. Adjustment may be applied during the CFA tests. Evidence of construct validity is evaluated based on the indices of Goodness-of-Fit, intercorrelations of constructed, patterns of items loaded on purported constructs, and the error variances.

A second order CFA is applied as the last step of this factor analysis. The second order CFA will test how well the suggested engagement factors measure the student Engagement. Student Engagement is a latent construct that supposed to be measured by the hypothesized engagement factors. The same goodness-of-fit indices and criteria apply to the second order CFA as well.

Further more, this phase of analyses estimates the reliability and construct validity of the NSSE engagement factor for student-athletes. Engagement factor scores and college outcome scores (e.g., student satisfaction) are calculated. They are used for the rest of the data analysis of this research study instead of using NSSE provided five benchmark scores.

The third phase of the data analyze is the model-based analyses. Ordinary Least Squares (OLS) regression and Multivariate Linear Models (MLM), and Hierarchical Linear Modeling (HLM) are applied at this stage.

General Linear Regression

In the first step, Univariate Linear Regression, each college outcome variable Satisfaction (SA), General Education and Personal Competence (GEPC), Personal and

Social Development (PSD), and GPA (see Chapter Four for details) enters the regression model as a dependent variable. Both student profile variables and school characteristic variables are employed as predictors, as well as engagement factors. A series of linear regressions are employed to test the possible significant associations of independent variables on each of the college outcomes.

In the second step Multivariate Linear Regression is applied. Each category of the variables, engagement factors, school characteristics, student profile variables, and college outcome variables, is entered into the models to examine the statistical associations as described below. Main effects and selected interactions between variables will be explored.

For engagement factors as dependent variables:

- The statistical associations between student demographics and engagement factors will be examined.
- The statistical associations between school characteristics and engagement factors will be examined.

For college outcome variables as dependent variables:

- The statistical associations between engagement factors and college outcome variables are examined.
- The statistical associations between student profile variables and college outcome variables are examined.
- The statistical associations between school characteristics and college outcome variables are examined.

- The statistical associations between student and school-level variables and college outcome variables are examined.

Introducing Hierarchical Linear Modeling

Multilevel modeling is an appropriate analytical method when a dataset has a hierarchical structure. In this study the data for students are nested within schools. The term HLM was first used by Lindley and Smith (1972). It has been given different names in different research fields: multi-level model, multilevel linear model, mixed-effects models and random effects models (Raudenbush & Bryk, 2002).

Multilevel solutions have a number of advantages over OLS solutions when the data are hierarchical in nature. The implementation of HLM in this research will solve the following potential problems typically associated with the nested data:

Correlation Error

The assumption of homoscedasticity in OLS assumes that the errors are normally distributed along the whole range of predicted values. In a hierarchical structure this assumption is violated when between-school variation contributes to the within-school variation. The result is that an incorrect number of degree of freedom will be applied when estimating the standard error.

The OLS assumption of "independence of observations" is violated in a nested data structure since students from the same school are more likely to share the same experiences: taking classes with the same teacher, joining the same activities, sharing the same school environment etc.. Some of the similarities between individual are observable and could be explained by controlling independent variables, while the non-observed variance is contribute to the error term (the residual) instead. Therefore, the error terms of individuals from the same group are no longer independent within that group. When the residuals are correlated, the standard errors for the regression coefficients will be smaller than they should be. This will cause an inflate Type I error rate resulting in more significant results than warranted.

In this study HLM handles this limitation by constructing both student-level and school-level models. The dependence among students within schools will be taken care of by allowing researchers to produce correct estimates for standard errors of school effects on student outcomes (Bryk & Raudenbush, 1992, p. 199; Goldstein, 1995; Kreft & Leeuw, 1998, p. 1). When school-level contextual variables are included in the models, they explain differences between intercepts and slopes. Therefore, the hierarchical nature of the data is taken into account and variables from different levels, in this case the student-level and school-level, are all included in the same model. The error structure can be estimated as random effects in variance analysis, which improves accuracy of the estimation of the variance and produces smaller standard errors when compared with OLS regression (Aitkin, Anderson, & Hinde, 1981; Raudenbush & Bryk, 1987).

HLM can be considered a generalization of OLS regression with the coefficients of the predictor variables as outcomes. The primary difference between traditional regression analyses and multilevel models is that in a multilevel approach coefficients are specified at different levels in the hierarchical structure of the data. Most importantly, the intercept and slopes may vary randomly across schools in HLM models.

Heterogeneity of Regression Slopes

When between school differences exist, estimating the slopes in OLS regression without taking into account the school effects would be incorrect. One of the advantages of HLM is that it allows the relationship between the predictors and the outcomes to vary randomly within each level. For example, this study will model how the relationships between students' demographic characteristics vary across schools as a function of the college outcomes for each school. In this "slopes-as-outcomes" model the random slopes between schools then can be modeled by taking into account the within-unit predictors (Raudenbush & Bryk, 1987).

Multilevel solutions have a number of advantages over ordinary least squares solutions when the data are hierarchical in nature. The primary difference between traditional regression analyses and multilevel models is that the multilevel coefficients refer to specific levels in the hierarchical structure of the data. HLM has been applied in many settings with a hierarchical data structures and has been shown to be appropriate (Mason, Wong, & Entwisle, 1984; Raudenbush & Bryk, 1986; Raudenbush, 1988). Applying HLM to the study of student-athletes' educational engagement improves the accuracy of estimates of fixed and random effects across student and school levels.

Applying Hierarchical Linear Models

The HLM approach is applied to the initial model based on the theoretical framework shown in Figure 4**.** In this phase, hierarchical linear modeling techniques (HLM 6.6 for Windows) are used to control for the possible problems related to the nested data as discussed in the literature review. Bryk and Raudenbush (1992) and Raudenbush and Bryk (2002) have provided detailed reviews of HLM. This section discusses the two-level approach for analyzing multilevel data. HLM models are defined at each step of the analysis.

The level-1units of the HLM are the students and the level-2 units of analysis are the schools. HLM models allow partitioning the variance of college outcomes into within and between-school components. This analytical method makes it possible (i) to calculate how much of the variance in college outcomes can be attributed to between-student differences, within-school differences, and between-school differences, (ii) to model school differences in average level of college outcomes, and (iii) to model school differences in the effects of the independent variable on college outcomes.

Five two-level HLM models will be introduced at each step of this phase of data analyses.

Model-I: One-Way ANOVA with Random Effects Model

One-Way ANOVA with Random Effects Model is used as the Null model. This model is also called Fully Unconditional Model (FUM) in that there are no independent variables at the student or school-level. The results from the following HLM models are compared with the FUM to test the possible improvement of the models.

This model answers the research question: Does the average level of college outcomes (SA, GEPC, PSD, and GPA) vary across schools?

Level-1 Model:

$$Y_{ij} = \beta_{0j} + r_{ij} \quad (1)$$

Level-2 Model:

$$\beta_{0j} = \gamma_{00} + u_{0j} \quad (2)$$

where

i indexes the level-1 unit;

j indexes the level-2 unit;

Y_{ij} is the college outcome score for student i in school j;

β_{0j} is the mean college outcome score for school j;

r_{ij} is the random error associated with student i in school j, assumed to be independently and normally distributed with mean zero and homogeneous variance across schools, $r_{ij} \sim N(0, \sigma^2)$;

γ_{00} is the mean college outcome score across all schools (grand mean);

u_{0j} is the random error (between-school effect associated with school j) at school-level, assumed to be independently and normally distributed across schools with mean zero and variance τ;

$Var(r_{ij})= \sigma^2$ is the average within-school variance on the outcome variable;

$Var(u_{0j})= \tau_{00}$ is the variance in school means on the outcome variable. The fully unconditional model provides an estimation of the within and between-school variances in college outcomes. Importantly, it tests the null hypothesis that the school means are equal.

Model-II: One-Way ANCOVA with Random Effects Model

This model is used to identify the possible statistical associations of the independent variables on college outcomes and the average intercept across all schools. Also, this model is useful for identifying compositional effects. It employed partitioned error terms for student and schools in order to control for correlated errors and heteroskedasticity.

Questions to be answered by this model:

1. Do engagement factors have statistical associations with college outcomes?
2. Do student profile variables have statistical associations with college outcomes?
3. What are the important student-level predictors of college outcomes?

4. Is there any evidence of composition effects?

Level-1 Model: $Y_{ij} = \beta_{0j} + \beta_{1j}(X_{1ij} - \overline{X}_{1..}) \cdots + \beta_{kj}(X_{kij} - \overline{X}_{k..}) + r_{ij}$ (3)

Level-2 Model:

$$\beta_{0j} = \gamma_{00} + u_{0j} \quad (4)$$

$$\beta_{1j} = \gamma_{10} \quad (5)$$

$$\vdots \quad (6)$$

$$\beta_{kj} = \gamma_{k0} \quad (7)$$

In addition to the notation provided earlier, here

k indexes the independent variables;

$X_1, \cdots, X_k$ are the k student-level variables, including engagement factors and student demographic variables;

β_{0j} is the mean college outcome for school j after controlling for the predictors $X_1, \cdots, X_k$;

$\beta_{1j}, \cdots, \beta_{k1}$ are the regression coefficients for school j associated with the predictors $X_1, \cdots, X_k$;

u_{0j} is the unique increment to the intercept associate with school j after controlling for student-level predictors;

$\gamma_{10}, \cdots, \gamma_{k0}$ are constant denoting the common values associated with each of the k regression coefficient across schools;

$Var(r_{ij}) = \sigma^2$ is remaining/unexplained within-school variance on the outcome variable after controlling for independent variables $X_1, \cdots, X_k$.

This model is conditional at level-1 and unconditional at level-2, since there are no school-level predictor variables. Model-II analyses are done with three steps. Each step forms a sub-model of Model-II. The engagement factors are introduced to model-II in the first step, which forms Model-II-A. Model-II-B is build upon model-II-A with student profile variables as predictors, in addition to the Engagement factors. Model-II-C is built upon Model-II-B, with three college outcome variables as additional predictors while the fourth is the dependent variable. In all three models in Model-II, all interval scaled variables are grand-mean centered, while others are not centered.

The variance components from Model-II are compared with those from the Null model to determine how much within and between-school variances in college outcomes has been explained by student-level variables. Differences in the average levels of student-level variables across schools can account for some of the school differences in average levels of college outcomes. For example, if SAT Total (SATT) score has a significant strong effect on college outcomes and there are differences in the average levels of SATT across schools, the compositional differences of schools in average levels of SATT can account for same proportion of school-level differences in college outcomes. Therefore, Models-II estimates how much between-school variance in college outcomes is due to compositional differences.

Model-III: Random Coefficient Regression Model

The previous models assume that student-level variables would have the same impact on college outcome variables in all schools. Model-III, Random Coefficient Regression Model (RCRM), includes random effects in the slopes in level-2 model. This allows the slopes to vary across schools. In addition, all interval scaled variables are group-mean centered and others are not centered since the slopes vary across schools. This model provides a test of whether the effects of the independent variables are the same across the schools.

Questions to be answered by this model:

1. Do the statistical associations of Engagement Factors on college outcome variables vary across schools?
2. Do the statistical associations of student profile variables on college outcomes vary across schools?
3. Do the statistical associations of college outcome variables as predictors on college outcomes (as dependent variable) vary across schools?

The rule of thumb of predicting a single level-2 outcome (e.g., a random intercept or a random slope) is that it needs 10 observations for each predictor. For school size of 30, including three random slopes is appropriate.

Since interval scaled predictors in Model-III are group-mean centered, the variance components have changed from those in Model-I and II. Therefore, the variance decomposition of Model-III is used as the null for comparisons with Model-IV and V later in the chapter.

Level-1 Model:

$$Y_{ij} = \beta_{0j} + \beta_{1j}(X_{1ij} - \overline{X}_{1\bullet j}) \cdots + \beta_{kj}(X_{kij} - \overline{X}_{k\bullet j}) + r_{ij} \quad (8)$$

Level-2 Model:

$$\beta_{0j} = \gamma_{00} + u_{0j} \quad (9)$$

$$\beta_{1j} = \gamma_{10} + u_{1j} \quad (10)$$

$$\vdots \quad (11)$$

$$\beta_{kj} = \gamma_{k0} + u_{kj} \quad (12)$$

where

($X_{1ij} - \overline{X}_{1\bullet j}$), … , ($X_{kij}$ - $\overline{X}_{k\bullet j}$) are the group mean centered student-level variables associated with student i in school j;

u_{0j}, ⋯, u_{kj} are random effects in level-2 equations;

Var(u_{0j}), ⋯, Var(u_{kj})= τ_{11}, ⋯ ,τ_{kj} are the unconditional variances in level-2 residuals;

Var(u_{0j}, u_{kj}) are the unconditional covariance between the level1 intercept and slopes associated with each of the predictors

Model-IV: The Intercept-as-Outcomes Model

This model allows us to predict variation in college outcome variables using school-level variables, which also increases the statistical precision and the power of the analysis by reducing the group-to-group variability. This model is conditional at both level-1 and level-2. This model can explain differences in the average level of the dependent variable across schools, in other words, we want to understand why there are school differences on college outcomes.

1. What school-level characteristics predict differences in average levels of college outcomes? For example: Do school private schools have higher average level of college outcomes than Public schools?
2. Does average school standard score of SATT (ZSATT) have statistical association with college outcomes? Does a school have higher Mean ZSATT also have higher college outcomes?
3. Do the means of college outcomes vary once we control for school-level variables?
4. Is there a composition effects?

Level-1 Model:

$$Y_{ij} = \beta_{0j} + \beta_{1j}(X_{1ij} - \overline{X}_{1\bullet j}) \cdots + \beta_{kj}(X_{kij} - \overline{X}_{k\bullet j}) + r_{ij} \qquad (13)$$

Level-2 Model:

$$\beta_{0j} = \gamma_{00} + \gamma_{01}W_1 + \cdots + \gamma_{0p}W_p + u_{0j} \qquad (14)$$

$$\beta_{1j} = \gamma_{10} \qquad (15)$$

.

. (16)

.

$$\beta_{kj} = \gamma_{k0} \qquad (17)$$

where

p indexes the school characteristic variables;

γ_{00} is the intercept for the regression controlling for the school characteristics;

$\gamma_{01}, \cdots, \gamma_{0p}$ are the regression coefficients associated with school characteristics.

The student-level predictors (including both engagement factors, student profile variables, and college outcomes) in Model-IV are the ones that have significant associations on college outcomes suggested by Model-III. The variances from the intercepts-as-outcomes model are compared with Model-III, the Null model, to see how much of the variations in the intercepts have been explained by student- and school-level variables.

Model-V: Intercepts and Slopes as Outcome Variables Model

This model is a full model that means it is conditional at both student and school-level. In other words, there are independent variables on both levels. This model is employed to explain the differences in the effects of student-level variables and the differences in the intercepts and slopes across schools. For example, using school-level variables to explain why the effects of student GPA on college outcomes varies across schools, and why some schools have higher average GPA than others.

Questions to be answered by this model:

1. If the statistical associations of student-level variables on college outcomes vary across schools, what are the sources of variation?
2. Do school-level variables have statistical associations on the coefficient of student-level variables?

Level-1 Model:

$$Y_{ij} = \beta_{0j} + \beta_{1j}(X_{1ij} - \overline{X}_{1..}) \cdots + \beta_{kj}(X_{kij} - \overline{X}_{k..}) + r_{ij} \qquad (18)$$

Level-2 Model:

$$\beta_{0j} = \gamma_{00} + \gamma_{01}W_1 + \cdots + \gamma_{0p}W_p + u_{0j} \qquad (19)$$

$$\beta_{1j} = \gamma_{10} + \gamma_{11}W_1 + \cdots + \gamma_{1p}W_p + u_{1j} \qquad (20)$$

$$\vdots \qquad (21)$$

$$\beta_{kj} = \gamma_{k0} + \gamma_{k1}W_1 + \cdots + \gamma_{kp}W_p + u_{kj} \qquad (22)$$

In addition to the previous notation

$\gamma_{11}, \cdots, \gamma_{kp}$ are the regression coefficient associated with school-level covariates $W_1, \ldots, W_p$.

This model predicts the variability in the student-level intercepts and slopes using school-level contextual variables and estimates cross-level effects. The error terms at each level are conditional residuals.

The analytical methods introduced in this chapter are next applied step by step in both preliminary and primary analyses. The results of these analyses are reported in Chapter Four.

CHAPTER FOUR: RESULTS

This chapter presents the data analysis results following the research design described in Chapter Three.

Descriptive Analysis

This data set contains 2596 student-athletes from 30 Division-I schools who have completed the National Survey of Student Engagement 2006 (NSSE2006). School sample sizes range from 54 to 171, with an average of 87. This research focuses on student-athlete subgroups by Class and by Gender. Most of the schools have more than 20 students for each subgroup. The range of sample sizes for subgroups is from 1026 to 1570, as shown in Table 4-1.

Table 4-1: Student-Athlete Sample Size by Class and by Gender

Subgroups	# Of students (Min-Max)	Mean School Size	Sample Size
Seniors	18-77	34	1026
Freshmen	26-105	52	1570
Males	19-120	42	1251
Females	17-104	45	1345
Total (30 schools)	54-171	87	2596

Table 4-2 shows the distribution of student-athletes by class and gender. There are at least 500 students in each student category. The sample sizes of student-athletes are sufficient for each category to compare the item response patterns with the general population. As a comparison group, the general population in this research is defined as all students from all schools, including all Division-I schools, who have participated in NSSE2006. Note that student-athlete is a subgroup of the general population[4].

Table 4-2: Student Sample Size by Class and Gender

Category	Males	Females	Total
Seniors	520	506	1026
Freshmen	731	839	1570
Total	1251	1345	2596

In Chapter Three the appropriateness of applying the Five-benchmark Model to student-athletes was discussed. This section focuses on verifying whether student-athletes respond to NSSE2006 in a similar way as the general population. This is based on the assumption that if the student-athletes respond to NSSE2006 in a way similar to the general population, it is possible that the Five-benchmark Model would fit student-athlete data as well.

Table 4-3: Number of Items with Significant Mean Differences Between Student-Athletes and General Population

Student Subgroups	Benchmark Items (% Of 42)	College Outcome Items		Total (% Of 61)	Mean Differences Range
		College Gains Items (% Of 16)	Satisfaction Items (% Of 3)		
Freshmen Male	31 (74%)	16 (100%)	3 (100%)	50 (82%)	(0.07, 0.47)
Freshmen Female	27 (64%)	13 (81%)	3 (100%)	43 (70%)	(-0.15, 0.77)
Senior Male	28 (67%)	14 (88%)	2 (67%)	44 (72%)	(-0.28, 0.68)
Senior Female	29 (69%)	11 (69%)	2 (67%)	42 (69%)	(-0.16, 0.91)

This assumption is first tested by comparing the item mean differences between student-athletes and the general population. A series of one-sample t-tests are applied to the benchmark and college outcome items (a total of 61 items) using the item means from the general population as the test values. Table 4-3 shows the number of items with item

[4] The statistics of student participation and item response information for the general population is from:
a. NSSE 2006 Grand Frequencies: Frequency Distributions by Majors
b. NSSE 2006 Grand Means: Mean and Standard Deviations by 2005 Basic Carnegie Classification
c. NSSE 2006 Grand Means By Class and Gender

means that are significantly different between these two groups by class and gender. It also shows the percentage of that number over the total number of items in each item category in the parentheses.

For the 42 benchmark component items (see Appendix II), the Freshmen Male category has 31 items (74% of 42 items) with significant mean differences between student-athletes and the general population. In addition, the item means are significantly different for all sixteen College Gains items (defined in Chapter Three) and all three Satisfaction items. Overall, there are 50 items (82% of a total of 61 items) that have significant item mean differences between student-athletes and the general population, with mean differences ranging from 0.07 and 0.47 for the Freshmen Male category. The same pattern appears for the other three student categories, with large mean difference ranges. Based on this evidence, we conclude that student-athletes respond to NSSE2006 differently from the general population. It should be noted that although t-test statistics show statistically significant item mean differences between these two groups, they may not suggest practical significance given the large sample size (over 500 per group) for each student category.

Additional evidence is provided by comparing the response patterns of item choices between the two populations for all 61 items mentioned above. The percentages of students' responses to each of the item choices are compared and Chi-square statistics are estimated for each item. The results are shown in Table 4-4.

For the senior student-athlete subgroup, 40 out of 42 benchmark component items have statistically different response patterns to the item choices between student-athletes and the general population. All the response patterns for college outcome items are significantly different as well. Overall, 97% of the items have different response patterns between student-athletes and the general population. Similar results appear for the freshmen student-athlete subgroup.

Table 4-4: Differences in Response Patterns of Item Choices between Student-Athlete and General Population

Student Group	Comparison Groups	Benchmark Items (% of 42)	College Outcome Items		Total (% of total of 61)
			College Gains Items (% of 16)	Satisfaction Items (% of total of 3)	
General Population vs. Student-Athletes	Senior Student-Athletes	40 (95%)	16 (100%)	3 (100%)	59 (97%)
	Freshmen Student-Athletes	39 (93%)	15 (94%)	3 (100%)	57 (93%)

Overall, across all subgroups, the number of items with significantly different response patterns is very high (mostly between 80% and 97%), both by item categories and by the total number of items. This additional evidence supports the conclusion that student-athletes respond to NSSE2006 differently from the general population.

Table 4-5: Differences in Response Patterns of Item Choices Between Student-athlete subgroups

Student Group	Comparison Groups	Benchmark Items (% of 42)	College Outcome Items		Total (% of 61)
			College Gains Items (% of 16)	Satisfaction Items (% of 3)	
Student-Athletes	Males vs. Females	35 (83%)	10 (63%)	3 (100%)	48 (79%)
	Freshmen vs. Seniors	42 (100%)	13 (81%)	3 (100%)	58 (95%)
Senior Student-Athletes	Males vs. Females	40 (95%)	14 (88%)	3 (100%)	57 (93%)
Freshmen Student-Athletes	Males vs. Females	40 (95%)	14 (88%)	3 (100%)	57 (93%)

In addition to the comparisons between student-athletes and the general population, this study compared the response patterns of item choices between student-athlete subgroups by class and by gender, and also by class and gender. The results in

Table 4-5 show a high percentage of items that have significantly different response patterns between student-athlete subgroups. It suggests that student-athletes respond to NSSE2006 differently by class and by gender, and by class and gender. Therefore, it is possible that there are different engagement factors for each of the student-athlete subgroups.

Since GPA is a commonly used college outcome indicator, this study further compared the distributions of students' GPA at each grade point (ranging from "C- and below" to "A") between student-athletes and the general population. The results provide evidence that there is no difference in GPA between these two groups. However, there are different GPA distributions between student-athlete subgroups by class and by gender. Since this is not the main focus of this section, the detailed results are not presented here.

In summary, descriptive analyses yield substantial evidence that student-athletes do respond to NSSE2006 differently than the general population. In the next section Factor Analysis will provide evidence from a psychometric perspective.

Factor Analysis

Exploratory Factor Analysis (EFA)

An EFA with Principal Component Analysis (PCA) and Oblique rotation was applied to the 42 benchmark component items to extract engagement factors for each of the student-athlete subgroups. This is the same extraction method used to construct the Five-benchmarks for the general population. The Oblique rotation is a reasonable choice when the extracted factors are assumed to be correlated. Two extraction criteria are applied one at a time when exploring the best-fitted engagement factors: (1) eigenvalues greater than 1; and (2) the extraction of five factors.

When applying the first criterion of eigenvalues greater than 1 to EFA, the number of factors obtained and the items that loaded on each factor differ from the Five-benchmarks. Instead this method extracted either 10 or 11 factors with variances explained between 54% and 56%, depending upon subgroup. When forced to extract five factors, the second criterion, items that loaded on each factor differed from the Five Benchmarks across all subgroups. In addition, the variances explained for each subgroup were all below 40%. This evidence suggests a poor fit of the Five-benchmark Model to the student-athlete data.

Furthermore, for both extraction criteria, inconsistent signs of factor loadings appear within a factor: some items have positive factor loadings while others have negative factor loadings. Since all items are coded correctly and the intra-item correlations are all positive or around zero, factor loadings should be consistently positive or negative within a factor. The inconsistent signs of factor loadings within a factor suggest the misfit of items to the factor.

Factor loadings with opposite signs not only appear within a factor, but also appear between factors: for example, some factors have all negative loadings while other factors have all positive loadings. This suggests that using the Oblique rotation method may not be appropriate for student-athlete data.

According to Tabachnick and Fidell (2007) an Oblique rotation will be deemed appropriate in an EFA if the factor correlations are larger than .32. This indicates 10% or more common variances between factors. When using Oblique rotation for student-athlete data in this study it was found that the correlations between engagement factors were mostly smaller than .32. This result doesn't support the assumption that all engagement factors are correlated. Therefore, we conclude that the relationships between engagement factors are Orthogonal and that a Varimax rotation is more appropriate than Oblique rotation to construct engagement factors for student-athlete data.

Based on these conclusions, EFAs with PCA and Varimax rotation on student-athlete subgroups by Class and by Gender were conducted. An Eigenvalue greater than 1 criterion was used to extract engagement factors. Items that were misfit to the models have been deleted according to criteria discussed in Chapter 3. The results are shown in Table 4-6 for each student-athlete subgroup. Two engagement factor names are borrowed from the Five Benchmarks, Student-Faculty Interaction and Enriching Educational Experiences (EEE). The component items for these two factors are a subset of the items for the same factors from the Five Benchmark Model. There are five factors which are applicable for all subgroups: Deep Learning, Student-Faculty Interaction, Institution Support, Collaborative Learning, and Diversity. These factors do not necessarily contain the same items across subgroups but the same names are used to keep the number of factor names manageable. The remaining three engagement factors, Relations with others, Workload, and Enriching Educational Experiences (EEE), are only applicable for certain subgroups. Workload, for example, is a unique factor for Seniors. There are three component items for this factor that describe the amount of reading and writing for the past semester. For Freshmen, Male, and Female subgroups, one (or more) of the component items misfit the factor in one or more of the following ways: it was loaded on the wrong engagement factors with large factor loadings; it had small factor loadings on the correct factor; the factor extracted had very low reliability. Therefore, it was determined that Workload is not applicable for the other three subgroups.

The total number of component items for all engagement factors varies from 22 to 25 across subgroups with variances explained ranging from 57 to 63%. The Five Benchmark Model used 42 items and explained from 54 to 56% of variances. We can see that with the new model more of the variance is explained with fewer items.

Table 4-6: Component Items of Engagement Factors and Factor Loadings

Engagement Factors	Items for Engagement Factors	Senior Factor Loadings (22)	Freshmen Factor Loading (23)	Male Factor Loading (25)	Female Factor Loading (23)
Deep Learning	analyze_2b	0.78	0.80	0.80	0.79
	synthesz_2c	0.76	0.80	0.78	0.80
	evaluate_2d	0.74	0.73	0.74	0.74
	applying_2e	0.73	0.72	0.73	0.74
Student-Faculty Interaction	facplans_1o	0.79	0.75	0.74	0.74
	facideas_1p	0.77	0.73	0.72	0.74
	facgrade_1n	0.65	0.70	0.63	0.70
	facother_1s	0.64	0.55	0.61	0.56
	facfeed_1q	N/A	0.55	N/A	0.55
Institution Support	envnacad_10d	0.83	0.82	0.84	0.83
	envsocal_10e	0.79	0.79	0.81	0.80
	envdivrs_10c	0.74	0.74	0.75	0.73
	envsuprt_10b	N/A	0.65	N/A	N/A
Collaborative Learning	occgrp_1h	0.77	0.61	0.77	0.68
	clpresen_1b	0.76	0.70	0.69	0.74
	classgrp_1g	0.63	0.71	0.69	0.65
Diversity	divrstud_1u	0.89	0.88	0.85	0.90
	diffstu2_1v	0.85	0.85	0.84	0.87
Relationship with others	envfac_8b	0.76	N/A	0.78	0.83
	envstu_8a	0.72	N/A	0.72	0.82
	envadm_8c	0.65	N/A	0.66	N/A
Workload	writemid_3d	0.82	N/A	N/A	N/A
	readasgn_3a	0.69	N/A	N/A	N/A
	writesml_3e	0.68	N/A	N/A	N/A
Enriching Educational Experiences	snrx04_7h	N/A	0.69	0.68	0.67
	indstd04_7g	N/A	0.65	0.66	0.68
	resrch04_7d	N/A	0.69	0.63	0.72
	stdabr04_7f	N/A	N/A	0.57	N/A
	intern04_7a	N/A	0.46	0.55	N/A
	lrncom04_7c	N/A	0.64	0.58	0.61

N/A: Not Applicable

Instead of the five benchmarks suggested for the general population, the number of engagement factors found for student-athlete data varies across subgroups: 6

engagement factors were found for Freshmen and 7 for Senior, Male, and Female subgroups. The reliabilities for each of the engagement factors are between 0.55 and 0.82 across subgroups (factors with reliability lower than .55 were excluded).

Table 4-7 shows the results of EFAs with PCA and Oblique rotation conducted to construct college outcome variables. Oblique rotation was chosen because correlation coefficients were higher than .32 between college outcome variables. Three college outcome variables were extracted: General Education and Practical Competence (GEPC), Personal and Social Development (PSD), and Satisfaction (SA). Component items were the same for each of the college outcome variables across subgroups. Therefore, each college outcome measures the same experiences for student-athletes in each subgroup. This was not necessarily the case for certain engagement factors as some subgroups contained different component items than others.

Table 4-7: Component Items and Factor Loadings for College Outcome Variables

College Outcomes	Items	Senior	Freshmen	Male	Female
General Education and Practical Competence (GEPC)	gnanaly_11e	0.83	0.85	0.87	0.81
	gnquant_11f	0.80	0.77	0.80	0.77
	gnspeak_11d	0.75	0.73	0.73	0.77
	gncmpts_11g	0.72	0.73	0.74	0.72
	gnwrite_11c	0.71	0.84	0.77	0.80
	gnothers_11h	0.66	0.63	0.67	0.63
	gnwork_11b	0.66	0.55	0.63	0.57
	gngenled_11a	0.60	0.62	0.63	0.60
Personal and Social Development (PSD)	gnspirit_11p	0.79	0.78	0.80	0.79
	gncommun_11o	0.77	0.74	0.78	0.74
	gnethics_11n	0.73	0.77	0.70	0.81
	gndivers_11l	0.72	0.74	0.76	0.71
	gnself_11k	0.67	0.71	0.72	0.65
	gncitizn_11i	0.66	0.66	0.70	0.57
	gnprobsv_11m	0.49	0.68	0.54	0.65
	gninq_11j	0.48	0.47	0.47	0.46
Satisfaction (SA)	advise_12	0.70	0.71	0.71	0.70
	entirexp_13	0.86	0.85	0.86	0.85
	samecoll_14	0.80	0.78	0.76	0.81

For all subgroups, the variances explained by GEPC and PSD ranged from 53 to 56% and for SA from 60 to 62% across subgroups. The reliabilities across subgroups for

GEPC and PSD were about 0.88 and for SA were about 0.67. These results suggest a good model fit.

Factor scores for all engagement factors and college outcome variables are calculated with Bartlett's approach. This approach provides unbiased estimation of the true factor scores (Hershberger, 2005). The descriptive statistics of engagement factors and college outcomes are shown in Table 4-8 and Table 4-9.

Table 4-8: Descriptive Statistics of Engagement Factors

Factors	Descriptive Statistics	Minimum	Maximum	Mean	Std. Deviation
Deep Learning	Seniors	-3.51	2.33	0	1
	Freshmen	-3.39	2.25	0	1
	Males	-3.57	2.18	0	1
	Females	-3.54	2.07	0	1
Student-Faculty Interaction	Seniors	-2.52	2.67	0	1
	Freshmen	-2.68	3.31	0	1
	Males	-3.10	2.98	0	1
	Females	-2.75	3.09	0	1
Institutional Support	Seniors	-2.60	2.66	0	1
	Freshmen	-3.25	2.73	0	1
	Males	-2.61	2.59	0	1
	Females	-2.56	2.79	0	1
Collaborative Learning	Seniors	-3.03	2.35	0	1
	Freshmen	-3.23	3.38	0	1
	Males	-3.09	2.59	0	1
	Females	-2.86	3.05	0	1
Diverse	Seniors	-2.80	2.18	0	1
	Freshmen	-2.91	2.25	0	1
	Males	-2.81	2.33	0	1
	Females	-2.63	2.11	0	1
Relationship with others	Seniors	-4.76	1.73	0	1
	Freshmen	N/A			
	Males	-4.08	1.81	0	1
	Females	-3.34	1.87	0	1
Workload	Seniors	-2.02	2.85	0	1
	Freshmen	N/A			
	Male s	N/A			
	Females	N/A			
Enriching Educational Experiences	Seniors	N/A			
	Freshmen	-2.54	3.72	0	1
	Males	-2.99	3.35	0	1
	Females	-2.46	3.27	0	1

N/A: Not Applicable

The distributions for some of the engagement factor scores (see Table 4-8) are highly skewed. A good example is the engagement factor Relationships With Others. The engagement scores ranges from -4.74 to 1.73 for Seniors (with a skewness of -.957 and standard error of skewness of 0.076). The highly skewed factor scores are caused by the skewed distribution of component items of these factors. For the same example, all three component items for Relationships With Others (envstd_8a, envfac_8b, and envadm_8c) are highly skewed. Item 'envstd_8a' has a mean of 3.61 (on a 4-point Likert scale) and standard deviation (S.D) of 0.71 for Seniors. The other two-component items 'envfac_8b' and 'envadm_8c' have a mean of 3.43 (S.D=0.79) and 2.83 (S.D=1.02), respectively. This also explains the skewed distribution of all other engagement factors and college outcome scores.

Table 4-9: Descriptive Statistics for College Outcome Variables

College Outcome Variables	Subgroups	Minimum	Maximum	Mean	Std. Deviation
General Education and Personal Competence	Seniors	-3.90	1.56	0	1
	Freshmen	-3.55	1.69	0	1
	Males	-3.54	1.64	0	1
	Females	-3.31	1.61	0	1
Personal and Social Development	Seniors	-2.57	2.16	0	1
	Freshmen	-2.49	2.18	0	1
	Males	-2.58	2.00	0	1
	Females	-2.63	2.22	0	1
Satisfaction	Seniors	-3.68	1.25	0	1
	Freshmen	-3.86	1.28	0	1
	Males	-3.67	1.28	0	1
	Females	-3.89	1.26	0	1

The distributions of college outcome scores are shown in Table 4-9. Since the assumption of normality may be violated by the appearance of a skewed distribution of engagement factors, regression coefficients for these predictors need to be interpreted with caution.

The correlation amongst the four college outcome variables SA, GEPC, PSD, and GPA for seniors and freshmen are shown in

Table 4-10 and for Males and Females are shown in Table 4-11. The strength of correlations among GEPC, PSD and SA are generally moderate, ranging from .37 to .58 across all subgroup while GPA has consistently weaker correlations with other college outcome variables, ranging from 0.04 to 0.18.

Table 4-10: Correlations between College Outcome Variables For Seniors (Lower Left) and Freshmen (Upper Right)

Correlations	SA	GEPC	PSD	GPA
SA		.483**	.403**	.184**
GEPC	.442**		.581**	.117**
PSD	.411**	.532**		0.042
GPA	.168**	.120**	.078*	

** Correlation is significant at p<0.01 level (2-tailed).
* Correlation is significant at p<0.05 level (2-tailed).

Table 4-11: Correlations between College Outcome Variables For Males (Lower Left) and Females (Upper Right)

Correlations	SA	GEPC	PSD	GPA
SA		.427**	.369**	.145**
GEPC	.477**		.567**	.072**
PSD	.447**	.566**		.060*
GPA	.197**	.172**	.068*	

** Correlation is significant at p<0.01 level (2-tailed).
* Correlation is significant at p<0.05 level (2-tailed).

In addition, all engagement factors are positively correlated with the four college outcome variables across all subgroups. The Pearson Correlations between engagement factors and SA, GEPC, and PSD are mostly significant with correlation coefficients smaller than 0.3 (several exceptions of higher correlations range from 0.3 to 0.5). The strength of the correlations between engagement factors and GPA are consistently weak (ranging from 0.01 to 0.13) across subgroups, only half of which are significant.

Confirmatory Factor Analysis (CFA)

A confirmatory factor analysis is used to test whether the Five-benchmark Model fits student-athlete data. It will also confirm whether the engagement factors suggested by EFAs fit the data.

The results shown in Table 4-12, Five-Benchmark Model in First-Order CFA, further confirm that the application of the Five-benchmark Model to student-athlete data is inappropriate per the Goodness-of-fit indices given in Chapter Three.

Table 4-12: CFA Goodness-of-Fit statistics

CFA Type	Subgroups	CMIN/D.F.	P-value	GFI	AGFI	PGFI	NFI	CFI	RMSEA
Five-Benchmark Model in First-Order CFA	Senior	5.080	0.000	0.823	0.801	0.737	0.631	0.679	0.063
	Freshmen	7.115	0.000	0.830	0.810	0.743	0.648	0.680	0.062
	Male	6.445	0.000	0.809	0.787	0.725	0.645	0.681	0.066
	Female	6.185	0.000	0.833	0.814	0.747	0.643	0.681	0.062
Engagement Model in First-Order CFA	Senior	2.451	0.000	0.961	0.947	0.714	0.927	0.955	0.038
	Freshmen	3.494	0.000	0.957	0.944	0.745	0.924	0.944	0.040
	Male	2.626	0.000	0.957	0.945	0.748	0.924	0.952	0.036
	Female	2.896	0.000	0.958	0.945	0.725	0.930	0.953	0.039
Engagement Model in Second-Order CFA	Senior	2.553	0.000	0.956	0.944	0.763	0.919	0.949	0.039
	Freshmen	3.592	0.000	0.953	0.942	0.774	0.918	0.940	0.041
	Male	2.996	0.000	0.949	0.939	0.782	0.909	0.937	0.040
	Female	3.335	0.000	0.948	0.935	0.766	0.914	0.938	0.043

The results of the first-order and second-order CFA for the engagement models are also shown in Table 4-12. The Goodness-of-Fit indices listed show evidence of good fit for all engagement models. Therefore, we conclude that the engagement factors suggested by EFA for each subgroup are appropriate. Note that since the sample sizes are very large for all subgroups (over 1000), significant Chi-square statistics are not unexpected.

Summary

Both EFA and CFA analyses provided evidence that engagement factors fit student-athletes' data better than the Five-benchmarks. In addition, variables SA, GEPC, PSD, and GPA are shown to be more appropriate college outcomes for student-athletes than SA, GE, PC, and PSD, which were defined for the general population. Therefore, the following analyses will employ these student-athlete specific engagement factors and college outcome variables, instead of the variables suggested for the general population.

General Linear Regression

In the preliminary data analysis stage, both Univariate Linear Regression and Multiple Linear Regression were applied to each of the college outcome variables for all subgroups. These analyses provided information about relationships amongst engagement factors, student profile variables, school characteristics, and college outcome variables. Since the data has a nested structure, a multi-level analysis provides more accurate results. For this reason, the results of linear regressions are not reported at this stage.

Hierarchical Linear Models

In the following sections we restate some of the equations previously presented in Chapter Three in order to help clarify data analyses procedures. The equations, the equation number, and the associated terms for each equation are kept the same as in Chapter Three.

Model-I: One-Way ANOVA with Random Effects Model

This model will answer the research question: Does the average level of college outcomes, Satisfaction (SA), General Education and Practical Competence (GEPC), Personal and Social Development (PSD), and GPA vary across schools?

Level-1 Model:

$$Y_{ij} = \beta_{0j} + r_{ij} \quad (1)$$

Level-2 Model:

$$\beta_{0j} = \gamma_{00} + u_{0j} \quad (2)$$

Hypotheses:

1. There are no statistically significant differences between mean **SA** scores across schools for Seniors, Freshmen, Males or Females.
2. There are no statistically significant differences between mean **GEPC** scores across schools for Senior, Freshmen, Male or Female.
3. There are no statistically significant differences between mean **PSD** scores across schools for Seniors, Freshmen, Males or Females.
4. There are no statistically significant differences between mean **GPA** scores across schools for Senior, Freshmen, Male or Female.

The dependent variables in Model-I are the four college outcome variables. They are each tested separately. There are no independent variables at either the student or school-level in this model.

The results from Model-I are shown in Table 4-13. For SA as a dependent variable, the Senior student-athlete subgroup shows a between-school variance of .05 and a within-school variance of .95. The intra-class correlation is about 5%. This indicates that 5% of the variance from Senior SA is from the between-school variance, and about 95% of the variance is from within schools. Although this small percentage of between-school variance is statistically significant, it may not have practical importance. The between-school variance is significant at a level of $p<.05$ with a Chi-square statistic of 77 with 29 degrees of freedom. Therefore, we reject the null hypothesis and accept the alternative hypothesis that there are statistically significant differences between mean SA scores across schools for Seniors.

Table 4-13 also indicates that for SA as dependent variable the Chi-square statistics are significant at the level of $p<.05$ for Freshmen, Male and Female subgroups. Therefore, we reject the null hypotheses and accept the alternative hypotheses that there are statistically significant differences between mean SA scores across schools for Freshmen, Males and Females. The same pattern is evident in the college outcome variables GEPC, PSD, and GPA as well. These results can be explained in the same manner as for SA.

Table 4-13: Variance Decompositions for One-Way ANOVA (Model-I)

College Outcome Variables	Student Subgroups	Within Schools Variance	Between Schools Variance	Inter-Class Correlation (ICC)	Chi-Square (d.f.)
Satisfaction (SA)	Senior	0.954	0.046	5%	77 (29)*
	Freshmen	0.968	0.034	3%	81 (29)*
	Male	0.962	0.044	4%	79 (29)*
	Female	0.953	0.059	4%	59 (29)*
General Education and Practical Competence (GEPC)	Senior	0.981	0.022	2%	52 (29)*
	Freshmen	0.975	0.026	3%	70 (29)*
	Male	0.980	0.023	2%	58 (29)*
	Female	0.981	0.021	2%	58 (29)*
Personal and Social Development (PSD)	Senior	0.941	0.069	7%	52 (29)*
	Freshmen	0.964	0.038	4%	88 (29)*
	Male	0.951	0.052	5%	93 (29)*
	Female	0.979	0.023	2%	59 (29)*
GPA	Senior	0.954	0.046	5%	77 (29)*
	Freshmen	0.908	0.093	9%	189 (29)*
	Male	0.944	0.049	5%	102 (29)*
	Female	0.979	0.023	2%	100 (29)*

*: $p<.05$

In summary, the results of Model-I show that the between school effects are statistically significant ($p<.05$) for all four college outcome variables by class and by gender. This indicates that there are significant differences amongst mean college outcome scores across schools for all subgroups. However, very large proportions of the total variances are within schools. The between-school variances are very small, ranging from 2% to 5%, with slightly higher PSD values (7%) for values for Seniors and GPA values (9%) for Freshmen. There is little empirical research that explores the relationships between school characteristics and college outcomes for student-athletes. This study will fill that void by examining whether such relationships exist and how much variance is explained by including school characteristics in the level-two model in Model-IV and Model-V later in this chapter.

In the following sections, student-level variables, including engagement factors, student profile variables, and college outcome variables as predictors will be introduced into the Level-1 model in Model-II-A, II-B, and II-C. School-level variables will be introduced into Level-2 models in Model-III, IV, and V, while keeping the significant student-level variables in the Level-1 models.

All the intercepts and regression coefficients listed in the following sections are from tables of Final Estimation of Fixed Effects (with robust standard errors) from the HLM output. Regression coefficients will be used to compare the strength of the associations between predictors and the dependent variables in multi-predictor models. This is similar to the function of correlation coefficients across single-predictor models (Vittinghoff, 2004).

Model-II: One-Way ANCOVA with Random Effects Model

In Model-II, student-level predictors are introduced into the level-1 models for each of the college outcome variables. Interval scale predictors are grand-mean centered. This centering method is a common choice in an ANCOVA model. In this case, an intercept represents the adjusted mean for school j. Dummy variables are not centered.

Level-1 Model:

$$Y_{ij} = \beta_{0j} + \beta_{1j}(X_{1ij} - \overline{X}_{1..}) + \cdots + \beta_{kj}(X_{kij} - \overline{X}_{k..}) + r_{ij} \qquad (3)$$

Level-2 Model:

$$\beta_{0j} = \gamma_{00} + u_{0j} \qquad (4)$$

$$\beta_{1j} = \gamma_{10} \qquad (5)$$

$$\vdots \qquad (6)$$

$$\beta_{kj} = \gamma_{k0} \qquad (7)$$

Model-II will answer the following questions:

1. Do engagement factors have statistically significant associations with college outcomes?
2. Do engagement factors and student profile variables have statistically significant associations with college outcomes?
3. Do student engagement factors, student profile variables, and college outcome variables (as predictors) have statistically significant associations with college outcomes (as dependent variables)?

Model-II-A: One-Way ANCOVA with Random Intercept Model (With Engagement Factors only)

In Model-II-A, only the engagement factors are introduced into the level-1 model for each subgroup and for each college outcome variable. This model examines which engagement factors are significantly associated with the college outcome variables and how much of the variance is explained by these engagement factors.

Null hypotheses for Model-II-A:

1. Engagement factor Deep Learning does not have statistically

significant associations with college outcome variables SA, GEPC, PSD, or GPA for any of the student subgroups.

2. Engagement factor Student-Faculty Interaction does not have statistically significant associations with college outcome variables SA, GEPC, PSD, or GPA for any of the student subgroups.
3. Engagement factor Institution Support does not have statistically significant associations with college outcome variables SA, GEPC, PSD, or GPA for any of the student subgroups.
4. Engagement factor Collaborative Learning does not have statistically significant associations with college outcome variables SA, GEPC, PSD, or GPA for any of the student subgroups.
5. Engagement factor Diversity does not have statistically significant associations with college outcome variables SA, GEPC, PSD, or GPA b for any of the student subgroups.
6. Engagement factor Relationship with Others does not have statistically significant associations with college outcome variables SA, GEPC, PSD, or GPA for Seniors, Males or Females.
7. Engagement factor Enriching Educational Experiences does not have statistically significant associations with college outcome variables SA, GEPC, PSD, or GPA for Freshmen, Male, or Female.
8. Engagement factor Workload does not have statistically significant associations with college outcome variables SA, GEPC, PSD, or GPA for Seniors.

For each student subgroup, Model-II-A estimates the regression coefficients of the relevant set of engagement factors with each college outcome variable, one at a time. The variances explained by including engagement factors in Model-II-A are shown in Table 4-22. The results will be explained later in the chapter, together with the results from Model-II-B and II-C.

SA

The intercepts and regression coefficients of engagement factors of SA are shown in Table 4-14**.** The magnitudes of all intercepts are close to zero when centered at the grand mean. Engagement factors Deep Learning, Student-Faculty Interaction, Institution Support, and Relationship with Others (not applicable for Freshmen) are significant for all subgroups, while Diversity and Enriching Educational Experiences (EEE) are not significant for any of the subgroups. All significant predictors are positively associated with SA.

Table 4-14: Regression coefficients of SA on Engagement Factors in model-II-A

Engagement Factors	Regression Coefficient (S.E.)			
	Senior	Freshmen	Male	Female
Intercept	0.00 (0.04)#	0.00 (0.04)#	0.01 (0.04)#	0.00 (0.03)#
Deep Learning	0.21 (0.03)*	0.18 (0.03)*	0.19 (0.03)*	0.17 (0.02)*
Student-Faculty Interaction	0.17 (0.03)*	0.19 (0.03)*	0.14(0.03)*	0.18 (0.02)*
Institution Support	0.25 (0.02)*	0.37 (0.03)*	0.24 (0.02)*	0.31 (0.03)*
Collaborative Learning	—	0.07 (0.02)*	—	0.08 (0.02)*
Diversity	—	—	—	—
Relationship with Others	0.43 (0.03)*	N/A	0.41 (0.03)*	0.36 (0.03)*
Enriching Educational Experiences	N/A	—	—	—
Workload	—	N/A	N/A	N/A

#: P>.05 ; *: P<.05; N/A: Not Applicable; — : No significant association; 0.00 means the value is smaller than .01

The magnitude of the regression coefficients of Relationship with Others is higher than all the other significant predictors for Seniors (0.43), Males (0.41) and Females (0.36). For Freshmen, Institution Support (0.37) has the strongest association with SA.

Although Collaborative Learning is significant for Freshmen and Females, the strength of these two coefficients is much weaker than other regression coefficients within the same subgroup.

For the Senior student-athlete subgroup,

Predicted Satisfaction = 0 + .21*(Deep Learning) + .17*(Student-Faculty Interaction) + .25*(Institution Support) + .43*(Relationship with Others)

For student *i* in school *j,* if he/she scores at the average level for all four independent variables, his/her predicted SA score will be 0. The score 0 is the adjusted mean score across all student-athletes since all the dependent variables and predictors have been standardized. With a one standard deviation increase in Deep Learning, student's SA score will increase by .21 standard deviations, while holding all other independent variables constant. Similarly, a one standard deviation increase in Student-Faculty Interaction, Institution Support, and Relationship with Others will increase the SA score by .17, .25, and .43 standard deviations respectively.

The results for the other three subgroups will be explained in a similar manner. To save time and space the results will not be explicitly explained one by one. This will apply to the rest of this chapter as well.

GEPC

Table 4-15 shows intercepts and the regression coefficients of the engagement factors that have statistically significant associations with the dependent variable GEPC by class and by gender.

The engagement patterns, the patterns of associations between engagement factors and college outcomes, across subgroups are very similar: all the engagement factors have statistically significant associations with GEPC, except that Diversity is significant only for Males (with a weak regression coefficient). All the predictors are positively associated with GEPC. Deep Learning has the strongest associations with GEPC for Seniors (0.41), Freshmen (0.39), Males (0.41), and Females (0.36).

Table 4-15: Regression coefficients for GEPC on Engagement Factors in model-II-A

Engagement Factors	Regression Coefficient (S.E.)			
	Senior	Freshmen	Male	Female
Intercept	0.00 (0.03)#	-0.01 (0.03)#	-0.02 (0.03)#	-0.01 (0.03)#
Deep Learning	0.41 (0.03)*	0.39 (0.02)*	0.41 (0.03)*	0.36 (0.03)*
Student-Faculty Interaction	0.21 (0.02)*	0.20 (0.02)*	0.16 (0.03)*	0.24 (0.02)*
Institution Support	0.24 (0.03)*	0.39 (0.02)*	0.25 (0.02)*	0.29 (0.02)*
Collaborative Learning	0.18 (0.02)*	0.11 (0.02)*	0.16 (0.02)*	0.20 (0.02)*
Diversity	—	—	0.07 (0.02)*	—
Relationship with Others	0.23 (0.03)*	N/A	0.23 (0.02)*	0.25 (0.03)*
Enriching Educational Experiences	N/A	0.09 (0.02)*	0.16 (0.03)*	0.08 (0.02)*
Workload	0.07 (0.03)*	N/A	N/A	N/A

#: P>.05 ; *: P<.05; N/A: Not Applicable; —: No significant association; 0.00: the value is smaller than .001

PSD

The intercepts and regression coefficients of engagement factors for PSD are shown in Table 4-16.

Table 4-16: Regression coefficients for PSD on Engagement Factors in model-II-A

Engagement Factors	Regression Coefficient (S.E.)			
	Senior	Freshmen	Male	Female
Intercept	-0.01 (0.05)#	0.00 (0.04)#	-0.02 (0.04)#	0.00 (0.03)#
Deep Learning	0.26 (0.03)*	0.26 (0.02)*	0.25 (0.03)*	0.28 (0.02)*
Student-Faculty Interaction	0.21 (0.02)*	0.27 (0.02)*	0.22 (0.03)*	0.26 (0.02)*
Institution Support	0.44 (0.03)*	0.47 (0.02)*	0.44 (0.03)*	0.44 (0.03)*
Collaborative Learning	0.09 (0.02)*	0.16 (0.02)*	0.10 (0.02)*	0.18 (0.02)*
Diversity	0.10 (0.02)*	0.10 (0.02)*	0.09 (0.02)*	0.12 (0.02)*
Relationship with Others	0.19 (0.02)*	N/A	0.18 (0.02)*	0.17 (0.03)*
Enriching Educational Experiences	N/A	0.15 (0.02)*	0.17 (0.03)*	0.09 (0.02)*
Workload	0.11 (0.02)*	N/A	N/A	N/A

#: P>.05 ; *: P<.05; N/A: Not Applicable; —: No significant association; 0.00: the value is smaller than .001

The engagement patterns are consistent across all subgroups: all engagement factors are significantly associated with PSD and all associations are positive. For all predictors, the magnitudes across subgroups are approximately equal. Engagement factor

Institution Support has significantly stronger associations with PSD than with other factors.

GPA

Table 4-17 shows the regression coefficients of engagement factors in Model-II-A when GPA is the dependent variable. The engagement patterns for GPA are very different from SA, GEPC, and PSD. Only two engagement factors, Deep Learning and Relationship With Others, are significantly associated with GPA across subgroups. The magnitudes of the regression coefficients are much lower than those for the other three college outcome variables. This pattern is consistent across subgroups.

Table 4-17: Regression coefficients for GPA on Engagement Factors For model-II-A

Engagement Factors	Regression Coefficient (S.E)			
	Senior	Freshmen	Male	Female
Intercept	0.02 (0.05)#	-0.01 (0.04)#	0.02 (0.05)#	-0.03 (0.05)#
Deep Learning	0.15 (0.03)*	0.13 (0.02)*	0.13 (0.03)*	0.10 (0.03)
Student-Faculty Interaction	0.06 (0.02)*	—	—	—
Institution Support	—	—	—	—
Collaborative Learning	-0.08 (0.03)*	-0.05 (0.02) *	—	—
Diversity	-0.08 (0.02)*	—	—	—
Relationship with Others	0.11 (0.03)*	N/A	0.08 (0.03)*	0.13 (0.03)*
Enriching Educational Experiences	N/A	—	0.15 (0.03)*	0.09 (0.03)*
Workload	—	N/A	N/A	N/A

#: P>.05 ; *: P<.05; N/A: Not Applicable; —: No significant association.

There are negative associations between Collaborative Learning and GPA for Seniors (-0.08) and Freshmen (-0.05). This is very different from the other three college outcomes as dependent variables. With one standard deviation increase in the Collaborative Learning scores, there will be .08 standard deviations decrease in GPA for Seniors and .05 standard deviations decrease for Freshmen while controlling for the other factors. Diversity also has a negative association with GPA for the Senior subgroup, with a regression coefficient of -0.08.

Summary for Model-II-A:

All engagement factors are significantly and positively associated with outcome variables SA, GEPC, and PSD across subgroups, with some exceptions. The engagement patterns for GPA across subgroups are very different from others. Only Deep Learning and Relationship with Others are significant for GPA across applicable subgroups.

Model-II-B: One-Way ANCOVA with Random Intercept Model (with engagement factors and student profile variables)

Model-II-B is built upon Model-II-A with student profile variables as additional predictors. Student profile variables include students' Gender, Race, Class, High Profile Sports Status, Father's and Mother's Education, and SATT. The description of these variables and their coding were shown in Chapter Three. It should be noted that Gender is not an applicable predictor for Male and Female subgroups, as Class is not applicable to Senior and Freshmen subgroups, and High Profile is not applicable to Female subgroups.

This model will provide an answer to question 2 as mentioned above for each subgroup: Do engagement factors and student profile variables have statistically significant associations with college outcomes?

Hypotheses for Model-II-B:

1. None of the student profile variables have statistically significant associations with college outcome variables SA, GEPC, PSD, or GPA for any subgroup.
2. None of the engagement factors have statistically significant associations with college outcome variables SA, GEPC, PSD, or GPA for any subgroup.

As in Model-II-A, the interval scale variables (engagement factors and SATT) are grand-mean centered and the dummy variables (Father and Mother's Education, Race, High Profile, Gender, and Class) are not centered.

SA

Table 4-18 shows the intercepts and regression coefficients of engagement factors and student profile variables as predictors for dependent variable SA for all student-athlete subgroups.

Table 4-18: Regression coefficients for SA on Engagement Factors and Student Profile Variables in Model-II-B

Student Demographics	Regression Coefficient (S.E.)			
	Senior	Freshmen	Male	Female
Intercept	0.13 (0.05)*	0.06 (0.04)#	0.05 (0.04)#	0.02 (0.03)#
Deep Learning	0.21(0.03) *	0.17 (0.03)*	0.18 (0.04)*	0.16 (0.02)*
Student-Faculty Interaction	0.17 (0.03) *	0.20 (0.02)*	0.15 (0.03)*	0.19 (0.02)*
Institution Support	0.26 (0.02) *	0.37 (0.03)*	0.25 (0.03)*	0.31 (0.03)*
Collaborative Learning	—	0.08 (0.02)*	—	0.08 (0.02)*
Diversity	—	—	—	0.06 (0.03)*
Relationship with Others	0.42 (0.03) *	N/A	0.40 (0.03)*	0.36 (0.03)*
EEE	N/A	—	—	—
Workload	-0.05 (0.02) *	N/A	N/A	N/A
Mother's Education	—	—	—	—
Father's Education	-0.13 (0.05) *	—	—	—
High Profile	—	-0.27 (0.09)*	-0.16 (0.06)*	N/A
Race	-0.17 (0.05) *	-0.14 (0.05)*	-0.11 (0.05)*	-0.15 (0.05)*
Class	N/A	N/A	—	—
Gender	—	—	N/A	N/A
SATT	0.08 (0.03) *	0.07 (0.03)*	0.09 (0.03)*	0.05 (0.02)*

#: P>.05 ; *: P<.05; N/A: Not Applicable; —: No significant association;

The regression of SA on engagement factors and student profile variables displays similar patterns across all subgroups:

- Engagement factors Deep Learning, Student-Faculty Interaction, Institution Support, and Relationship with Others, and student profile variables Race and SATT are significant predictors for SA.

- Diversity, EEE, Mother's and Father's Education, Class, and Gender are not significant predictors for any of the subgroups, with the exception of Diversity for Females, EEE for Males, and Father's Education for Seniors.

- Workload, Father's Education, High Profile, and Race have negative associations with SA for the applicable subgroups, while all other predictors have positive associations with SA.

GEPC

Table 4-19 shows the intercepts and regression coefficients of engagement factors and student profile variables as predictors for dependent variable GEPC for all student-athlete subgroups.

Table 4-19: Regression coefficients for GEPC on Engagement Factors and Student Profile Variables in Model-II-B

Student Demographics	Regression Coefficient (S.E.)			
	Senior	Freshmen	Male	Female
Intercept	-0.01 (0.03)#	-0.01 (0.03)#	0.05 (0.04)#	0.09 (0.05)#
Deep Learning	0.41 (0.03)*	0.39 (0.02)*	0.41 (0.03)*	0.36 (0.03)*
Student-Faculty Interaction	0.21 (0.02)*	0.20 (0.02)*	0.16 (0.03)*	0.22 (0.02)*
Institution Support	0.24 (0.03)*	0.39 (0.02)*	0.26 (0.03)*	0.30 (0.02)*
Collaborative Learning	0.18 (0.02)*	0.11 (0.02)*	0.15 (0.02)*	0.17 (0.02)*
Diversity	0.05 (0.02)*	—	0.08 (0.02)*	—
Relationship with Others	0.23 (0.03)*	N/A	0.22 (0.02)*	0.24 (0.03)*
EEE	N/A	0.09 (0.02)*	0.15 (0.02)*	0.05 (0.02)*
Workload	0.07 (0.03)*	N/A	N/A	N/A
Mother's Education	—	—	—	—
Father's Education	—	—	—	—
High Profile	—	—	0.09 (0.03)*	N/A
Race	-0.15 (0.05)*	—	-0.11 (0.05)*	—
Class	N/A	N/A	-0.12 (0.06)*	-0.16 (0.05)*
Gender	—	—	N/A	N/A
SATT	-0.06 (0.03)*	—	—	-0.05 (0.02)*

#: P>.05; *: P<.05; N/A: not applicable; —: not significant

The regression of GEPC on the predictors also displays similar patterns across subgroups. All engagement factors have significant and positive associations with GEPC across subgroups, except that Diversity is insignificant for the Freshmen and Female subgroups.

High Profile has a positive association with Male GEPC scores, while Race, Class, and SATT have negative associations with GEPC for the applicable subgroups. This association pattern is very different from when SA is used as the dependent variable. In this case High Profile has negative associations with Freshmen and Male SA scores and SATT has positive associations with SA for all subgroups.

PSD

Table 4-20 shows the intercepts and regression coefficients of engagement factors and student profile variables as predictors for dependent variable PSD for all student-athlete subgroups.

Table 4-20: Regression coefficients for PSD on Engagement Factors and Student Profile Variables in Model-II-B

Predictors	Regression Coefficient (S.E.)			
	Senior	Freshmen	Male	Female
Intercept	-0.01 (0.05)#	-0.06 (0.04)*	-0.02 (0.04)#	-0.08 (0.04)#
Deep Learning	0.26 (0.03)*	0.25 (0.02)*	0.25 (0.03)*	0.28 (0.02)*
Student-Faculty Interaction	0.21 (0.02)*	0.27 (0.02)*	0.22 (0.03)*	0.26 (0.02)*
Institution Support	0.44 (0.03)*	0.47 (0.02)*	0.44 (0.03)*	0.43 (0.03)*
Collaborative Learning	0.09 (0.02)*	0.17 (0.02)*	0.10 (0.02)*	0.18 (0.02)*
Diversity	0.10 (0.02)*	0.10 (0.02)*	0.09 (0.02)*	0.12 (0.02)*
Relationship with Others	0.19 (0.02)*	N/A	0.18 (0.02)*	0.17 (0.03)*
EEE	N/A	0.15 (0.02)*	0.17 (0.03)*	0.09 (0.02)*
Workload	0.11 (0.02)*	N/A	N/A	N/A
Mother's Education		0.10 (0.04)*		0.13 (0.04)*
Father's Education	—	—	—	—
High Profile			—	N/A
Race	—	—	—	—
Class	N/A	N/A	—	—
Gender	—	—	N/A	N/A
SATT	—	—	—	-0.07 (0.03)*

#: P>.05; *: P<.05; N/A: not applicable; —: not significant

The patterns of regressions for PSD are very similar across student-athlete subgroups. All engagement factors are positively and significantly associated with PSD.

However, all student profile factors are insignificant predictors for PSD, with the exceptions of Mother's Education for Freshmen and Females, and SATT for Females. These results suggest that there are weak relationships between student profile variables and college outcome PSD.

GPA

Table 4-21 shows the intercepts and regression coefficients of engagement factors and student profile variables as predictors for dependent variable GPA for all student-athlete subgroups.

Table 4-21: Regression coefficients for GPA on Engagement Factors and Student Profile Variables in Model-II-B

Student Demographics	Regression Coefficient (S.E.)			
	Senior	Freshmen	Male	Female
Intercept	0.29 (0.08)*	0.11 (0.08)#	0.08 (0.09)#	0.13 (0.08)#
Deep Learning	0.12 (0.03)*	0.09 (0.02)*	0.10 (0.02)*	0.09 (0.03)*
Student-Faculty Interaction	0.07 (0.02)*	0.07 (0.02)*	—	0.05 (0.02)*
Institution Support	—	0.05 (0.02)*	—	—
Collaborative Learning	—	—	—	—
Diversity	-0.06 (0.02)*	—	—	—
Relationship with Others	—	N/A	—	0.13 (0.03)*
EEE	N/A	—	0.09 (0.02)*	—
Workload	—	N/A	N/A	N/A
Mother's Education	—	0.14 (0.05)*	0.13 (0.05)*	0.14 (0.07)*
Father's Education	—	—	—	—
High Profile	—	—	—	N/A
Race	-0.26 (0.07)*	-0.18 (0.05)*	-0.15 (0.06)*	-0.31 (0.05)*
Class	N/A	N/A	-0.18 (0.06)*	-0.26 (0.05)*
Gender	-0.41 (0.06)*	-0.33 (0.04)*	N/A	N/A
SATT	0.47 (0.03)*	0.44 (0.03)*	0.44 (0.03)*	0.47 (0.03)*

Note: #: P>.05; *: P<.05; N/A: not applicable; —: not significant.

The regression of GPA on engagement factors and student profile variables is very different from those for SA, GEPC, and PSD. There is only one engagement factor, Deep Learning, which is significant for all subgroups, while Collaborative Learning is insignificant for all subgroups. All significant engagement factors have positive associations with GPA with the exception of Diversity.

Student profile variables Mother's Education, Race, Class, Gender, and SATT are significant for all subgroups, except Mother's Education for Seniors. Father's Education and High Profile are insignificant across subgroups. In addition, Race, Gender, Class and Diversity are negatively associated with GPA.

Summary for Model-II-B

The associations between college outcomes SA, GEPC, and PSD and the engagement factors in Model-II-B are very similar in that (1) almost all the engagement factors have significant associations with these three college outcomes, with a couple of exceptions for SA, (2) almost all the student profile variables are insignificant across college outcomes and subgroups, and (3) the magnitudes of the regression coefficients of engagement factors remain the same as they were in Model-II-A. However, for GPA the regression results are that (1) almost all the engagement factors have insignificant associations with GPA (with a couple of exceptions), and (2) almost all the student-profile variables are significant predictors for GPA, except Father's Education and High Profile.

For the engagement factors, the magnitudes of the regression coefficients remain similar to those in Model-II-A for all college outcomes and subgroups. Adding student profile variables in this model does not affect the patterns or strengths of the associations between engagement factors and college outcomes. The associations between student profile variables and college outcomes were scattered. In addition, the signs and strengths of the associations were inconsistent across applicable college outcomes and subgroups.

Race, Gender and High Profile variables are commonly used categories when examining different college outcomes. In this model, Race differences were shown in all subgroups for SA and GPA, and for Senior and Male GEPC. Black student-athletes have lower scores in these three college outcomes than non-Black. The magnitudes were consistent for SA, and GEPC, but varied greatly for GPA across subgroups. Gender differences only appeared for Senior and Freshmen GPA: male student-athletes have lower GPA then females for both subgroups. The magnitudes and the signs of associations for High Profile to SA and GEPC were inconsistent for the applicable subgroups. These results suggest that in Model-II-B the association patterns of Race, Gender, and High Profile with college outcomes are unstable and inconsistent.

Model-II-C: One-Way ANCOVA with Random Intercept Model (with engagement factors, student profile variables and college outcome variables as predictors)

Model-II-C is built upon Model-II-B with three of the four college outcome variables as additional predictors, while the fourth one is the dependent variable. The idea of introducing college outcomes into a student-level equation as predictors to estimate the other college outcome is based on the assumption that all college outcomes are correlated with each other: College experiences may affect more than one type of college outcomes and these outcomes may affect each other.

Since the engagement patterns in Model-II-C are very similar to those in Model-III, the regression coefficients from Model-II-C are not presented. However, the variance decomposition is presented in Table 4-23 in the next section. This will provide a full picture of the proportions of total variance accounted for by engagement factors, student profile variables, and college outcomes.

Variance Decomposition for Model-I and II

Variance decompositions for Model-I and II are presented in Table 4-22. This table also includes the percentages of within-school and between-school variances explained by Model-II-A, II-B, and II-C.

Within-School Variance Explained

In Model-II-A, for dependent variables SA, GEPC, and PSD, the significant engagement factors explained from 21 to 43 percent of the within-school variances across all subgroups. For dependent variable GPA, the within-school variances explained by engagement factors are very low, only about 2 to 5 percent.

In Model-II-B, for dependent variables SA, GEPC, and PSD, the significant engagement factors and student profile variables explained from 23 to 43 percent of the within-school variances across subgroups, which is about 0 to 2 percent more than those in Model-II-A for a subgroup. This means that student profile variables accounted for no more than 2% of the within-school variances for a subgroup. For GPA, the within-school variances explained vary from 22 to 28 percent across subgroups, which is about 20% more than those in Model-II-A. This means about 20% of the within-school variances are explained by student profile variables.

In Model-II-C, engagement factors, student profile variables, and college outcome variables explain from 28 to 50 percent of the within-school variances across subgroups for dependent variables SA, GEPC, and PSD. This is about 5 to 10 percent more than those in Model-II-B for a subgroup. It suggests that college outcome variables accounted for less than 10% of the within-school variances of the criterion outcome variable in Model-II-C for a given student-athlete subgroup.

Table 4-22: Variance Decomposition for Model-I and II

College Outcome Variables	Student Subgroups	Within School Variance	% of Within Schools Explained			Between School Variance	% of Between Schools Explained		
		Model-I	Model-II-A	Model-II-B	Model-II-C	Model-I	Model-II-A	Model-II-B	Model-II-C
SA	Senior	0.95	31%	32%	39%	0.05	47%	53%	74%
	Freshmen	0.97	21%	23%	28%	0.03	11%	13%	40%
	Male	0.96	28%	29%	34%	0.04	30%	42%	42%
	Female	0.98	29%	30%	36%	0.02	9%	15%	40%
GEPC	Senior	0.98	35%	36%	45%	0.02	87%	64%	77%
	Freshmen	0.97	37%	37%	46%	0.03	34%	34%	55%
	Male	0.98	37%	37%	47%	0.02	20%	19%	64%
	Female	0.98	37%	38%	45%	0.02	70%	56%	54%
PSD	Senior	0.94	38%	38%	45%	0.07	33%	33%	31%
	Freshmen	0.96	43%	43%	50%	0.04	30%	29%	36%
	Male	0.95	40%	40%	48%	0.05	21%	21%	35%
	Female	0.98	42%	42%	49%	0.02	28%	40%	31%
GPA	Senior	0.95	5%	28%	29%	0.05	N/A	N/A	N/A
	Freshmen	0.91	2%	22%	24%	0.09	N/A	N/A	N/A
	Male	0.94	4%	22%	24%	0.05	N/A	N/A	N/A
	Female	0.95	3%	24%	25%	0.06	N/A	N/A	N/A

N/A: not applicable

For GPA, all significant student-level predictors explained 23 to 29 percent of the within-school variances across subgroups. This means only from 1 to 2 percent of within-school variance is explained by college outcome variables for a subgroup.

Overall, the proportions of within-school variances explained for SA, GEPC, and PSD in Model-II are larger than those for GPA. Engagement factors and college outcomes (as predictors) accounted for most of the explained variances for SA, GEPC, and PSD. Student profile variables, however, explain very little within-school variance. GPA has the opposite pattern: student profile variables accounted for most of the explained variance, and very little was explained by engagement factors and college outcomes.

Between-school Variance Explained

For all three models in Model-II, the percentages of between-school variances explained by student-level predictors vary from 9% to 87% across subgroups for SA, GEPC, and PSD. The high percentages of between-school variances explained by the level-1 predictors suggest that these predictors are capitalizing on between-school student-level heterogeneity that is greater than within school heterogeneity (i.e., students within a school are more alike than students from different schools). Thus, including these variables will usually account for more between-school variance than within-school variance.

The percentage of between-school variance explained is not applicable for GPA in all three models in Table 4-22. This is because the between-school variance increased somewhat after including student-level predictors. This pattern may have resulted from grouping effects on student-level variables, which indicates that grand-mean centering student-level predictors are not appropriate for GPA. Unlike SA, GEPC, and PSD that were constructed using the same scale for all schools, GPA was student self-reported data and its scale was determined by each school (although with a common range).

Model-III: One-Way ANCOVA with Random Intercept and Slopes

In Model-III, all student-level variables are introduced into the Level-1 models, as they were in Model-II-C. However, in Model-III the Level-1 slopes are allowed to vary randomly across schools. Therefore, group-mean centering the interval scaled predictors is now appropriate for the Level-1 models in Model-III. This is different from Model-II in which the grand-mean centering was applied since there were fixed effects on the slopes.

Group-mean centering affects both the estimation and interpretation of the intercepts and slopes. It also affects the estimation of random effect variances. The intercepts are the unadjusted means for each school when predictors are group-mean centered. When predictors are grand-mean centered as in Model-II, the slopes are a combination of student-level effects and compositional effects. When group-mean centering is employed, the slopes estimated reflect only the student-level effects. Therefore, we expect that the estimated slopes will be smaller in Model-III compared to those in Model-II. The slopes become the person-level effects within each group instead of within the whole population. For example, if a student scores one standard deviation higher than his school mean (instead of the grand mean when grand-mean centered) his college outcome will be increased by X standard deviations. The larger between-school variances in Model-III when compared to those in Model-I and Model-II are expected. This is because it is possible that more differences exist among students in different schools than among students in the same school. Between-school variances from Model-III will be used as the baseline values to compute the percentages of variance explained in Model-IV and V. Variance decomposition information from Model-III will be presented side-by-side with information from Model-IV and V in Table 4-31.

Questions to be answered by Model-III:

1. What are the important student-level predictors for college outcomes?
2. Do the slopes of student-level predictors on college outcome variables vary across schools?

Hypotheses for question 1 for Model-III are the same as those for Model-II-A and Model-II-B with additional null hypotheses:

1. SA as a predictor does not have any statistically significant association with college outcome variables GEPC, PSD, or GPA for any subgroup.
2. GEPC as a predictor does not have and statistically significant association with college outcome variables SA, PSD, or GPA for any subgroup.
3. PSD as a predictor does not have any statistically significant association with college outcome variables SA, GEPC, or GPA for any subgroup.
4. GPA as a predictor does not have any statistically significant association with college outcome variables SA, GEPC, and PSD for any subgroup.

For question 2, the null hypothesis is:

There is no variation among schools in the slopes of student-level predictors for dependent variables SA, GEPC, PSD, or GPA.

SA

Regression coefficients of predictors for the dependent variable SA and the statistically significant random variations are shown in Table 4-23.

For Seniors, all variables that were significant in Model-II (including Model-II-A, II-B, and II-C) are still significant in Model-III. Therefore, we reject the null hypotheses for these variables (see Senior column in Table 4-23) and adopt the alternative hypotheses that they have statistically significant associations with SA. However, we retain the null hypotheses for the rest of the student-level variables.

Table 4-23 also indicates that there are significant variances in slopes for Relationship with Others and GEPC (as a predictor) across schools. Therefore, we reject the corresponding null hypotheses for the dependent variable SA.

For Freshmen, only two engagement factors, Student-Faculty Interaction and Institution Support, have significant associations with SA, which is the same as in Model-II-C. However, this is very different from Model-II-A and II-B where four of the engagement factors have significant associations with SA. High Profile, Race, together with GEPC, PSD and GPA (as predictors) are also significant in Model-III. Therefore, we reject the null hypotheses for these predictors in favor of the alternatives that these predictors have statistically significant associations with SA.

Table 4-23: Regression coefficients of SA on Student-Level Predictors for Model-III

Predictors	Regression Coefficient (S.E.)			
	Senior	Freshmen	Male	Female
Intercept	0.10 (0.05)*	0.05 (0.05)#	-0.03 (0.07)#	-0.08 (0.05)#
Deep Learning	0.07 (0.03)*	—	0.07 (0.03)*	—
Student-Faculty Interaction	0.09 (0.03)*	0.10 (0.03)*	0.09 (0.03)*	0.09 (0.02)*
Institution Support	0.15 (0.03)*	**0.21 (0.03)* †**	0.14 (0.03)*	**0.16 (0.03)* †**
Collaborative Learning	—	—	—	—
Diversity	—	—	—	—
Relationship with Others	**0.34 (0.03)* †**	N/A	0.33 (0.03)*	0.26 (0.02)*
Enriching Educational Experiences	N/A	—	—	—
Workload	-0.08 (0.02)*	N/A	N/A	N/A
Mother's Education	—	—	—	—
Father's Education	-0.14 (0.05)*	—	—	—
High Profile	—	**-0.26 (0.09)* †**	-0.17 (0.06)*	N/A
Race	-0.12 (0.05)*	-0.13 (0.05)*	—	—
Class	N/A	N/A	0.13 (0.06)*	0.11 (0.05)*
Gender	—	—	N/A	N/A
SATT	0.12 (0.03)*	—	—	—
SA	N/A	N/A	N/A	N/A
GEPC	**0.25 (0.04)* †**	0.22 (0.02)*	0.20 (0.04)*	**0.25 (0.04)* †**
PSD	0.12 (0.04)*	0.15 (0.03)*	0.10 (0.04)*	**0.16 (0.03)* †**
GPA	—	0.11 (0.02)*	0.11 (0.03)*	0.09 (0.02)*

#: P>.05; *: P<.05; N/A: not applicable; —: not significant;
†: bolded coefficient denotes coefficient to be modeled with random slopes

The variations of the slopes across schools for Institution Support and High Profile are significantly different from zero at p<.05. Therefore, we reject the corresponding null hypotheses for the dependent variable SA.

For Males, all predictors that were significant in Model-II-C remain significant in Model-III. However, SATT is no longer significant as it was in Model-II-B. Therefore, we reject the null hypothesis for these predictors (see Male column in Table 4-23) and support the alternative that they have statistically significant associations with SA.

The variations of slopes of all predictors across schools are not significantly different from zero at p<.05. Therefore, we accept the corresponding null hypotheses for the dependent variable SA.

For Females, all the predictors that were significant in Model-II-C remain significant in Model-III. However, there are only three significant engagement factors, Student-Faculty Interactions, Institution Support, and Relationship with Others. This is different from Model-II-A that had five and Model-II-B in which all of the engagement factors had significant associations with SA. Predictors Class, GEPC, PSD, and GPA are also significantly associated with Satisfaction in Model-III.

The variances in the slopes across schools for Institution Support, GEPC and PSD are significant. Therefore, we reject the corresponding null hypotheses for the dependent variable SA.

In summary, for all student-athlete subgroups, with SA as the dependent variable:

1. Engagement factors Student-Faculty Interaction, Institution Support, and Relationship with Others have statistically significant associations with SA, while Collaborative Learning, Diversity, and EEE are not significant.

2. Patterns of association between engagement factors and the dependent variable are consistent, but patterns for student profile variables are not.
3. Mother’s and Father’ Education, Gender, and SATT do not have significant associations with SA for any subgroup, with some exceptions.
4. As predictors, college outcome variables GEPC, PSD and GPA have significant associations with SA for all subgroups, with the exception that GPA is not significant for the Senior subgroup.
5. The regression coefficients of Workload, Father’s Education, High Profile, and Race are negatively associated with SA.
6. All slopes are smaller in Model-III than in Model-II-A, and Model-II-B.
7. Relationship with Others has very strong associations with SA across subgroups.

GEPC

The regression coefficients of predictors for the dependent variable GEPC are shown in Table 4-24. The same table also indicates the slopes with significant random variation.

For Seniors, Deep Learning, Student-Faculty Interaction, Collaborative Learning, and Relationship with Others remain statistically significantly associated with GEPC at $p<.05$ (as they were in Model-II). However, Workload is no longer significant whereas it was in Model-II-B. Predictors SA, PSD, and SATT are also significant, in addition to the significant engagement factors mentioned earlier. Therefore, we reject the corresponding null hypotheses in favor of the alternatives that these predictors (see Senior column in

Table 4-24) have statistically significant associations with GEPC. We retain the null hypotheses for the rest of the predictors.

For Seniors, there are no significant variations for any of the slopes. Therefore, we accept the corresponding null hypotheses for the dependent variable GEPC.

Table 4-24: Regression coefficients of GEPC on Student-Level Predictors for Model-III

Student-Level Variables	Regression Coefficient (S.E.)			
	Senior	Freshmen	Male	Female
Intercept	-0.02 (0.04)#	-0.01 (0.04)#	0.01 (0.05)#	0.08 (0.05)#
Deep Learning	0.26 (0.03)*	0.28 (0.02)*	**0.29 (0.03)*†**	0.24 (0.03)*
Student-Faculty Interaction	0.10 (0.02)*	**0.09 (0.02)* †**	0.06 (0.03)*	0.11 (0.02)*
Institution Support	—	0.18 (0.02)*	0.07 (0.03)*	0.11 (0.01)*
Collaborative Learning	0.15 (0.02)*	0.05 (0.02)*	0.11 (0.02)*	0.10 (0.02)*
Diversity	—	—	0.05 (0.02)*	—
Relationship with Others	0.07 (0.03)*	N/A	0.08 (0.03)*	0.11 (0.02)*
Enriching Educational Experiences	N/A	0.04 (0.02)*	0.07 (0.02)*	—
Workload	—	N/A	N/A	N/A
MotherEd	—	—	—	—
FatherEd	—	—	—	—
High Profile	—	—	0.12 (0.04)*	N/A
Race	—	—	—	—
Class	N/A	N/A	-0.12 (0.06)*	-0.17 (0.04)*
Gender	—		N/A	N/A
SATT	-0.09 (0.02)*	—	—	-0.09 (0.02)*
SA	0.23 (0.04)*	0.16 (0.02)*	0.17 (0.03)*	0.20 (0.02)*
GEPC	N/A	N/A	N/A	N/A
PSD	0.33 (0.02)*	**0.33 (0.03)* †**	0.34 (0.03)*	0.29 (0.02)*
GPA	—	—	**0.07 (0.02)*†**	—

#: P>.05; *: P<.05; N/A: not applicable; —: not significant;
†: bolded coefficient denotes coefficient to be modeled with random slopes

For Freshmen, all predictors that were significant in Model-II remain significant in Model-III. In addition, EEE becomes significant for GEPC in Model-III. Therefore, we reject the corresponding null hypotheses in favor of the alternatives that those predictors (see Freshmen Column Table 4-24) are significantly associated with GEPC.

The variations of the slopes of Student-Faculty Interaction and PSD are significantly different from zero at p<.05. Therefore, we reject the corresponding null hypotheses for the dependent variable GEPC.

For Males, all of the student-level predictors that have statistically significant associations with GEPC in Model-II remain significant in Model-III. Therefore, we reject the corresponding null hypotheses in favor of the alternatives that these predictors (see Male Column in Table 4-24) have significant associations with GEPC for the Male subgroup.

The variances in the slopes of Deep Learning and GPA (as a predictor) across schools are significant. Therefore, we reject the corresponding null hypothesis for the dependent variable GEPC for the Male subgroup.

For Females**,** all student-level predictors that have statistically significant associations with GEPC in Model-II-C remain significant in Model-III. In addition, Relationship with Others and SATT now show significant associations with GEPC in Model-III, whereas in Model-II-C they did not. Therefore**,** we reject the corresponding null hypotheses in favor of the alternatives that these predictors (see Female Column in Table 4-24) have significant associations with GEPC. For the rest of the predictors we retain the null hypotheses.

There is no significant variation in any of the slopes for GEPC. Therefore, we accept the null hypotheses that there are no random variations in the slopes of student-level predictors on the dependent variable GEPC for the Female subgroup.

In summary, with GEPC as the dependent variable, for all subgroups:

1. Nearly all engagement factors are significant predictors for GEPC.

2. Nearly all student profile variables are not significantly associated with GEPC.
3. For college outcome variables as predictors, both SA and PSD are significantly associated with GEPC, but GPA is only significant for Males.
4. Class and SATT are negatively associated with GEPC while the remaining predictors have positive associations.
5. PSD has the strongest associations with GEPC, with regression coefficients ranging from 0.29 to 0.34.

PSD

Regression coefficients of predictors on the dependent variable PSD and the random variations on slopes are shown in Table 4-25.

All student-level predictors that were significant in Model-II-C remain significant for PSD in Model-III across subgroups, except collaborative Learning for Seniors and SATT for Females becoming insignificant.

In summary, the engagement patterns of student-level predictors for PSD are very consistent across subgroups:

1. All engagement factors, except Collaborative Learning for Seniors, are significantly associated with PSD.
2. None of the student demographic variables are significant, except Mother's Education for Freshmen and Females.
3. For college outcome variables as predictors, both SA and GEPC have significant associations with the dependent variable PSD. However, GPA is significant only for Freshmen with a negative regression coefficient.

4. Institution Support and GEPC have the strongest associations with the dependent variable PSD.

The variation in the slopes of Institution Support across schools is significant at p<.05 for both Seniors and Females. Therefore, we reject the corresponding null hypotheses for dependent variable PSD for Seniors and Female. However, there are no significant variations for any of the slopes for Freshmen and Male.

Table 4-25: Regression coefficient of PSD on Student-Level Predictors For model-III

Student-Level Variables	Regression Coefficient (S.E.)			
	Senior	Freshmen	Male	Female
Intercept	-0.01 (0.06)#	-0.07 (0.05)#	-0.02 (0.05)#	-0.06 (0.05)#
Deep Learning	0.12 (0.03)*	0.13 (0.02)*	0.10 (0.03)*	0.16 (0.02)*
Student-Faculty Interaction	0.13 (0.02)*	0.19 (0.02)*	0.16 (0.03)*	0.17 (0.02)*
Institution Support	**0.33 (0.03)* †**	0.31 (0.02)*	0.35 (0.02)*	**0.30 (0.03)* †**
Collaborative Learning	—	0.12 (0.02)*	0.05 (0.02)*	0.11 (0.02)*
Diversity	0.08 (0.02)*	0.09 (0.02)*	0.07 (0.02)*	0.11 (0.02)*
Relationship with Others	0.09 (0.02)*	N/A	0.08 (0.02)*	0.06 (0.03)*
Enriching Educational Experiences	N/A	0.12 (0.02)*	0.11 (0.02)*	0.06 (0.02)*
Workload	0.09 (0.02)*	N/A	N/A	N/A
MotherEd	—	0.12 (0.04)*	—	0.09 (0.04)*
FatherEd	—	—	—	—
High Profile	—	—	—	N/A
Race	—	—	—	—
Class	N/A	N/A	—	—
Gender	—	—	N/A	N/A
SATT	—	—	—	—
SA	0.10 (0.03)*	0.10 (0.02)*	0.07 (0.03)*	0.11 (0.03)*
GEPC	0.29 (0.03)*	0.31 (0.02)*	0.33 (0.03)*	0.29 (0.02)*
PSD	N/A	N/A	N/A	N/A
GPA	—	-0.06 (0.02)*	—	—

#: P>.05; *: P<.05; N/A: not applicable; —: not significant;
†: bolded coefficient denotes coefficient to be modeled with random slopes

GPA

Regression coefficients of predictors for GPA and the random variations on the slopes are shown in Table 4-26.

For Seniors, all of the significant predictors in Model-II-C remain significant for the dependent variable GPA in Model-III. Therefore, we reject the null hypotheses in favor of the alternatives that these predictors (see Senior column in Table 4-26) have statistically significant associations with GPA. For the rest of the predictors we retain the null hypotheses.

There are no significant variations for any of the slopes. Therefore, we accept the corresponding null hypotheses for the dependent variable GPA for the Senior subgroup.

Table 4-26: Regression coefficient of GPA on Student-Level Predictors For model-III

Student-Level Variables	Regression Coefficient (S.E.)			
	Senior	Freshmen	Male	Female
Intercept	0.27 (0.05)*	0.05 (0.06)#	0.04 (0.06)#	0.08 (0.06)#
Deep Learning	0.07 (0.03)*	0.06 (0.02)*		0.07 (0.02)*
Student-Faculty Interaction	—	0.05 (0.02)*		—
Institution Support	—	—	—	—
Collaborative Learning	—	—	—	—
Diversity	-0.07 (0.02)*	—	—	—
Relationship with Others	—	N/A	—	**0.10 (0.03)*†**
EEE	N/A	—	0.06 (0.02)*	—
Workload	—	N/A	N/A	N/A
MotherEd	—	0.16 (0.05)*	0.13 (0.05)*	**0.17 (0.07)*†**
FatherEd	—	—	—	—
High Profile	—	—	—	N/A
Race	-0.22 (0.07)*	-0.15 (0.05)*	—	-0.27 (0.05)*
Class	N/A	N/A	**-0.17 (0.07)*†**	-0.28 (0.05)*
Gender	-0.42 (0.05)*	-0.33 (0.04)*	N/A	N/A
SATT	0.50 (0.03)*	0.45 (0.02)*	0.48 (0.03)*	0.49 (0.03)*
SA	0.07 (0.04)*	**0.10 (0.03)*†**	0.09 (0.03)*	**0.09 (0.03)*†**
GEPC	0.09 (0.03)*	0.08 (0.03)*	**0.11 (0.03)*†**	—
PSD	—	-0.06 (0.03)*	—	—
GPA	N/A	N/A	N/A	N/A

#: P>.05; *: P<.05; N/A: not applicable; —: not significant;
†: bolded coefficient denotes coefficient to be modeled with random slopes

For Freshmen**,** all significant predictors in Model-II-C remain significant in Model-III. In addition, SATT shows significant association with GPA in Model-III, which was significant in Model-II-B as well, but not in II-C. We then reject the corresponding null hypotheses in favor of the alternatives that these predictors (see Freshmen column in Table 4-26) have statistically significant associations with GPA.

The variations for the slopes of SA (as a predictor) across schools are significant. Therefore, we reject the corresponding null hypothesis for the dependent variable GPA for the Freshmen subgroup.

For Males, the engagement pattern in Model-III is very different from Model-II-A and II-B, but similar to II-C. The only engagement factor that is significant for GPA in Model-III is EEE. Predictors Deep Learning, Relationship with Others and Race are no longer significant as they were in Model-II. We then reject the corresponding null hypotheses in favor of the alternatives that these predictors (see Male column in Table 4-26) have statistically significant associations with GPA.

The variations of the slopes of Deep Learning, Class, and GEPC are significant. Therefore, we reject the corresponding null hypothesis for the dependent variable GPA for the Male subgroup.

For Females, all the predictors that were significant in Model-II remain significant in Model-III, with the exception of EEE. In addition, SATT shows significant associations with GPA, whereas it was insignificant in Model-II. Therefore, we reject the corresponding null hypotheses in favor of the alternatives that these predictors (see Female column in Table 4-26) have statistically significant associations with GPA.

The variations of the slopes of Relationship with Others, Mother's Education, and SA (as a predictor) are significant. Therefore we reject the null hypothesis and accept the alternative that there are random variations on the slopes for the dependent variable GPA for the Female subgroup.

In summary, although the association patterns of statistically significant predictors for GPA (as a dependent variable) are very different from those for the other three college outcomes, the pattern across all subgroups for GPA are very similar:

- There are one or two engagement factors that have significant associations with GPA, however, the pattern is not consistent across subgroups.
- Student profile variables, Mother's Education, Race, Class, Gender, and SATT, are significant predictors for GPA, with the exception of Mother's Education for Seniors, and Race for Males.
- For college outcome variables as predictors, SA and GEPC are significant across all subgroups, with the exception of GEPC for Females.
- Diversity, Race, Gender, and Class have negative associations with GPA while the rest have positive associations.
- SATT has the strongest associations with GPA across subgroups, with regression coefficients ranging from 0.45 to 0.50.

Summary for Model-III

In general, the engagement patterns across subgroups are more similar for the same dependent variable than among different dependent variables. The engagement patterns for GPA are very different from those for the other three college outcome variables. The engagement patterns for GEPC and PSD are similar: (1) nearly all the engagement factors along with SA, GEPC, and PSD (as predictors) have significant associations with the dependent variables; (2) nearly all the demographic variables are insignificant across subgroups for GEPC and PSD.

Similarities of engagement patterns across subgroups and dependent variables are shown in the following ways (with some exceptions across subgroups):

- SA, GEPC, and PSD (as predictors) are significant and positively associated with all dependent variables, with the exception of several insignificant associations with GPA (as a dependent variable) across subgroups.
- Engagement factors Deep Learning and Student-Faculty Interaction are significantly associated with all four college outcome variables; Institution Support and Relationship with Others are significant for three of the four college outcome variables.
- Father's Education, High Profile, and Gender have insignificant associations with all dependent variables.
- Race and Gender are negatively associated with the dependent variables; however, Class, High Profile, and SATT display inconsistent signs of associations with dependent variables based on subgroups.

Models-IV and V: Intercepts- and Slopes-as-Outcomes Model

As presented above, Model-III provides estimates of the variability in the random intercept and slopes. However, it is an unconditional model that does not account for these variations in terms of school-level characteristics. By incorporating school-level characteristics into the school-level regression model, Model-IV and Model-V enable us to extend our analyses. In those two models, the student-level models remain the same as in Model-III.

Results from Model-III show that the slopes in certain models do not display significant random variation (SA for Male, GEPC for Senior and Female, PSD for Freshmen and Male, and GPA for senior subgroup). For those models Model-IV is the final model. For the remaining models, Model-V is the final model. Model-V is used to explore the relationships between school-level variables and the random slopes to answer the following research questions:

1. Which model best describes the statistical associations among the engagement factors and college outcomes?
   a. How does the best-fitting model vary by class and by gender?
   b. To what extent do the engagement factors account for the variations in college outcomes?
2. How do the statistical relationships in #1 change when student profile and college outcome variables (as predictors) are introduced in the models?
3. To what extent do school characteristics account for between-school variation in college outcomes?

In Model-IV, the Intercepts-as-Outcomes Model (the intercept model), school characteristics are introduced into the Level-2 intercept models as predictors to account for variances in the Level-1 adjusted intercepts. Each school's (adjusted) mean college outcome scores are now predicted by school-level variables. In Model-V, the Slopes-as-Outcomes Models (the slope models), school-level variables are introduced into the Level-2 slope models to account for variances in the Level-1 random slopes. The intercept models in Model-V are the same as in Model-IV. In both Model-IV and Model-

V, all interval scaled school-level variables are grand-mean centered while the dummy variables are not centered.

There are 12 school-level variables in this analysis: Private (school type), FBS (Football Bowl Subdivision), FCS (Football Championship Subdivision), Classification (Carnegie Basic Classification), Selectivity (Barron's selectivity), SAGSA (Student-Athlete Graduate Success Rate), Aid (percentage of students receiving aid), SA Enroll (Student-athlete program size), S-F Ratio (Student-Faculty Ratio), School Size, Mean SATT, and Mean GPA. The descriptions and the coding of each variable were presented in Chapter Three.

The following sections will focus on presenting the significant associations of the school-level predictors with the intercepts and slopes from the Level-1 models. Intercepts and slopes are the dependent variables in the Level-2 models for Model-IV and Model-V.

In addition to answering the research questions of this study, the analyses of Model-IV and Model-V will provide answers to these related questions:

1. What are the school-level variables that are significant predictors for within-school adjusted intercepts?
2. Do SATT and GPA have compositional effects on college outcome variables?
3. What are the school-level variables that account for variations across within-school slopes?

The results from Model-IV or Model-V (depending on which is the final model) are shown in Tables 27 - 30 for each of the college outcome variables. There is a set of three tables for each outcome variable, labeled tables ‘A’, ‘B’, and ‘C’, to better organize the results. The ‘A’ tables contain regression coefficients of predictors in the Level-1 models, while results for the intercept and slope models in Level-2 models are shown in ‘B’ and ‘C’ tables. ‘A’ tables present three types of results:

1. Regression coefficients and standard errors (S.E.) of the predictors that have fixed effects, as defined in equations (15) to (17) for Model-IV.
2. Regression coefficients and S.E. of the predictors that have random effects but don’t have significant school-level predictors, as defined in equations (10) to (12) in Model-III. These are noted with a ‘†’.
3. The slopes with random effects and significant school-level predictors, as defined in equations (20) to (22) in Model-V, are presented by indices ‘$\beta_{\text{Predictor Name}, j}$’ for the corresponding predictors. The detailed results are presented in the ‘C’ tables.

The ‘B’ tables contain the results from the intercept models, including the baseline intercepts and the regression coefficients of school-level predictors. β_{0j} is the dependent variable in the intercept models, which is defined in equations (14) and (19) in Model-IV and Model-V respectively.

The ‘C’ tables contain detailed results of the third type (see above) presented in the A tables. C tables include mean slopes and regression coefficients of the predictors for the within-school slopes for all subgroups.

SA

Table 4-27-A shows the regression coefficients (β_{1j} , … , β_{kj}) of the student-level predictors for dependent variable SA for all subgroups. Insignificant predictors are excluded from this table. This format will be employed for all the tables in the following sections as well.

Table 4-27-A: Regression Coefficients of Within-School Predictors for SA in Models-IV/ V

Predictors	Regression Coefficient (S.E.)			
	Senior	Freshmen	Male	Female
Deep Learning	0.07 (0.03)*	—	0.07 (0.03)*	—
Student-Faculty Interaction	0.09 (0.03)*	0.10 (0.03)*	0.09 (0.03)*	0.09 (0.02)*
Institution Support	0.15 (0.03)*	$\beta_{IS,j}$	0.14 (0.03)*	**0.16 (0.03)*†**
Relationship with Others	$\beta_{RwO,j}$	N/A	0.33 (0.03)*	0.26 (0.02)*
Workload	-0.08 (0.02)*	N/A	N/A	N/A
Father's Education	-0.15 (0.05)*	—	—	—
Race	-0.15 (0.05)*	-0.12 (0.05)*	—	—
High Profile	—	$\beta_{HP,j}$	-0.17 (0.06)*	N/A
Class	N/A	N/A	0.12 (0.06)*	0.11 (0.05)*
SATT	0.09 (0.03)*	—	—	—
GEPC	$\beta_{GEPC,j}$	0.22 (0.02)*	0.20 (0.04)*	**0.25 (0.04)*†**
PSD	0.12 (0.04)*	0.15 (0.03)*	0.10 (0.04)*	$\beta_{PSD,j}$
GPA	—	0.11 (0.02)*	0.11 (0.03)*	0.09 (0.02)*

*: P<.05; —: not significant; †: bolded coefficient denotes coefficient with random slopes

Table 4-27-B: Regression Models for Adjusted Intercepts for SA in Models-IV/V

Predictors	Regression Coefficient (S.E.)			
	Senior	Freshmen	Male	Female
Intercept, γ_{00}	-0.53 (0.06)*	-0.40 (0.08)*	-0.36 (0.09)*	-0.27 (0.06)*
Private	0.52 (0.05)*	—	—	—
FBS	0.71 (0.10)*	0.50 (0.08)*	0.66 (0.12)*	0.37 (0.10)*
FCS	—	0.22 (0.07)*	—	—
Classification	0.17 (0.05)*	0.35 (0.07)*	0.28 (0.08)*	0.15 (0.06)*
SAGSR	—	-0.08 (0.03)*	—	—
Aid	-0.18 (0.03)*	-0.14 (0.03)*	-0.17 (0.04)*	-0.17 (0.03)*
S-F Ratio	—	—	0.13 (0.04)*	—
School Size	-0.12 (0.03)*	-0.29 (0.04)*	-0.35 (0.03)*	-0.23 (0.05)*
Mean SATT	—	-0.25 (0.06)*	—	-0.10 (0.05)*
Mean GPA	—	0.35 (0.09)*	0.38 (0.10)*	0.33 (0.10)*

*: P<.05; —: not significant

Table 4-27-B contains the average of the school mean SA scores across all schools (γ_{00}) and the regression coefficients (γ_{01}, … , γ_{0j}) of the school-level predictors in the Intercept-as-Outcomes models. In these models, the dependent variables are the within-school adjusted intercepts β_{0j} from the Level-1 model.

Table 4-27-C contains intercepts (γ_{10}, … , γ_{k0}) and regression coefficients (γ_{k1}, … , γ_{kj}) of the school-level predictors in the Slopes-as-Outcomes models. The random slopes β_{kj} from the Level-1 models are the dependent variables. Since the Slopes-as-Outcomes model does not apply to the Male subgroup, the Male column is deleted from this table.

Table 4-27-C: Regression Model for Radom Slopes for SA in Model-V

Subgroups	Dependent Variable	Predictors	Intercept and Regression Coefficient (S.E.)
Seniors	$\beta_{RwO, j}$	Intercept	0.22 (0.04)*
		Private	0.15 (0.05)*
		Aid	-0.08 (0.04)*
		School Size	-0.09 (0.03)*
		Mean SATT	-0.17 (0.06)*
	$\beta_{GEPC, j}$	Intercept	0.29 (0.04)*
		FBS	-0.19 (0.07)*
		SAGSR	-0.08 (0.03)*
		Aid	-0.08 (0.03)*
Freshmen	$\beta_{IS, j}$	Intercept	0.04 (0.07)#
		Classification	0.10 (0.04)*
		Selectivity	0.15 (0.06)*
	$\beta_{HP, j}$	Intercept	0.44 (0.15)*
		Private	-0.49 (0.14)*
		Classification	-0.62 (0.12)*
		S-F Ratio	0.15 (0.05)*
		Mean GPA	0.69 (0.19)*
Females	$\beta_{PSD, j}$	Intercept	0.15 (0.03)*
		School Size	-0.05 (0.02)*

*: P<.05, #: not significant

<u>Seniors</u>

Using the results shown in Table 4-27-A, equation (18) in the Level-1 model of Model-V for SA as a dependent variable can be written as:

$$\text{Predicted } Y_{ij} = \hat{\beta}_{0j} + 0.07*\text{DeepLearning} + 0.09*\text{SFInteraction} - 0.08*\text{Workload} - 0.15*\text{FatherEd} - 0.15*\text{Race} + 0.09*\text{SATT} + 0.15*\text{InstitutionSupport} + \hat{\beta}_{RwO,j}*\text{RwO} + \hat{\beta}_{GEPC,j}*\text{GEPC} + 0.12*\text{PSD}$$

The level of significance and magnitudes of intercepts and slopes from the Level-1 model remain the same as in Model-III. Therefore, the association patterns between college outcomes and student-level predictors, and the magnitudes of the regression coefficients will not be addressed again. The following section will focus on the results from Intercept and Slope models.

In the above equation, $\hat{\beta}_{0j}$ (the predicted within-school adjusted intercepts in Level-1 models) is the dependent variable in the intercept models as defined in equation (19) in Model-V. Using the results shown in Table 4-27-B, the estimated adjusted school mean SA score for Seniors can be written as:

$$\hat{\beta}_{0j} = -0.53 + 0.52*\text{Private} + 0.71*\text{FBS} + 0.17*\text{Classification} - 0.18*\text{Aid} - 0.12*\text{SchoolSize}$$

For Seniors, the average of the adjusted school mean SA scores across all schools is -0.53, when holding all Level-2 predictors constant. For Private FBS schools with high Classification and average school size and average Aid received, the predicted mean SA score is 0.87 (0.87=-0.53+0.52+0.71+0.17).

Aid and School Size have negative associations with the predicted intercept. One standard unit increase in Aid decreases the mean school SA score by 0.18 standard deviations, when holding all other predictors constant. However, the smaller schools tend to have a higher mean SA score: one standard unit decrease in school size will increase the mean SA score by 0.12 standard deviations, when holding all other predictors constant.

In Table 4-27-A, indices $\beta_{RwO,j}$ and $\beta_{GEPC,j}$ indicate that the slopes of Relationship with Others (RwO) and GEPC have random effects and significant school-level predictors in Model-V. $\hat{\beta}_{\text{RwO, j}}$ and $\hat{\beta}_{\text{GEPC, j}}$ are the dependent variables in the Slopes-as-Outcomes models. Using the results shown in Table 4-27-C, the slope model for Relationship with Others can be written as:

$$\hat{\beta}_{\text{RwO, j}} = 0.22 + 0.15\text{*Private} - 0.08\text{*Aid} - 0.09\text{*SchoolSize} \\ - 0.17\text{*MeanSATT}$$

School-level predictors Private School, Aid, School Size, and Mean SATT have significant associations with $\hat{\beta}_{\text{RwO, j}}$. Aid, School Size, and Mean SATT have negative associations with RwO slopes. The average slope across all schools is 0.22. Private schools have significantly higher slopes, on average, than public schools, with regression coefficients of 0.15. Therefore, Senior student-athletes' SA scores are more sensitive to RwO in Private schools while controlling for all other predictors. There is a tendency for schools with high Aid to have smaller slopes than do schools with low Aid: one standard deviation increase in Aid will lower the slope by 0.08 standard deviations, while controlling for all other predictors. The same tendency appears for School Size with a regression coefficient of -0.09 and for Mean SATT with a regression coefficient of -0.17.

The slope model for GEPC can be written as:

$$\hat{\beta}_{\text{GEPC, j}} = 0.29 - 0.19\text{*FBS} - 0.08\text{*SAGSR} - 0.08\text{* Aid}$$

School-level variables FBS, SAGSR, and Aid are significant predictors for $\hat{\beta}_{\text{GEPC, j}}$. The average slope across all schools is 0.29. FBS schools have smaller slopes than the general D-I schools by 0.19 standard deviations. SAGSR and Aid also have negative associations with $\hat{\beta}_{\text{GEPC, j}}$: they decrease the GEPC slopes by 0.19 and 0.08 standard deviations per one standard deviation increase in these two predictors, respectively.

The equations for Level-1 models, intercept and slope models for the other subgroups and college outcome variables will be written and explained in a similar manner as SA for Seniors. Therefore, these equations will not be listed one by one in the following sections.

Freshmen

Indices $\beta_{IS,j}$ and $\beta_{HP,j}$ in Table 4-27-A in the Freshmen column indicate that the within-school slopes of Institution Support (IS) and High Profile (HP) have random effects and significant school-level predictors in Model-V. The results of the slope models for $\beta_{IS,j}$ and $\beta_{HP,j}$ are shown in Table 4-27-C.

For the intercept model, Table 4-27-B shows that the average of the school mean SA score (γ_{00}) for Freshmen is -0.40, which is slightly larger than that for Seniors. All school level predictors listed are significant in the intercept model, with the exception of Private and Student-Faculty Interaction. Both FBS and FCS schools have higher mean SA scores than the general D-I schools by 0.50 and 0.22 standard deviations respectively when holding other predictors constant. High Classification schools have higher mean SA scores than low Classification schools by 0.35 standard deviations. SAGSR, Aid, School Size, and Mean SATT have negative effects on the intercept. One standard deviation increase in these predictors decreases the mean SA score by 0.08, 0.14, 0.29, and 0.25 standard deviations respectively (see Freshmen Column in Table 4-27-B), while controlling for all other predictors. Schools with a higher Mean GPA tend to have a higher mean SA score for Freshmen: one standard deviation increase in Mean GPA is associated with a 0.35 standard deviations increase in mean SA score.

For the slope models, the average slope for Institution Support is 0.04 (see Table 4-27-C). Two school-level variables are significant predictors for this slope, Classification and Selectivity. High Classification and high Selectivity schools have, on average, 0.10 and 0.15 standard deviations larger slopes respectively than schools with low Classification and low Selectivity when other predictors are held constant.

The average slope for High Profile is 0.44 for Freshmen. On average, Private schools have a regression coefficient of -0.49. High Classification schools have significantly smaller slopes than low Classification schools, by -0.62 standard deviations. Schools with high Student-Faculty Ratio tend to have larger High Profile slopes: one standard deviation increase in Student-Faculty Ratio will increase the slope for High Profile by 0.15 standard deviations. In addition, schools with high Mean GPA scores tend to have larger High Profile slopes, increasing the slope by 0.69 standard deviations per standard deviation increase in Mean GPA.

For Freshmen, compositional effects appear when Mean GPA at the school-level remains significant ($\beta_{MeanGPA}$ =0.35) for SA after controlling for GPA at the student-level (β_{GPA} =0.11). These compositional effects represent the difference between the school-level and student-level coefficients. Student-athletes who enrolled in a school with higher mean GPA tend to have higher SA scores than those who enrolled in schools with lower mean GPA. Since predictors in the Level-1 model are group-mean centered, the compositional effect β_C is:

$$\beta_C = \gamma_B - \gamma_w = 0.35 - 0.11 = 0.24.$$

Males

Results from Table 4-27-A show that no slopes in the Level-1 model display significant random variation for the Male subgroup. Therefore, Model-IV is the final model for the Male subgroup. In addition, the Male column is eliminated in Table 4-27-C since it is not applicable.

For the intercept model, the average of the school mean SA scores for the Male subgroup is -0.36 when controlling for all predictors. FBS schools have significantly higher mean SA scores than the general D-I schools by 0.66 standard deviations when holding all other predictors constant. High Classification schools have higher mean SA scores than low Classification schools by 0.28 standard deviations. Schools with high Student-Faculty Ratio and Mean GPA tend to have higher average SA scores, with regression coefficients of 0.13 and 0.38, respectively when controlling for all other predictors. Aid and School Size have negative associations with the mean SA scores for Males: one standard deviation increase in Aid and School Size will decrease the mean SA score by 0.17 and 0.35 standard deviations respectively when holding other predictors constant.

<u>Females</u>

For the Female subgroup, results from Table 4-27-A indicate that three predictors display significant random variables. Two of them, Institution Support and GEPC, have random slopes but no significant predictors. The third one, PSD, has random slopes and significant school-level predictors, indicated by index $\beta_{PSD, j}$. The results for the slope model for PSD are shown in Table 4-27-C.

For the intercept model, Table 4-27-B shows that the average of the school mean is -0.27, when controlling for all other student-level predictors. This is the highest baseline SA score of all subgroups. The regression coefficient of Mean SATT and Mean GPA are significant predictors for the average intercept for SA, in addition to FBS, Classification, Aid, and School Size. The school mean SA score for a FBS school with high Classification, and average Aid, school size, Mean GPA and Mean SATT, is 0.25 (0.25 = -0.27+ 0.37 + 0.15). Under the same conditions, the mean SA score for a General

D-I school with low classification is -0.27. Aid, School Size, and Mean SATT have negative associations with mean SA scores: one standard deviation increase in these predictors decreases the mean SA scores by 0.17, 0.23, and 0.10 standard deviations, respectively. Mean GPA has positive associations with mean SA scores, with a slope of 0.33.

For the slope model, the average slope for PSD is 0.15 for the Female subgroup. School size is the only significant predictor for $\beta_{PSD,j}$ with a regression coefficient of -0.05. This indicates that big schools tend to have smaller PSD slopes than small schools: one standard deviation increase in school size will decrease the PSD slope by 0.05.

Compositional effects appear for Female SA. Female Student-athletes who enrolled in schools that have a higher average GPA tend to have 0.24 standard deviations higher SA scores than those who enrolled in schools with a lower average GPA.

$$\beta_{C\text{-}GPA} = \gamma_B - \gamma_w = 0.33 - 0.09 = 0.24$$

GEPC

Results for GEPC as a dependent variable for all subgroups in Models-IV/V are presented in Table 4-28. Tables A, B, and C organize the results for the Level-1, intercept, and slope models.

Table 4-28-A contains the regression coefficient of the within-school predictors for GEPC in the Level-1 models for all subgroups. Model-IV is the final model for Seniors and Females. For Freshmen and Male, Model-V is the final model since the slopes of PSD for Freshmen and GPA for Males have random variations and significant predictors, indicated by Indices $\beta_{PSD,j}$ and $\beta_{GPA,j}$. Results of the corresponding slope models are presented in Table 4-28-C.

For the Level-1 models in Models-IV/V, the association patterns and the magnitudes of the regression coefficients of student-level predictors for GEPC are almost identical to those in Model-III. The only difference is that Institution Support for Male is no longer significant in Model-IV. This causes only slight changes in the magnitudes of the regression coefficients in Model-IV for Males. Therefore, the patterns and the magnitudes of the associations shown in Table 4-28-A will not be reiterated here.

Table 4-28-A: Regression Coefficients of Within-School Predictors for GEPC in Models-IV/V

Predictors	Regression Coefficient (S.E.)			
	Senior	Freshmen	Male	Female
Deep Learning	0.26 (0.03)*	0.28 (0.02)*	**0.28 (0.03)*** †	0.24 (0.03)*
Student-Faculty Interaction	0.10 (0.02)*	**0.09 (0.02)*** †	0.06 (0.03)*	0.11 (0.02)*
Institution Support	—	0.18 (0.02)*	—	0.11 (0.01)*
Collaborative Learning	0.15 (0.02)*	0.05 (0.02)*	0.13 (0.02)*	0.10 (0.02)*
Diversity	—	—	0.04 (0.02)*	—
Relationship with Others	0.07 (0.03)*	N/A	0.08 (0.03)*	0.11 (0.02)*
EEE	N/A	0.04 (0.02)*	0.08 (0.02)*	—
High Profile	—	—	0.13 (0.04)*	N/A
Class	N/A	N/A	—	-0.17 (0.04)*
SATT	-0.09 (0.02)*	—	—	-0.09 (0.02)*
SA	0.23 (0.04)*	0.16 (0.02)*	0.17 (0.03)*	0.20 (0.02)*
PSD	0.33 (0.02)*	$\boldsymbol{\beta_{PSD,j}}$	0.37 (0.03)*	0.29 (0.02)*
GPA	—	—	$\boldsymbol{\beta_{GPA,j}}$	—

*: P<.05; N/A: not applicable; —: not significant; †: bolded coefficient denotes coefficient with random slopes

Table 4-28-B contains results from the intercept models. The association patterns between school-level predictors and mean GEPC scores (β_{0j}) are very different across subgroups. They are also very different from those for the intercept model for SA, where each subgroup has many significant school-level predictors.

The average of the school mean GEPC scores (γ_{00}) for each subgroup varies between -0.28 and 0.21. The differences between them are statistically significant based on studentized range statistics. For Seniors, there are only two significant predictors, Private Schools and Aid. For Freshmen, there are three significant predictors Private, School Size, and Mean GPA. For Males, there are five predictors that are significant: Private School, Aid, School Size, and Mean GPA, and Student-Athletes Enrollment. For Females, there are three significant predictors: Classification, SAGSA and Mean GPA.

Associations of Private with mean GEPC are complicated across subgroups: they are positive for Seniors, but negative for Freshmen and Males. Classification, Aid, and School Size have negative associations with the mean GEPC scores for the applicable subgroups.

Table 4-28-B: Regression Models for Adjusted Intercept for GEPC in Models-IV/V

Predictors	Regression Coefficient (S.E.)			
	Senior	Freshmen	Male	Female
INTERCEPT, γ_{00}	-0.28 (0.07)*	0.21 (0.07)*	0.16 (0.08)*	0.19 (0.05)*
Private	0.34 (0.08)*	-0.31 (0.08)*	-0.30 (0.10)*	—
Classification	—	—	—	-0.20 (0.06)*
SAGSR	—	—	—	0.08 (0.02)*
Aid	-0.13 (0.03)*	—	-0.07 (0.03)*	—
SA-Enroll	—	—	0.13 (0.03)*	—
School Size		-0.20 (0.04)*	-0.28 (0.04)*	—
Mean GPA	—	0.28 (0.08)*	0.51 (0.14)*	0.21 (0.10)*

*: P<.05; —: not significant

Table 4-28-C: Regression Model for Radom Slopes for GEPC in Model-V

Subgroups	Dependent Variable	Predictors	Intercept and Regression Coefficient (S.E)
Freshmen	$\beta_{PSD,j}$	Intercept	0.51 (0.04)*
		FBS	-0.20 (0.05)*
		Classification	-0.11 (0.03)*
		Selectivity	-0.11 (0.03)*
		School Size	0.12 (0.02)*
Male	$\beta_{GPA,j}$	Intercept	0.09 (0.02)*
		FBS	-0.13 (0.04)*
		Classification	0.17 (0.04)*
		Aid	-0.10 (0.02)*
		S-F Ratio	0.06 (0.02)*
		School Size	-0.07 (0.02)*

*: P<.05

Table 4-28-C contains the results of the slope model of PSD for Freshmen and GPA for Male. For Freshmen, the mean PSD slope is 0.51 across all schools. Predictors FBS, Classification, and Selectivity have negative associations with the dependent variable. However, School Size is positively associated with the slope of PSD. For Male, the mean GPA slope is 0.09. FBS, Aid and School Size negatively associated with the GPA slope, while Classification and Student-Faculty Ratio have positive association with GPA slope.

There are compositional effects for Male GEPC scores. Male Student-athletes who enrolled in schools that have a higher average GPA tend to achieve 0.42 standard deviations higher GEPC scores than those who enrolled in schools with a lower average GPA. This can be shown as:

$\beta_{C\text{-}GPA} = \gamma_B - \gamma_w = 0.51 - 0.09 = 0.42.$

PSD

Results in Table 4-29-A show that the association patterns between student-level predictors and PSD scores in Models-IV/V are identical to those in Model-III. Regression coefficients from these two models have only minor differences. Therefore, the patterns and the magnitudes of these associations will not be reiterated here.

Table 4-29-B contains results from the intercept models for all subgroups, including the baseline intercepts and the regression coefficients of the significant school-level predictors.

Table 4-29-A: Regression Coefficients of Within-School Predictors for PSD in Models-IV/V

Predictors	Regression Coefficient (S.E.)			
	Senior	Freshmen	Male	Female
Deep Learning	0.12 (0.03)*	0.13 (0.02)*	0.10 (0.03)*	0.16 (0.02)*
Institution Support	$\beta_{IS,j}$	0.31 (0.02)*	0.35 (0.02)*	$\beta_{IS,j}$
Student-Faculty Interaction	0.13 (0.02)*	0.19 (0.02)*	0.16 (0.02)*	0.17 (0.02)*
Collaborative Learning	—	0.12 (0.02)*	0.05 (0.02)*	0.11 (0.02)*
Diversity	0.08 (0.02)*	0.09 (0.02)*	0.07 (0.02)*	0.10 (0.02)*
Relationship With Others	0.09 (0.02)*	N/A	0.08 (0.02)*	0.06 (0.03)*
EEE	N/A	0.12 (0.02)*	0.11 (0.02)*	0.06 (0.02)*
Workload	0.09 (0.02)*	N/A	N/A	N/A
Mother's Education	—	0.12 (0.04)*	—	0.09 (0.04)*
SA	0.10 (0.03)*	0.10 (0.02)*	0.07 (0.03)*	0.11 (0.03)*
GEPC	0.29 (0.03)*	0.31 (0.02)*	0.33 (0.03)*	0.29 (0.02)*
GPA	—	-0.06 (0.02)*	—	—

*<.05; N/A: not applicable; —: not significant

Table 4-29-B: Regression Models for Adjusted Intercept for PSD Models-IV/ V

Predictors	Regression Coefficient (S.E.)			
	Senior	Freshmen	Male	Female
Intercept, γ_{00}	0.07 (0.05)#	-0.07 (0.05)#	-0.19 (0.05)#	-0.05 (0.09)#
Private	—	—	—	0.41 (0.11)*
FBS	-0.41 (0.14)*	—	—	—
FCS	—	—	—	-0.29 (0.06)*
Classification	—	—	0.29 (0.10)*	—
Selectivity	—	—	—	-0.25 (0.09)*
Aid		-0.08 (0.04)*	-0.13 (0.04)*	-0.10 (0.04)*
SA-Enroll	0.16 (0.07)*	—	0.10 (0.04)*	—
School Size	—	-0.13 (0.03)*	-0.29 (0.04)*	—
Mean SATT	—	-0.19 (0.07)*	-0.18 (0.07)*	—
Mean GPA	—	—	—	0.18 (0.08)*

Note: *: P<.05; #: P>.05; N/A: not applicable; —: not significant

Table 4-29-C: Regression Model for Radom Slopes for PSD in Model-V

Subgroups	Dependent Variable	Predictors	Intercept and Regression Coefficient (S.E)
Senior	$\beta_{IS,j}$	Intercept	0.04 (0.06)#
		Private	0.40 (0.07)*
		Aid	0.10 (0.02)*
		SA-Enroll	-0.08 (0.03)*
		School Size	0.27 (0.05)*
		Mean GPA	-0.61 (0.14)*
Female	$\beta_{IS,j}$	Intercept	0.32 (0.02)*
		Student Ratio	0.07 (0.03)*
		School Size	-0.12 (0.03)*

*: P<.05; #: P>.05.

As shown in Table 4-29-A Model-V is the final model for the Senior and Female subgroups. The results of the slope models for Institution Support for Seniors and Females are presented in Table 4-29-C.

Seniors

As shown in the Senior column in Table 4-29-B, the average of the school mean PSD scores across schools is 0.07 for Seniors. For schools with an average sized student-athlete program, the mean PSD for FBS schools is -0.41 standard deviations lower than the general D-I schools. The size of the student-athlete program has a positive association with the mean PSD scores: One standard deviation increase in Student-Athlete Enrollment is associated with 0.16 standard deviation increase in the school mean PSD scores, while holding other predictors constant.

As shown in Table 4-29-C, five school-level predictors, Private, Aid, Student-Athlete Enrollment, School Size, and Mean GPA, have significant associations with the slope of Institution Support ($\beta_{IS, j}$). The average slope for private schools is 0.40 standard deviations larger than public schools when controlling for all other predictors. Aid and School Size are positively associated with $\beta_{IS, j}$, with regression coefficients of 0.10 and 0.27, respectively. However, Student-Athlete Enrollment and Mean GPA have negative associations with the slope: one standard deviation increase in these predictors decreases the Institution Support slope by 0.08 and 0.61 standard deviations respectively.

Freshmen

The results from the Freshmen column in Table 4-29-B show that the average of the school mean PSD scores is -0.07. School-level variables Aid, School Size, and Mean SATT are negatively associated with the mean PSD. The predicted mean PSD scores for schools with high Aid are 0.08 standard deviations lower than those with low Aid when holding all other variables constant. One standard deviation increase in School Size and Mean SATT is associated with 0.13 and 0.19 standard deviations decrease in average PSD scores, respectively.

Males

The average of the mean PSD scores across all schools is -0.19 (shown in the Males column in Table 4-29-B), when holding all predictors constant. This value is the lowest of all subgroups. School-level predictors Classification and Student-Athlete Enrollment have positive associations with mean PSD scores, while Aid and School Size have negative associations. High Classification schools tend to have 0.29 standard deviations higher mean PSD scores than low Classification schools, when controlling for all other predictors. Schools with high Aid, on average, have lower mean PSD scores than low Aid schools, with a regression coefficient of -0.08. One standard deviation increase in Student-Athlete Enrollment is associated with a 0.10 standard deviation increase in mean PSD, while holding all other predictors constant. Both School Size and Mean SATT have negative effects on mean PSD scores, with regression coefficients of -0.13 and -0.19 respectively.

Females

The average of the mean PSD scores across all schools is -0.05 for Females (shown in the Females column in Table 4-29-B). There are significant associations between Private School, FCS, Selectivity, and Aid with mean PSD scores. For schools with Mean GPA, the average school mean PSD score is -0.05, when controlling for all other predictors. Private schools have 0.41 standard deviations higher mean PSD scores than public schools when controlling all other predictors. One standard deviation increase in Mean GPA is associated with a 0.18 standard deviation increase in mean PSD scores.

As shown in Table 4-29-C, the mean Institution Support slope is 0.32 for schools with average Student-Faculty Ratio and average school size. There will be a 0.07 standard deviation increase in the slope of Institution Support per standard deviation increase in Student-Faculty Ratio, while holding other predictors constant. School Size has a negative association with $\beta_{IS,\,j}$: one standard deviation increase in School Size is associated with a 0.12 standard deviation decrease in $\beta_{IS,\,j}$.

GPA

Tables A, B, and C in Table 4-30 present the results from the Level-1, intercept, and slope models for the dependent variable GPA. In Models-IV/V, results from Table A remain mostly the same as they were in Model-III with some exceptions. For the Freshmen, Male, and Female subgroups, indices β_{kj} indicate these slopes have significant predictors in the slope models. The detailed results for these models are presented in Table 4-30-C.

Table 4-30-A: Regression Coefficients of Within-School Predictors for GPA in Models-IV/V

Predictors	Regression Coefficient (S.E)			
	Senior	Freshmen	Male	Female
Deep Learning	0.07 (0.03)*	0.06 (0.02)*	—	0.07 (0.02)*
Student-Faculty Interaction	—	0.05 (0.02)*	—	—
Relationship with Others	—	N/A	—	$\boldsymbol{\beta_{RwO,j}}$
Diversity	-0.07 (0.02)*	—	—	—
EEE	—	—	0.06 (0.02)*	—
Mother's Education	—	0.16 (0.05)*	0.13 (0.04)*	$\boldsymbol{\beta_{MEd,j}}$
Race	-0.22 (0.07)*	-0.15 (0.05)*	—	-0.24(0.05)*
Class	N/A	N/A	$\boldsymbol{\beta_{Class,j}}$	-0.27 (0.05)*
Gender	- 0.40 (0.05)*	-0.32 (0.04)*	N/A	N/A
SATT	0.50 (0.03)*	0.46 (0.02)*	0.48 (0.03)*	0.49 (0.03)*
Satisfaction	0.07 (0.04)*	$\boldsymbol{\beta_{SA,j}}$	0.09 (0.03)*	$\boldsymbol{\beta_{SA,j}}$
GEPC	0.09 (0.03)*	0.08 (0.03)*	$\boldsymbol{\beta_{GEPC,j}}$	—
PSD	—	-0.06 (0.03)*	—	—

#: P> .05; *: P< .05; N/A: not applicable; --: not significant

Table 4-30-B: Regression Models for Adjusted Intercept for GPA Models-IV/ V

Predictors	Regression Coefficient (S.E)			
	Senior	Freshmen	Male	Female
Intercept, γ_{00}	-0.06 (0.09)#	-0.38 (0.09)*	-0.08 (0.05)#	-0.60 (0.08)*
Private	0.44 (0.11)*	0.49 (0.06)*	0.18 (0.05)*	0.91 (0.12)*
FCS	—	0.21 (0.09)*	—	—
Aid	0.07 (0.03)*	0.13 (0.05)*	—	—
SA-Enroll	—	—	-0.05 (0.02)*	—
S-F Ratio	—	-0.14 (0.05)*	—	-0.09 (0.03)*
School Size	0.23 (0.05)*	0.35 (0.06)*	0.11 (0.03)*	0.41 (0.05)*

#: P>.05; *: P<.05; N/A: not applicable; —: not significant

<u>Seniors</u>

Model-IV is the final model for Seniors since no within-school slopes display significant random variations for GPA. Therefore, there is no Senior Column in Table 4-30-C.

Table 4-30-C: Regression Model for Random Slopes for GPA in Model-V

Subgroups	Dependent Variable	Predictors	Intercept and Regression Coefficient (S.E)
Freshmen	$\beta_{SA,j}$	Intercept	0.10 (0.03)*
		Mean SATT	-0.13 (0.05)*
Male	$\beta_{Class,j}$	Intercept	-0.17 (0.06)*
		Private	0.38 (0.10)*
		S-F Ratio	-0.13 (0.05)*
		School Size	0.22 (0.05)*
	$\beta_{GEPC,j}$	Intercept	-0.02 (0.04)#
		Classification	0.23 (0.05)*
		Aid	-0.13 (0.03)*
		S-F Ratio	0.07 (0.03)
		School Size	-0.11 (0.03)*
Female	$\beta_{MEd,j}$	Intercept	-0.02 (0.05)#
		FBS	0.36 (0.09)*
		FCS	0.22 (0.08)*
		AID	0.18 (0.04)*
	$\beta_{SA,j}$	Intercept	0.26 (0.05)*
		Private	-0.23 (0.06)*
		SA-Enroll	-0.07 (0.03)*
	$\beta_{RwO,j}$	Intercept	0.20 (0.06)*
		Classification	-0.13 (0.06)*

*: P<.05; #: P>.05;

For the intercept model, school-level predictors Private, Aid, and School Size have significant associations with mean GPA. The average of the school mean GPA across schools for Seniors is -0.06. Private schools have a higher mean GPA than public schools by 0.44 standard deviations when holding all other predictors constant. One standard deviation increase in Aid and School Size is associated with a 0.07 and 0.23 standard deviation increase in mean GPA, respectively.

Freshmen

The average of school mean GPA is -0.38 for Freshmen. The variables that are significant for seniors are all significant for Freshmen as well. In addition, FCS and Student-Faculty Ratio are also significant predictors for the mean GPA for Freshmen. For private FCS schools with average Aid, Student-Faculty Ratio, and School Size, the mean GPA is 0.83 (0.83=0.49+0.21+0.13). Of all significant school-level predictors, Student-Faculty Ratio is the only one that has a negative association with mean GPA: schools with a higher Student-Faculty Ratio tend to have lower mean GPAs.

For the slope model, the mean slope of SA is 0.10 for schools with average Mean SATT scores for the Freshmen subgroup. There is a tendency for schools with higher Mean SATT to have smaller SA slopes.

Males

For the intercept model, the average of the mean GPAs across all schools is -0.08. Private, Student-Athlete Enrollment, and School Size are the only three significant predictors for mean GPA for Males. Mean GPA is 0.18 standard deviations higher for Private schools than Public schools given the same school size and student-athlete program. There is a tendency for schools with a larger student-athlete program to have lower mean GPAs. However, larger schools tend to have higher mean GPAs on average by 0.41 standard deviations per one standard deviation change in School Size.

The slopes of Class ($\beta_{Class,j}$) and GEPC ($\beta_{GEPC,j}$) for the Male subgroup have significant predictors. For the slopes of Class ($\beta_{Class,j}$), the mean slope is -0.17 for public schools with an average Student-Faculty Ratio and school size. Private schools have larger slopes than Public schools with a regression coefficient of 0.38 when controlling for all other predictors. Student-Faculty Interaction has negative associations with the slope of Class. School size, however, is positively associated with this slope. Since the Class is dichotomous, this slope model only affects the predicted GPA for Freshmen (when Class=1) Male student-athletes.

The average slope for GEPC is -0.02 across schools when holding all predictors constant. Classification has positive associations with the slopes of GEPC: high classification schools, on average, have 0.23 standard deviations higher slopes than schools with low classification. Aid and School Size have negative associations with $\beta_{GEPC,j}$, one standard deviation increase in these two predictors will decrease the GEPC slope by 0.13 and 0.11 standard deviations respectively. However, the slope will increase by 0.07 standard deviations per standard unit increase in student-Faculty Ratio.

Female

The average of the mean GPA across all schools is -0.60 for the Female subgroup. School-level predictors Private, Student-Faculty Ratio, and School Size have significant associations with the mean GPA. Given the same Student-Faculty Ratio and School Size, Female student-athletes enrolled in Private schools, on average, have 0.31 (0.31 = -0.60 + 0.91) standard deviations higher GPA scores than those in Public schools. Student-Faculty Ratio has negative associations with mean GPA: one standard deviation increase in Student-Faculty Ratio will decrease the mean GPA by 0.09 standard deviations when controlling all other predictors. However, the mean GPA will be increased by 0.41 standard deviations per one standard deviation increase in school size.

There are three slopes $\beta_{RwO,j}$, $\beta_{MEd,j}$, and $\beta_{SA,j}$ that have significant predictors in the slope models. For the slope of Relationship with Others (RwO), the mean slope is 0.20. High Classification schools have -0.13 standard deviations smaller slopes than low Classification schools.

For the slope of Mother's Education (MEd), the predicted slopes of general D-I schools with average Aid will be -0.02. FBS and FCS schools have 0.36 and 0.22 standard deviations larger slopes than general D-I schools respectively, while holding Aid constant. For general D-I schools, those with high Aid have 0.18 standard deviations larger slopes than low Aid schools.

For the Slopes of SA, public schools with an average sized student-athlete program will have a mean slope of 0.26. Private schools have 0.23 standard deviations smaller slopes than public schools when controlling for all other predictors. Increasing the student-athlete program size will decrease the slope by 0.07 per standard deviation increase in SA-Enroll.

Summary for Models-IV/V:

In the Intercepts-as-Outcomes models, the baseline intercepts vary dramatically across subgroup and college outcomes. Studentized range statistics show significant differences between these intercepts within each subgroup.

The relationship between school-characteristics and the intercepts of the student-level models did not show clear patterns across subgroups for any of the college outcome variables. The regression coefficients of the school characteristics in the intercept models also varied greatly across subgroups and college outcomes.

The Slopes-as-Outcomes models do not show clear patterns of the relationships between within-school slopes and school-characteristics across all subgroups and all college outcomes. For the random slopes that have significant predictors, however, it is very common that predictors account for a significant amount of variance. This leads to the remaining variances being insignificant, which will be shown in the following section.

Model-IV and V provide evidence that Structural/Organizational Characteristics of institutions (school characteristics in this research) and Student Background and Precollege Trait (student profile variables in this research) in Pascarella's model (as shown in the initial model in Chapter Two) did not explain as much of the variances as the Environmental variables (engagement factors in this research) for the college outcomes SA, GEPC, and PSD. However, these two sets of inputs did explain more variances than the environmental variables for GPA as college outcomes. Therefore, the application of Pascarella's model to student-athlete data needs caution.

Variance decomposition for Models-III, IV, and V

Table 4-31 contains the variance decomposition information for Models-III, IV, and V. Between-school variance from Model-III will be used as the baseline value to compute the percentage of variance explained in Models-IV and V.

Within-school variances and the proportion explained by Models-IV and V are not reported in this table since they remain the same in Model-IV and V as they were in Model-II. Readers should refer to Table 4-22 for this information.

Summary of the Variance Decomposition for Model-IV

As shown in Table 31, within-school variances in Model-III are smaller than those in Model-I (see Table 4-22: Variance Decomposition for Model-I and II) due to the change in centering method from grand-mean centering in Model-I to group-mean centering in Model-III. GPA has slightly larger within-school variances (ranging from 0.68 to 0.70) than the other three college outcomes (ranging from 0.48 to 0.68).

Table 4-31: Variance Decomposition For Models III, IV, and V

Dependent Variable	Student Subgroups	Within-School Variance	Between-School Variance	% of Between-school Variance Explained	
		Model-III	Model-III	Model-IV	Model-V
SA	Senior	0.57	0.06	87%#	86%#
	Freshmen	0.68	0.04	49%	54%
	Male	0.63	0.06	63%	N/A
	Female	0.61	0.03	69%	70%
GEPC	Senior	0.54	0.04	61%	N/A
	Freshmen	0.51	0.04	37%	31%
	Male	0.50	0.04	44%	47%
	Female	0.52	0.03	50%	N/A
PSD	Senior	0.51	0.09	11%	11%
	Freshmen	0.48	0.05	14%	N/A
	Male	0.50	0.06	45%	N/A
	Female	0.49	0.04	33%	32%
GPA	Senior	0.68	0.04	79%#	N/A
	Freshmen	0.68	0.08	50%	52%
	Male	0.70	0.02	85%#	93%#
	Female	0.69	0.10	55%	57%

#: P>.05

Between-school variances in Model-III, however, are larger than in Model-I for SA, GEPC, PSD, and Female GPA. As explained earlier, it is possible that more differences between schools than between students. The decrease of the between-school variance in GPA for the Senior, Freshmen, and Male subgroups suggests that group-mean centering GPA is more appropriate than grand-mean centering. The grading standard for each school may differ: even though the GPAs are on the same scale they may not be commensurate with each other.

School-level predictors in Model-IV explain 11% to 87% of the between-school variances in Model-III (the baseline model) across subgroups and college outcomes. In general, school-level predictors account for more variances for college outcome SA (49 to 87 percent) and GPA (50 to 85 percent) than for GEPC (37 to 6 percent) and PSD (11 to 31 percent). In Senior SA and GPA, and male GPA models, school-level predictors explain the majority of the between-school variances. The remaining variances for these subgroups are insignificant.

Summary of the Variance Decomposition for Model-V

As shown in Table 4-31, for the applicable subgroups and college outcomes, school-level predictors in Model-V explain 11% to 93% of the between-school variance in Model-III (the baseline model). Compared to Model-IV, the proportions of variance explained show a slight increase or remain at the same level. These small changes may be caused by rounding since the between-school variances are very small in Model-IV and V, ranging from 0.001 to 0.08.

Table 4-32 shows the between-school variances for the slopes and the percentage explained by including school-level variables in the Slopes-as-Outcomes models in Model-V. The between-school variances of the random slopes from Model-III serve as the baseline value for those in Model-V to compare to. As described previously, for some random slopes, there are no school-level predictors that are significantly associated with the slopes. Therefore, for these slopes the variances in Model-V remain the same as in Model-IV. These values are not presented in this table.

Table 4-32: Between-School Variances of Slope Models for Model-V

Dependent Variable	Student Subgroups	Predictors	Model-III Between-School Variance	Model-V Between-school Variance	Model-V % of Between-school Variance Explained
SA	Senior	GEPC	0.010	0.006 #	42%
		Relationship with Others	0.007	0.006 #	18%
	Freshmen	High Profile	0.059	0.030 #	49%
		Institution Support	0.010	0.007 #	38%
	Female	PSD	0.011	0.009	18%
GEPC	Freshmen	PSD	0.009	0.007 #	20%
	Male	GPA	0.008	0.001#	88%
PSD	Senior	Institution Support	0.009	0.001 #	83%
	Female	Institution Support	0.012	0.001 #	90%
GPA	Freshmen	SA	0.015	0.010#	35%
	Male	Class	0.040	0.018 #	55%
		GEPC	0.011	0.001 #	90%
	Female	Mother's Ed	0.062	0.031#	50%
		Relationship with Others	0.008	0.008	0%
		SA	0.015	0.007#	52%

#: P>.05

The between-school variances of the slopes range from 0.007 to 0.062. School characteristic variables explain 18% to 90% of the variances of the random slopes across subgroups and dependent variables. For most of the slopes, the remaining variances are insignificant. There are two exceptions: one is the slope of PSD for Female SA, with 18% of variance explained, and the other is the slope of Relationship with Others for Female GPA, which does not explain any of the variance.

Summary of Chapter Four

The results from Models-II, III, IV, and V show that there are different engagement patterns for each of the student-athlete subgroups for each college outcome. Although the association patterns are different across student-athlete subgroups, there are more similarities for the same college outcome than for different college outcomes. GPA, however, has very distinct association patterns for SA, GEPC, and PSD across subgroups.

Engagement factors, student profile variables, and college outcome variables (as predictors) at the student-level explain a significant amount of within- and between-school variances in Model-II and Model-III. School characteristics also explain a significant amount of between-school variances in both intercept and slope models.

The above results provide evidence that different student-athlete subgroups do have different engagement patterns for each college outcome. Studying and understanding the differences will help student services and athletics to improve their services and programs to further assist student-athletes to excel in college experiences.

This research has also provided the different association patterns between school-level variables and college outcomes for each student-athlete subgroup. This information will provide reference for higher education institution with different school characteristics when seeking appropriate modeling to improve student-athletes' college outcomes.

CHAPTER FIVE: SUMMARY, DISCUSSION, AND IMPLICATIONS

The first section of this chapter presents a summary of the study, including the purpose, theoretical framework, methodology, and results. The next section contains a discussion of the findings and their implications. The concluding section addresses the limitations of the study and offers some recommendations for further research.

Summary

This study explored the nature of student-athletes' engagement in educationally purposeful activities in order to describe their engagement patterns, to investigate how they use the resources their universities provide, and to uncover statistical relationships between student engagement factors and targeted college outcomes. This study investigated the engagement patterns by class and by gender for student-athletes who enrolled in Division-I institutions. It utilized two major data sets: The National Survey for Student Engagement (NSSE) 2006 and aggregated school level data from National Collegiate Athletic Association (NCAA).

The theoretical framework for this research was derived from the college impact models of student change. The model utilized for this study was based on Astin's (1970) Input-Environment-Outcome (I-E-O) model and Pascarella's (1985) general model for assessing desired college outcomes. Hierarchical Linear Models (HLM) were applied to examine the complex relationships between student profile variables, school characteristics, engagement factors, and college outcome variables.

Three sets of research questions guided this investigation:

1. Which model best describes the statistical associations among the engagement factors and college outcomes?
    a. How does the best-fitting model vary by class and by gender?
    b. To what extent do the engagement factors account for the variation in college outcomes?
2. How do the statistical relationships in Question #1 change when student profiles and college outcome variables (as predictors) are introduced in the models?
3. To what extent do school characteristics account for between-college variation in college outcomes?

Based on the theoretical framework described in Chapter Two and the research methodology introduced in Chapter Three, student-athletes' engagement data was analyzed. Chapter Four presented the results and summarized the engagement patterns in relation to college outcomes. It also included the statistical evidence of the magnitude and direction of the associations between engagement factors, student profile variables, and school characteristics with college outcomes for all student subgroups.

In summary, the results from this study show that the engagement patterns for the college outcomes Satisfaction (SA), General Education and Personal Competence (GEPC), and Personal and Social Development (PSD) are very similar across student-athlete subgroups, but differ from those for GPA. These results show that engagement in educationally purposeful activities is the best predictor for student-athletes' college outcomes (except GPA) that are the focus of this study. The analyses also reveal that what students do on campus contribute more to their college outcomes than who they were at matriculation and which school they attend.

Discussion of the Results

Engagement Factors and College Outcomes

This study has shown evidence that the set of Five Benchmarks created for the general population by National Survey of Student Engagement (NSSE) was not suitable for student-athlete data. Exploratory Factor Analysis (EFA) with Principal Component Analysis (PCA) and Varimax rotation was applied to a survey sample of 2596 student-athletes and constructed 6 to 7 suitable engagement factors for the applicable student-athlete subgroups. These engagement factors were based on 22 to 25 suitable component items from the original 42 component items of the Five Benchmarks.

This study focuses on four types of college outcomes. Three of them: SA, GEPC, and PSD, were latent variables that were constructed by EFAs with PCA and Oblique rotation based on NSSE items. The forth college outcome, GPA, is the student self-reported data to the NSSE 2006 survey.

Model-I

The results of the one-way ANOVA for Model-I revealed that over 90% of the total variation is within schools for the outcome variables student-athletes' SA, GEPC, PSD, and GPA, and between-school variances ranged from 2% to 9%. Although the between-school variances are relatively small, they are worth exploring since there is limited research regarding institutional differences with respect to these outcomes for student-athletes.

Model-II-A

Engagement Factors were grand-mean centered in Model-II-A. Results of Model-II-A indicated that without student and school characteristics, student-athletes' engagement patterns, the patterns of how engagement factors associated with college outcomes, were very similar across class and gender subgroups for college outcome variables SA, GEPC and PSD. Engagement factors Deep Learning, Student-Faculty Interaction, Institution Support, and Relationship with Others were positively and significantly associated with these three college outcome variables across all subgroups. The engagement patterns for GPA were different from SA, GEPC, and PSD in that: (1) the engagement patterns were very different across subgroups, (2) only one engagement factor, Deep Learning, is significant for all subgroups, and (3) engagement factor Diversity is negatively associated with GPA for Seniors.

Engagement factors explained 20% to 40% of the within-school variances for SA, GEPC, and PSD across student-athlete subgroups. By contrast, for GPA, the variances explained by engagement factors were small, ranging from 2% to 5% across subgroups.

Model-II-B

Model-II-B was built upon Model-II-A with student profile variables as additional predictors. All interval scaled predictors were grand-mean centered. The results from this model revealed that some of student profile variables were significant predictors for SA, GEPC, and PSD. With some exceptions, each engagement factor still had statistically significant associations with these three outcome variables with magnitudes similar to those in Model-II-A; that is, including student profile variables in Model-II-B did not materially weaken the strength of the associations between the engagement factors and SA, GEPC, and PSD.

Introducing student profile variables as predictors in Model-II-B, however, accounted for very little of the within-school variances for SA, GEPC, and PSD. The proportions of within-school variances explained increased by only 0-2% over those in Model-II-A. This finding is consistent across subgroups for SA, GEPC, and PSD.

Student Profile variables have very different association patterns with GPA in comparison to SA, GEPC, and PSD. Five out of six student profile variables, Mother's Education, Race, Class, Gender, and SATT, were significant for all applicable subgroups, with the exception of Mother's Education for Seniors. In addition, the within-school variance explained by Model-II-B for GPA was between 22% and 28%. This is a notable increase from Model-II-A where the variance explained was between 3% and 5%.

Model-II-C

Model-II-C was built upon Model-II-B with three of the college outcome variables as additional predictors with the fourth as the dependent variable. As in the previous two models, all interval scaled predictors were grand-mean centered. Model-II-C explained 28% to 50% of the within-school variances for SA, GEPC, and PSD across subgroups. This is a 5% to 10% increase over Model-II-B and is due to the inclusion of applicable college outcomes as predictors in Model-II-C.

SA, GEPC and PSD are significant predictors to all applicable dependent variables (not including GPA). GPA as a predictor, however, was only significant for Freshmen, Males and Females' SA, Males' GEPC, and Freshmen's PSD.

For GPA as a dependent variable the percentage of within-school variance explained was much smaller than for the other three college outcomes, from 24% to 29%. This is only 0% to 2% more than Model-II-B across subgroups. For GPA, SA as a predictor was the only significant college outcome for all subgroups.

Model-III

Model-III is built upon Model-II-C by group-mean centering interval scaled student-level predictors and letting slopes in Level-2 models vary randomly across schools. In Model-III, the significance of predictors and their association patterns with college outcomes remained similar to those in Model-II-C.

In general, across subgroups, the relationships between the predictors and college outcomes (as dependent variables) were more similar for the same college outcome variable than between different college outcome variables. There were similar engagement patterns for GEPC and PSD in that (1) nearly all the engagement factors along with SA, GEPC and PSD (as predictors) had significant associations with the dependent variables; (2) nearly all the student profile variables were insignificant across subgroups. Again for this model, GPA showed very different relationships with applicable predictors when compared to SA, GEPC, and PSD.

As dependent variables, college outcomes SA, GEPC, and PSD were each significantly and positively associated with the other two college outcomes (as predictors). In addition, the engagement factors Deep Learning, Student-Faculty Interaction, Institution Support and Relationship with Others were frequently significant predictors for college outcome variables. Student profile variables Father's Education, High Profile, and Gender, however, did not have significant associations with any of the dependent variables. It should be noted that Race (Black=1; Otherwise=0) and Gender (Male=1; Female=0) were negatively associated with the dependent variables, while Class (Freshmen=1; Senior=0), High Profile (High Profile =1, Otherwise=0), and SATT show inconsistent signs of association with dependent variables across subgroups.

For each college outcome, not every student-athlete subgroup had predictors with random slopes in Model-III. There were three or fewer random slopes per model for those that did have random slopes. The variances for those random slopes ranged from 2 to 7% of the overall variance.

The within-school variances explained by Model-III remained similar to those in Model-II-C, with a less than 2% change for SA, GEPC, and PSD. For GPA, the change was less than 4%. These differences might be due to the change in centering method and minor changes in predictors for some cases.

Model-IV

Model-IV is built upon Model-III by including school-level predictors in the Intercepts-as-Outcomes model in the Level-2 model. All baseline intercepts in this model varied significantly across subgroups and outcome variables. The relationship between school-characteristics and the intercepts of the student-level models did not show clear patterns across subgroups for any of the college outcome variables. The regression coefficients of the school characteristics in the intercept models also varied greatly across subgroups and college outcomes.

The proportion of between-school variance explained by school-level variables in the Intercept-as-Outcomes models varied greatly between subgroups and college outcome variables. School-level predictors account for a greater proportion of the total variance for SA and GPA than for GEPC and PSD. Nevertheless, for a particular outcome, the senior subgroup typically had more variance explained by school-level variables than other subgroups.

Model-V

Model-V is built upon Model-IV by including school-level predictors in the Slopes-as-Outcomes models to the student-level random slopes. Not all of these random slopes had significant predictors. For those without significant predictors, Model-IV is the final model. For those that did have significant predictors, Slopes-as-Outcomes models were built. These models, however, did not show clear patterns of which random slopes have significant predictors. In addition, there were no clear patterns of which school-level variables were significant predictors to the random slopes.

A significant proportion (mostly between 20-90%) of the variance for each random slope was explained by school characteristic variables across subgroups and dependent variables. For most of these slopes the remaining variances were insignificant.

Summary of Findings by Engagement Factor and College Outcome

This section presents a summary of the findings for engagement factors and college outcomes based on Model-IV/V. First, the findings for the eight engagement factors are discussed, including comments on their importance to this study. Second, four college outcomes (as dependent variables) are discussed, including comments about the differences in association patterns by student-athlete subgroups.

Engagement Factors

<u>Deep Learning</u>

Deep Learning indicates the degree to which institutions emphasize intellectually challenging activities. Examples of these types of activities include tasks that involve analyzing basic elements of an idea, synthesizing and organizing ideas, making judgments about the value of information, and applying theories or concepts to practical problems (see Appendix I: NSSE Survey Instrument 2006). The importance of Deep Learning is addressed by NSSE 2000: "Challenging intellectual and creative work is central to student learning and collegiate quality" (p. 9). Deep Learning plays an important role for college outcomes in this study. It was the only engagement factor that was significantly associated with all college outcomes for most of the subgroups. This finding is consistent with the work of Chickering and Gamson (1987), outlined in their *Seven Principles for Good Practice in Undergraduate Education (Seven Principles)* regarding active learning: the practices of talking, thinking, writing, and applying what students have learned eventually integrates the knowledge and skills into their being. This study supports the hypothesis that Deep Learning is an important engagement factor for student-athlete outcomes and merits consideration when considering how to strengthen those outcomes.

Student-Faculty Interaction

Student-Faculty Interaction refers to the frequency of student-athletes' interactions with faculty both inside and outside of the classroom. It is considered one of the most important factors in keeping students focused on learning, promoting their motivation, and improving their engagement in educational activities (Chickering & Gamson, 1987). This factor was significantly associated with student-athletes' satisfaction, gains in the general education, and personal and social development across all student-athlete subgroups. These results are consistent with those of numerous other studies that indicate frequent interaction with faculty inside and outside of the classroom is strongly associated with student learning, increased social integration, and enhanced intellectual development (Astin, 1993a; Pascarella & Terenzini, 2005; Tinto, 1993, 2000; Umbach et al., 2006).

One interesting result in this study was that the regression coefficient of Student-Faculty Interaction for students' general education and personal competence is greater for Females than for Males. Some research has found gender differences in student-faculty interaction (Marx et al., 2008; Meyer, 1990), but others contradict this finding (Comeaux & Harrison, 2007; Umbach et al., 2004). The regression coefficient is consistent across gender groups for satisfaction and gains in personal and social development. Given the possible gender difference in associations of engagement factors with college outcomes, the interpretation of the relationship between Student-Faculty Interaction and college outcomes should be done with caution.

Relationship with Others

Relationship with Others attempts to capture the quality of student-athletes' relationships with peers, staff, and faculty. This engagement factor is significantly associated with student's satisfaction, gains in general education and personal competence, and personal and social development. These results are supported by research literature, which regards interacting with peers as a highly influential factor on almost all aspects of a student's development, including student's academic and personal development (Astin, 1993b; Gaston-Gayles & Hu, 2009). Results from this study also support the hypothesis that forming a positive connection with faculty and/or staff enhances student commitment and, in turn, is associated with gains in essential skills and competence (Chickering & Gamson, 1987; NSSE, 2000).

Institution Support

Institution Support reflects student-athletes' perceptions of how much emphasis their institutions place on providing support for them to thrive both academically and socially. Results from this study show that Institution Support was a significant factor in predicting students' satisfaction, gains in general education and personal competence, and personal and social development. This is consistent with the results from NSSE (2000, 2005) that students tend to have a higher level of satisfaction when they feel the institutional environment is supportive of their academic and social needs. These results also show that the associations between Institution Support and gains in personal and social development across subgroups were much stronger than those for satisfaction and general education and personal competence. This suggests that gains in personal and social development are more sensitive to change in Institution Support.

Collaborative Learning

Collaborative Learning represents student-athletes' experience working with others inside and outside of classroom. Working with others provides student-athletes opportunities to learn from people with different experiences and gain skills that will benefit them every day. This factor shows a significant and positive association with both GEPC and PSD. This result is supported by the Seven Principles, which state that working with others enhances learning and engagement. The importance of Collaborative Learning is also addressed in NSSE (2005), which states that students who are active in collaborative learning also tend to participate more often in other educational activities. In turn, these activities are associated with greater gains in college outcomes.

Enriching Educational Experience (EEE) and Diversity

EEE and Diversity are constructed from a subset of items comprising the NSSE benchmark Enriching Educational Experiences (EEE). EEE in this study is a measure of student-athletes' participation in learning opportunities that complemented their academic programs inside and outside of the classroom. EEE has significant associations with gains in personal and social development for the Freshmen, Male and Female subgroups. It is also significantly associated with gains in general education and personal competence for Freshmen and Males.

Diversity measures the frequency of student-athletes' interactions with peers from different backgrounds. It is significantly associated with gains in personal and social development across all subgroups. These results are supported by research that suggests college outcomes are enhanced when students are exposed to diversity and participate in various learning opportunities (NSSE, 2000, 2005). It should be noted that Diversity is only significantly associated with Senior GPA but it is a negative association. This specific association does not appear to have been studied. Future studies could further explore this relationship.

Workload

Workload represents the nature and the amount of assigned academic work, including reading and writing. It is linked to the NSSE benchmark Level of Academic Challenge. The literature suggests that when students spend more time in reading and writing, they gain more in essential skills and competencies (NSSE 2000). In this study, Workload was a unique engagement factor for the Senior subgroup only. It was a significant predictor for student-athlete's satisfaction and gains in personal and social development. Increasing workload resulted in a decrease in student-athletes' satisfaction but increased gains in personal and social development.

Overall

The engagement factors constructed in this study are appropriate and significant predictors for student-athletes' college outcomes. They closely matched with key elements in research on student engagement in educationally purposeful activities. These engagement factors are constructed from a subset of the component items employed by the NSSE Five Benchmarks, and are reasonably well aligned with those engagement categories and with the known good practices for undergraduate education (Astin, 1993a; Chickering & Gamson, 1987; NSSE, 2000, 2005; Pascarella & Others, 1991). Overall, most of the engagement factors have positive associations with college outcomes (SA, GEPC, and PSD) across subgroups. These results suggest that student-athletes do benefit from increasing engagement in different ways.

College Outcomes

Overall, college outcome variables *SA*, *GEPC* and *PSD* had similar patterns of association with the engagement factors: four of the engagement factors were significant for SA and six for GEPC and PSD. These predictors explained 30-40% of the total within-school variance across college outcomes and subgroups. These findings are supported by numerous studies on college outcomes; namely, that time and energy expended in educationally purposeful activities are the best predictors for college outcomes (Astin, 1993a; Kuh, 2003b; Pascarella & Terenzini, 1991).

In addition to the engagement factors, this study found college outcomes SA, GEPC and PSD (when they function as predictors) are positively and significantly associated with other college outcomes. They accounted for an additional 5 to 10% of the within-school variances for SA, GEPC, and PSD beyond that explained by the engagement factors and student profile variables. This result suggests that SA, GEPC, and PSD might be important when considering enhancement of other types of college outcomes.

For SA, GEPC, and PSD, across subgroups, there were generally only one or two student profile variables that were significant. In addition, these associations did not form consistent patterns across subgroups and college outcomes. Even when they were statistically significant, student profile variables explained less than 2% of the total variance.

The results presented in the previous three paragraphs are consistent with (Astin, 1993b; Chickering & Gamson, 1987; National Survey of Student Engagement, 2000, 2005; Pascarella & Terenzini, 1991) who stated that "what students do during college counts more in terms of desired outcomes than who they are or even where they go to college'' [p. 1]. This study concludes that student-athletes' engagement factors, which are different from those Five Benchmarks for the general population, are important predictors of key student-athletes' college outcomes.

GPA had very different association patterns with student-level predictors than did SA, GEPC, and PSD. There were only one or two significant engagement factors for each subgroup, when most of the engagement factors were significant for the other three college outcomes (as dependent variables). There were five student profile variables that were significant predictors of GPA for all subgroups. These profile variables accounted for most of the within-school variances explained. College outcomes SA and GEPC were significant predictors for GPA.

Implications

This dissertation has yielded many significant findings based on current data sets, a sound theoretical framework, and appropriate research methods. The implications presented in this section should be beneficial to Division-I universities in general. In particular, they should be helpful for student affairs professionals, educators and administrators who provide student service activities, work with student-athletes, and intend to improve student-athletes' college engagement and experience with the goal of promoting college success.

Implication of Engagement Patterns

This dissertation examined student-athletes' engagement patterns by class and by gender. The results show most of the engagement factors are very important for student-athlete subgroups, which is consistent with numerous studies in student engagement (Astin, 1993a; Chickering & Gamson, 1987; NSSE, 2000, 2005; Pascarella & Terenzini, 1991). This study also shows the differences between engagement patterns by class and gender, and by college outcomes. The findings of this study can inform institutional leaders and Athletics Directors who intend to improve programs and activities for student-athletes.

With regard to practice, researchers and educators should pay attention to the engagement pattern differences between college outcome variables and between student-athlete subgroups. For example, Institution Support is an important predictor for both GEPC and PSD. However, the strength of the associations of Institution Support with GEPC and PSD across subgroups was very different. For GEPC, Institution Support has regression coefficients of 0.18 for Freshmen, 0.07 for Males, and 0.11 for Females.

However, it was insignificant for Seniors. In contrast, Institution Support has much stronger and consistent associations with PSD, with regression coefficients ranging from 0.30 to 0.35. Taking account of the variation in these patterns might assist researchers and educators in developing and improving programs or activities that would have a positive impact on student-athlete's college success. Understanding the differences in the strength and direction of the associations may lead to improvements in related programs and policies targeted at student-athlete subgroups. Division-I universities could ultimately use the findings of this study to improve curriculum and instruction for student-athletes.

Implications of Student-Profile Variables

Some of the student profile variables are significant predictors of college outcomes. Their relationships with college outcomes, however, lack consistency across college outcomes and subgroups. In addition, these student profile variables did not account for much of the variance. When applying Model-II and Model-III to study student-athlete engagement, researchers should consider student-level variables and report results cautiously because these variables show complex relationships with college outcomes across subgroups. For example, mother's education level and student SATT scores should not be used to predict student-athletes' satisfaction scores. Mother's education level and student-athlete SATT scores, however, are significant predictors for GPA; thus, as predictors of GPA, they are worthy of examination.

Race, gender and High Profile variables are commonly used categories when examining the different college outcomes. In this study, Race differences were shown in two of the college outcomes, SA and GPA, across student-athlete subgroups. Black student-athletes have lower satisfaction scores and GPA than non-Black student-athletes.

The magnitudes of race difference in satisfaction were consistent across subgroups, but they varied significantly for GPA across subgroups.

Male student-athletes had lower GPA than Females. This finding was consistent with other research results (Pascarella & Others, 1991; Pascarella & Terenzini, 1995). However, Gender was not a significant predictor for SA, GEPC, and PSD, which suggested that there were no significant gender differences in these college outcomes.

High Profile only differed from its counterpart for Freshmen and Males' SA and Male GEPC. In addition, the direction and magnitude of the associations were inconsistent for these two college outcomes. This study revealed that students who played high profile sports had lower satisfaction scores than their counterparts. However, the High profile student-athletes gained more in the general education and personal competence than their counterparts. Thus, the patterns of association of participation in high profile sports with college outcomes were relatively weak and inconsistent.

Implication of Using College Outcomes as Predictors

This research also suggested that using college outcome variables as predictors to account for variation in other college outcomes can be useful, as they explain a significant amount of variation. Results from this study suggest that most of the college outcomes are strongly associated, even after taking into account engagement factors and student profile variables. Consequently, fostering gains in one college outcome may well lead to gains in others. An implication of this result would be that promoting a targeted college outcome could also result in the improvement of college outcome variables that are strongly associated with the targeted college outcome. For example, if a university is interested in improving senior student-athletes' gains in GEPC, one way to accomplish this may be to improve PSD by reinforcing activities that foster Institution Support. This is because PSD has the strongest association of all predictors with GEPC. At the same time, Institution Support has the strongest association with PSD. Increasing Institution Support may not directly improve GEPC for Seniors since Institution Support was insignificant for Senior GEPC, but it may significantly improve PSD scores, which in turn may increase gains in GEPC.

Implications of School-Level Variables

As suggested in Model-IV and Model-V, some school characteristics were significant predictors of Level-1 intercepts and slopes. Thus, another way of applying the results from this study might be to improve college outcomes indirectly by modifying certain school characteristics that are significantly associated with those intercepts and slopes. For example, decreasing the student-faculty ratio could help improve mean GPA (the intercepts in the Level-1 model) for Freshmen and Female student-athletes. Controlling the size of the school's athletics programs may positively affect engagement behaviors (the slopes in the Level-1 model) for some student-athlete subgroups, thus possibly improving their college outcomes. However, it may hurt other subgroups. Therefore, applying these results needs to be done with care because of the complex relationships between school-level variables and Level-1 intercepts and slopes.

It is often the case in multi-level models that between-school variances are relatively small. This dissertation has provided evidence that some school-level variables are significant predictors for the intercepts and slopes as outcome variables. These school-level variables explain a significant proportion of between-school variance. When applying a similar methodology to student-athletes' data in other studies, researchers should consider whether analyzing between-school variances of this size would provide practical and meaningful information to serve the purpose of the study. The methodology and research findings provided by this dissertation may also be used to guide future studies in which the purpose is to compare the similarities and differences of student engagement among universities from the same or different conferences, regions, or other categories.

Limitations

In addition to the discussion in Chapter Three regarding missing data, this study has several other limitations. First, this data set is cross-sectional, and captures only a snapshot of students' development. A longitudinal database for the same institutions that have participated in the NSSE programs for several years would give a more informative picture of how engaging in educationally purposeful activities contributes to college outcomes over time. If the analysis of data measured student-athletes' engagement patterns over time from multiple years, the results could differ in a number of ways.

Many recent studies use certain class and gender categories (for example, Senior Male student-athletes) when making comparisons among student-athletes. This study, however, is limited by the fact that only one year of data is available. The total number of participating student-athletes is not sufficient to explore their engagement patterns by class and gender simultaneously. In addition, some schools with a small number of participating student-athletes were eliminated from this study. A future study could consider using aggregated survey data from multiple years from the same school. This will increase the number of schools with sufficient participating student-athletes and make is possible to conduct analyses by class and gender together, allowing comparisons with other research results utilizing similar student categories.

Second, the outcomes variables SA, GEPC, and PSD were constructed from self-reported data. There is substantial literature supporting the credibility and validity of self-reported data (Kuh, 2001). However, Pike (2006) points out that using a single measurement method in validity studies for self-reported data alone may “produce misleading results due to shared, method-specific variances” (p. 557).

Another limitation associated with the nature of self-reported data is that there may be ambiguity in the interpretation of the questions by student-athletes. When specific instructions are not given, respondents may process the questions differently. For example, with questions regarding student-faculty interactions, some student-athletes may include their interactions with coaches and counselors as part of their student-faculty interactions (since these interactions are an important part of their athletic lives), while other student-athletes and non-athletes may not.

Third, this research lacks baseline information, for example, students' pre-college behavioral patterns. It is difficult to determine to what extent the college outcomes were due to value added by the faculty and the college environment. Without information about how students spent their time and effort during high school, it is impossible to measure gains.

Fourth, measuring student-engagement for first year student-athletes may be too early. Given only a short period of time to experience their new school, they have had limited exposure to engagement activities. In addition, making the transition from high school to college is challenging, especially for student-athletes. Given this, some of the items in NSSE might not have been appropriate for freshmen.

Fifth, this study has explored the relationships between student-athletes' college experiences and college outcomes focusing on academic and personal development. However, there are other important college experiences for student-athletes that are not included. For example, an important aspect of student-athletes' college experience is their spiritual engagement and development in college. Future studies should consider a wider range of student-athletes' college experiences in addition to those in this study to provide a more complete picture of how student-athletes spend their time and effort and how these experiences are associated with college outcomes.

A final limitation for this study is that the results from this study are based on data from universities with larger athletic programs. Due to the nature of the multilevel analysis, schools with a small number of students who participated NSSE 2006 are eliminated from this study. Future studies may reveal different engagement patterns and relationships when applying this methodology to smaller programs.

Recommendations for Future Research

This dissertation has provided engagement models for student-athlete subgroups and valuable results based on the available data sets. Nevertheless, there are several possible ways to improve the research design and methodology for future research.

In this study, there was a very limited proportion of variance explained by the student and school-level variables for some college outcomes across subgroups. It is possible that there are other factors that could account for those unexplained variances but are not included in this study. In future studies, additional predictors should be explored.

In the limitations section of this chapter, it was suggested that this methodology could capture student-athletes' changes in engagement patterns and their growth in desired college outcomes over time if it is applied to longitudinal data with pre-college information. It was also suggested that survey instruments should include proper items that measure the first-year student-athletes' engagement activities. Some survey items asked students whether they have done or plan to do certain activities that were associated with enriching their educational experience before they graduate from college. Including items that reflect their actual college experiences instead of their desired experiences may draw a different picture of Senior student-athletes' engagement patterns. To address these limitations, future studies could enhance the accuracy in estimating the relationships between student-athletes' engagement activities and desired college outcomes.

The NSSE survey instrument used in this study included questions about students' engagement activities, their lives on campus, conceptions about school, relationships with staff and other students developed for the general population. It served the purpose for this study to depict the nature of student engagement and the engagement patterns for student-athletes in a general college setting. The literature suggests that the specifically athletic aspects of their lives have a significant effect on student-athletes' academic and social lives on campus as discussed in Chapter Two. In future studies with similar research goals, a dataset including information from their athletic lives will improve the precision in depicting engagement patterns. For example, questions about student-athletes' relationships and interactions with coaches, assistant coaches, teammates, and staff for athletics departments should be asked separately from similar questions regarding their lives as general college students. It should also increase the accuracy for estimating the relationships between engagement factors, student and school characteristics, and college outcomes.

Closing Thoughts

This study investigated the nature of student engagement in educationally purposeful activities by student-athletes. It offers a set of new engagement factors that reflect current college practices and activities for student-athletes as reported by students themselves. The results describe student-athletes' engagement patterns and the relationships between engagement factors and desired college outcomes by class and gender. They also offer some sense of how student-athletes spend their time and effort on activities that are related to important college outcomes. They constitute a starting point for discussions of what student-athletes do, how well they do, and what should be changed. The results of this study have implications for higher education athletic programs with respect to policies to improve student-athletes' college experiences. This research along with other related studies could inform college administrators on how to better fulfill their primary obligations of creating genuine education opportunities for their student-athletes and fostering their holistic development.

Reference

Adelman, C. (1990). *Light and shadows on college athletes: College transcripts and labor market history* (No. OR-91-504). Office of Educational Research and Improvement (ED), Washington, DC.

Adler, P., & Adler, P. A. (1985). From idealism to pragmatic detachment: The academic performance of college athletes. *Sociology of Education*, *58*(4), 241–250.

Aitkin, M., Anderson, D., & Hinde, J. (1981). Statistical modelling of data on teaching styles. *Journal of the Royal Statistical Society, Series A*, *144*(4), 419–461.

Alexander, P. A., & Murphy, P. K. (1994). The research base for APA's learner-centered psychological principles. Presented at the Annual Meeting of the American Educational Research Association, New Orleans, LA.

Arnold, J. C., & Others. (1993). Student age and enrollment status as determinants of learning and personal development at metropolitan institutions. *Journal of College Student Development*, *34*(1), 11–16.

Astin, A. W. (1962). An empirical characterization of higher educational institutions. *Journal of Educational Psychology*, *53*(5), 224–235.

Astin, A. W. (1970). The methodology of research on college impact, part one. *Sociology of Education*, *43*(3), 223–254.

Astin, A. W. (1985). *Achieving educational excellence: A critical assessment of priorities and practices in higher education*. Francisco: Jossey-Bass.

Astin, A. W. (1991a). The changing American college student: Implications for educational policy and practices. *Higher Education*, *22*(2), 129–143.

Astin, A. W. (1991b). *Assessment for excellence : The philosophy and practice of assessment and evaluation in higher education*. Washington/New York: American Council on Education and Macmillan Publishing Co.

Astin, A. W. (1993a). *What matters in college? Four critical years revisited*. San Francisco: Jossey-Bass.

Astin, A. W. (1993b). What matters in college? *Liberal Education*, *79*(4), 4–16.

Athlete. (n.d.). *Online Etymology Dictionary*. Retrieved from August 13, 2010, from Dictionary.com website: http://dictionary.reference.com/browse/athlete

Benford, R. D. (2007). The college sports reform movement: Reframing the "edutainment" industry. *The Sociological Quarterly*, *48*(1), 1–28.

Bowen, W. G., & Levin, S. A. (2003). *Reclaiming the game: College sports and educational values*. NJ: Princeton University Press.

Bridges, B., Cambridge, B., Kuh, G. D., & Leegwater, L. H. (2005). Student engagement at minority-serving institutions: Emerging lessons from the BEAMS project. *New Directions for Institutional Research*, *2005*(125), 25–43.

Brophy, J. (1979). Teacher behavior and its effects. *Journal of Educational Psychology*, *71*(6), 733–750.

Brophy, J. (1983). Conceptualizing student motivation. *Educational Psychologist*, *18*(3), 200–215.

Bryk, A. S., & Raudenbush, S. W. (1992). *Hierarchical linear models: Applications and data analysis methods*. Newbury Park : Sage Publications.

Byrne, B. M. (2009). *Structural equation modeling with AMOS: Basic concepts, applications, and programming* (2nd ed.). New York: Routledge.

Carodine, K., Almond, K. F., & Gratto, K. K. (2001). College student athlete success both in and out of the classroom. *New Directions for Student Services*, *2001*(93), 19–33.

Chickering, A. W., & Gamson, Z. F. (1987). Seven principles for good practice in undergraduate education.

AAHE Bulletin, *39*(7), 3–7.

Chickering, A. W., & Reisser, L. (1993). *Education and identity* (2nd ed.). San Francisco: Jossey-Bass.

Child, D. (2006). *The essentials of factor analysis* (3rd ed.). Continuum International Publishing Group.

Comeaux, E. (2005). Environmental predictors of academic achievement among student-athletes in the revenue-producing sports of men's basketball and football. *Sport Journal*, *8*(3).

Comeaux, E., & Harrison, C. K. (2007). Faculty and male student athletes: Racial differences in the environmental predictors of academic achievement. *Race Ethnicity and Education*, *10*(2), 199–214.

Comeaux, E., & Harrison, K. C. (2011). A conceptual model of academic success for student-athletes. *Educational Researcher*, *40*(5), 235–245.

Cowley, W. H. (1999). Athletics in American colleges. *The Journal of Higher Education. Special Anniversary Issue: A Look Back*, *70*(5), 494–503.

Crawford, T. (2007). *Intercollegiate athletic participation and undergraduate student engagement* (Doctoral dissertation). Washington State University. Retrieved from ProQuest Digital Dissertation. (AAT 3268766)

Cronbach, L., & Meehl, P. (1955). Construct validity in psychological tests. *Psychological Bulletin*, *52*(4), 281–302.

Curtis, J. ., & McTeer, W. G. (1990). Sport involvement and academic attainment in university: Two studies in the Canadian case. In Lee Vander Velden & J. H. Humphrey (Eds.), *Psychology and sociology of sport: current selected research* (pp. 177–192). New York : AMS Press.

Davis, T. M., & Murrell, P. H. (1994). Turning teaching into learning. The role of student responsibility in the collegiate experience. ERIC Digest. *ASHE-ERIC Higher Education Reports*.

Dee, T. S. (2009). *Stereotype threat and the student-athlete* (NBER working paper no. 14705). National Bureau of Economic Research. Retrieved from http://www.nber.org/cgi-bin/get_bars.pl?bar=pub

DeHass, D. (2008). *2005-06 NCAA gender-equity report*. National Collegiate Athletic Association.

Denhart, M., Villwock, R., & Vedder, R. (2009). *The academics athletics trade-off: universities and intercollegiate athletics*. Washington, D.C.: Center for College Affordability and Productivity. Retrieved from http://www.centerforcollegeaffordability.org/uploads/athletics.pdf

Despres, J., Brady, F., & McGowan, A. S. (2008). Understanding the culture of the student-athlete: Implications for college counselors. *Journal of Humanistic Counseling, Education and Development*, *47*(2), 200–211.

Eitzen, D. (2009). *Fair and foul: beyond the myths and paradoxes of sport* (4th ed.). New York: Rowman & Littlefield.

Engstrom, C. M., & Sedlacek, W. E. (1991). A study of prejudice toward university student-athletes. *Journal of Counseling & Development*, *70*(1), 189–193.

Engstrom, C. M., Sedlacek, W. E., & McEwen, M. K. (1995). Faculty attitudes toward male revenue and nonrevenue student-athletes. *Journal of College Student Development*, *36*(3), 217–227.

Etzel, E. ., Ferrante, A. P., & Lantz, C. (1996). Counseling college student-athletes: The problem, the need. In P. J.W, A. P. Ferrante, & E. Etzel (Eds.), *Counseling college student-athletes: Issues and interventions* (2nd ed., pp. 3–26). Morgantown, WV: Fitness Information Technology.

Ferris, E., Finster, M., & McDonald, D. (2004). Academic fit of student-athletes: An analysis of NCAA Division I-A graduation rates. *Research in Higher Education*, *45*(6), 555–575.

Fisher, C., Berliner, D., Filby, N., Marliave, R., Cahen, L., & Dishaw, M. (1980). Teaching behaviors, academic learning time, and student achievement: An overview. In C. Denham & A. Lieberman (Eds.), *Time to Learn*. Washington, D.C.: National Institute of Education.

Frederick, W. C., & Walberg, H. J. (1980). Learning as a function of time. *The Journal of Educational Research*, *73*(4), 183–194.

Gaston-Gayles, J., & Hu, S. (2009). The influence of student engagEment and sport participation on college outcomes among Division I student athletes. *Journal of Higher Education*, *80*(3), 315–333.

Goldstein, H. (1995). *Multilevel statistical models* (2nd ed.). Edward Arnold, London.

Gonyea, R. M. (2005a). *The relationship between student engagement and selected desirable undergraduate outcomes in the first year of college* (Doctoral dissertation). Indiana University. Retrieved from ProQuest Digital Dissertation. (AAT 3173528)

Gonyea, R. M. (2005b, February). *NSSE benchmarks 101*. Presented at the National Survey of Student Engagement: NSSE User's Workshop, Indiana University Center for Postsecondary Research.

Gordon, J., Ludlum, J., & Hoey, J. J. (2008). Validating NSSE against student outcomes: Are they related? *Research in Higher Education*, *49*(1), 19–39.

Hanks, M. P., & Eckland, B. K. (1976). Athletics and social participation in the educational attainment process. *Sociology of Education*, *49*(4), 271–294.

Harper, S. R., & Quaye, S. J. (Eds.). (2009). *Student engagement in higher education : Theoretical perspectives and practical approaches for diverse populations*. New York : Routledge.

Harrison, J. H. (1976). Intercollegiate football participation and academic achievement. In *Paper presented at the Annual Meeting of the Southwestern Sociological Association, Dallas*.

Hathaway, S. B. (2005). *Student athletes' collegial engagement and its effect on academic development: A study of Division I student athletes at a Midwest research university*. (Doctoral dissertation). The College of William and Mary in Virginia. Retrieved from ProQuest Digital Dissertation. (AAT 3177669)

Henschen, K. P., & Fry, D. (1984). An archival study of the relationship of intercollegiate athletic participation and graduation. *Sociology of Sport Journal*, *1*(1), 52–56.

Hershberger, S. L. (2005). Factor score estimation. In B. S. Everitt & and D. C. Howell (Eds.), *Encyclopedia of Statistics in Behavioral Science* (pp. 636–644). New York: John Wiley.

Hu, S., & Kuh, G. D. (2003). Diversity experiences and college student learning and personal development. *Journal of College Student Development*, *44*(3).

Karweit, N., & Slavin, R. E. (1981). Measurement and modeling choices in studies of time and learning. *American Educational Research Journal*, *18*(2), 157–71.

Keating, J. W. (1964). Sportsmanship as a moral category. *Ethics*, *75*(1), 25–35.

Kennedy, D. (1990, January 28). So What if College Players Turn Pro? *New York Times*. Retrieved from http://www.nytimes.com/1990/01/28/opinion/so-what-if-college-players-turn-pro.html

Kline, R. B. (2005). *Principles and practice of structural equation modeling* (2nd ed.). New York, NY: Guilford Press.

Kreft, I. G. G., & Leeuw, J. de. (1998). *Introducing multilevel modeling*. London: Thousand Oaks, Calif. : SAGE Publications.

Kuh, G. D. (2001). Assessing what really matters to student learning: Inside the National Survey of Student Engagement. *Change*, *33*(3), 10–17.

Kuh, G. D. (2003a). What we've learning about student engagement from NSSE: Benchmarks for effective educational practices. *Change*, *35*(2), 24–32.

Kuh, G. D. (2003b). The National Survey of Student Engagement: Conceptual framework and overview of psychometric properties. Indiana University Center for Postsecondary Research and Planning. Retrieved from http://nsse.iub.edu/pdf/conceptual_framework_2003.pdf

Kuh, G. D. (2009). The National Survey of Student Engagement: Conceptual and empirical foundations.

New directions for institutional research, *2009*(141), 5–20.

Kuh, G. D., Hayek, J. C., Carini, R. M., Ouimet, J. A., Gonyea, R. M., & Kennedy, J. (2001). *NSSE technical and norms report*. Bloomington, IN: Indiana University Center for Post Secondary Research & Planning.

Kuh, G. D., Kinzie, J., Buckley, J. A., Bridges, B. K., & Hayek, J. C. (2006). What matters to student success: A review of the literature. In *Commissioned report for the National Symposium on Postsecondary Student Success: Spearheading a Dialog on Student Success [from the title page]*.

Kuh, G. D., Kinzie, J., Buckley, J. A., Bridges, B. K., & Hayek, J. C. (2007). Piecing together the student success puzzle: Research, propositions, and recommendations. *ASHE Higher Education Report*, *32*(5), 1–182.

Kuh, G. D., Kinzie, J., Schuh, J. H., & Whitt, E. J. (2005). *Student success in college: Creating conditions that matter*. San Francisco: Jossey-Bass.

Kuh, G. D., Pace, C. R., & Vesper, N. (1997). The development of process indicators to estimate student gains associated with good practices in undergraduate education. *Research in Higher Education*, *38*(4), 435–454.

Kuh, G. D., Schuh, J. H., Whitt, E. J., & Associates. (1991). *Involving colleges: Successful approaches to fostering student learning and development outside the classroom*. San Francisco : Jossey-Bass Publishers.

LaNasa, S. M., Cabrera, A. F., & Trangsrud, H. (2009). The construct validity of student engagement: A confirmatory factor analysis approach. *Research in Higher Education*, *50*(4), 315–332.

LaNasa, S. M., Olson, E., & Alleman, N. (2007). The impact of on-campus student growth on first-year student engagement and success. *Research in Higher Education*, *40*(8), 941–966.

Lapchick, R. (1990). Interview with T. Marchese. *AAHE Bulletin*, *42*(6).

Leach, B., & Conners, B. (1984). Pygmalion on the gridiron: The black student athlete at a white university. In A. Shriberg & F. R. Brodzinski (Eds.), *Rethinking Services for College Athletes. New directions for student services, no 28* (Vol. 1984, pp. 31–49). San Francisco: Jossey-Bass.

Lewin, K. (1936). *Principles of topological psychology*. New York: McGraw-Hill.

Lindley, D. V., & Smith, A. F. M. (1972). Bayes estimates for the linear model. *Journal of the Royal Statistical Society*. *Series B*, *34*(1), 1–41.

Loy, J. W. (1978). *Sport and social systems: A guide to the analysis, problems, and literature*. Longman Higher Education.

Maloney, M. T., & McCormick, R. E. (1993). An examination of the role that intercollegiate athletic participation plays in academic achievement. *Journal of Human Resources*, *28*(3), 555–570.

Martin, B. E. (2009). Redefining championship in college sports: Enhancing outcomes and increasing student-athlete engagement. In S. R. Harper & S. J. Quaye (Eds.), *Student engagement in higher education : Theoretical perspectives and practical approaches for diverse populations* (pp. 283–293). New York : Routledge.

Marx, J., Huffmon, S., & Doyle, A. (2008). The student-athlete model and the socialization of intercollegiate athletes. *Athletic Insight*, *10*(1). Retrieved from http://www.athleticinsight.com/Vol10Iss1/ StudentAthleteModel.htm

Mason, W. M., Wong, G. Y., & Entwisle, B. (1984). Contextual analysis through the multilevel linear model. In S. Leinhardt (Ed.), *Sociological Methodology* (pp. 72–103). San Francisco: Jossey-Bass.

Melendez, M. C. (2006). The influence of athletic participation on the college adjustment of freshmen and sophomore student athletes. *Journal of College Student Retention: Research, Theory & Practice*, *8*(1), 39–55.

Melendez, M. C. (2009). Psychosocial influences on college adjustment in Division I student-athletes: The role of athletic identity. *Journal of College Student Retention: Research, Theory & Practice*, *11*(3), 345–361.

Melnick, M. J., & Others. (1992). Educational effects of interscholastic athletic participation on African-American and Hispanic youth. *Adolescence*, *27*(106), 295–308.

Meyer, B. B. (1990). From idealism to actualization: The academic performance of female collegiate athletes. *Sociology of Sport Journal*, *7*(1), 44–57.

Miller, P. S., & Kerr, G. A. (2003). The role experimentation of intercollegiate student athletes. *The Sport Psychologist*, *17*(2), 196–219.

National Collegiate Athletic Association. (2009). *NCAA research related to graduation rates of Division I student-athletes1984-2002*. Retrieved from http://www.ncaa.org/wps/wcm/connect/babb88004058023db423b5a8eaf4dbca/Federal+Graduation+Rates+Summary+19+Year+11_09.pdf?MOD=AJPERES&CACHEID=babb88004058023db423b5a8eaf4dbca

National Survey of Student Engagement. (2000). *The NSSE 2000 report: National benchmarks of effective educational practice*. Bloomington, IN: Indiana University Center for Postsecondary Research. Retrieved from http://nsse.iub.edu/nsse_2000/pdf/report-2000.pdf

National Survey of Student Engagement. (2004). *National Survey of Student Engagement: 2004 Overview*. Bloomington, IN: Indiana University Center for Postsecondary Research. Retrieved from http://nsse.iub.edu/pdf/2004_inst_report/overview.pdf

National Survey of Student Engagement. (2005). *Exploring different dimensions of student engagement. 2005 annual survey results*. Bloomington, IN: Indiana University Center for Postsecondary Research. Retrieved from http://nsse.iub.edu/pdf/nsse2005_annual_report.pdf

National Survey of Student Engagement. (2006a). *The college student report 2006 codebook*. Indiana University Center for Postsecondary Research. Retrieved from http://nsse.iub.edu/NSSE_2006_Annual_Report/docs/NSSE_2006_Codebook.pdf

National Survey of Student Engagement. (2006b). *Engaged learning: fostering success for all students. annual report 2006*. Indiana University Center for Postsecondary Research. Retrieved from http://nsse.iub.edu/nsse_2006_annual_report/docs/nsse_2006_annual_report.pdf

National Survey of Student Engagement. (2006c). *NSSE 2006 Overview*. Bloomington, IN: Indiana University Center for Postsecondary Research. Retrieved from http://nsse.iub.edu/pdf/2006_Institutional_Report/NSSE%202006%20Overview.pdf

National Survey of Student Engagement. (2006d). *NSSE 2006 grand frequencies frequency distributions by 2005 basic Carnegie classification*. Bloomington, IN: Indiana University Center for Postsecondary Research.

National Survey of Student Engagement. (2006e). *NSSE 2006 grand means by class and gender*. Bloomington, IN: Indiana University Center for Postsecondary Research. Retrieved from http://nsse.iub.edu/NSSE_2006_Annual_Report/docs/NSSE06_means_by_gender.pdf

National Survey of Student Engagement. (2006f). *NSSE 2006 grand frequencies: Frequency distribution by majors*. Bloomington, IN: Indiana University Center for Postsecondary Research.

National Survey of Student Engagement. (2007). *Reliability: 2007 institution-level temporal stability* (NSSE's Psychometric Portfolio, a framework for presenting our studies of the validity, reliability, and other indicators of quality of NSSE data). Retrieved from http://nsse.iub.edu/pdf/psychometric_portfolio/Reliability_TemporalStability_Institution-Level_2007.pdf

National Survey of Student Engagement. (2010a). *Reliability: 2010 internal consistency* (NSSE's Psychometric Portfolio, a framework for presenting our studies of the validity, reliability, and other indicators of quality of NSSE data). Retrieved from http://nsse.iub.edu/pdf/psychometric_portfolio/Reliability_InternalConsistency_2010_Gains.pdf

National Survey of Student Engagement. (2010b). *Major differences: Examining student engagement by field of study: annual results 2010*. Bloomington, IN: Indiana University Center for Postsecondary Research. Retrieved from http://nsse.iub.edu/NSSE_2010_Results/pdf/NSSE_2010_AnnualResults.pdf

National Survey of Student Engagement. (2010c). *Factor analysis: 2009 internal structure for deep learning. validity-construct validity* (No. NSSE's Psychometric Portfolio, a framework for presenting our studies of the validity, reliability, and other indicators of quality of NSSE data). Retrieved from http://nsse.iub.edu/pdf/psychometric_portfolio/Validity_DeepLearning.pdf

Nelson Laird, T. F., Shoup, R., & Kuh, G. D. (2005). Measuring deep approaches to learning using the national survey of student engagement. Presented at the Annual Meeting of the Association for Institutional Research, Chicago, IL. Retrieved from http://nsse.iub.edu/pdf/conference_presentations/2006/AIR2006DeepLearningFINAL.pdf

Pace, C. R. (1982). Achievement and the Quality of Student Effort. Presented at the National Commission on Excellence in Education (ED), Washington, DC.

Pace, C. R. (1984). *Measuring the quality of college student experiences. An account of the development and use of the college student experiences questionnaire*. Los Angeles: Higher Education Research Institute.

Pascarella, E. T. (1985). College environmental influences on learning and cognitive development: A critical review and synthesis. In J. C. Smart (Ed.), *Higher education: Handbook of theory and research* (Vol. 3, pp. 271–326). New York: Agathon.

Pascarella, E. T. (2001). Identifying excellence in undergraduate education: Are we even close? *Change*, *33*(3), 18–23.

Pascarella, E. T., Bohr, L., Nora, A., & Terenzini, P. T. (1995). Intercollegiate athletic participation and freshman-year cognitive outcomes. *The Journal of Higher Education*, *66*(4), 369–387.

Pascarella, E. T., Edison, M., Hagedorn, L. S., Nora, A., & Terenzini, P. T. (1996). Influences on students' internal locus of attribution for academic success in the first year of college. *Research in Higher Education*, *37*(6), 731–756.

Pascarella, E. T., Edison, M., Nora, A., Terenzini, P. T., & Hagedorn, L. S. (1996). Influences on students' openness to diversity and challenge in the first year of college. *Journal of Higher Education*, *67*(2), 174–195.

Pascarella, E. T., & Others. (1991). *Intercollegiate athletic participation and freshman year cognitive outcomes*. Office of Educational Research and Improvement (ED), Washington, DC. (ERIC identifier: ED368268).

Pascarella, E. T., Seifert, T. A., & Blaich, C. (2010). How effective are the NSSE benchmarks in predicting important educational outcomes? *Change: The Magazine of Higher Learning*, *42*(1), 16–22.

Pascarella, E. T., & Terenzini, P. T. (1991). *How college affects students: Findings and insights from twenty-years of research (1st ed.)*. San Francisco : Jossey-Bass.

Pascarella, E. T., & Terenzini, P. T. (1995). The impact of college on students: Myths, rational myths, and some other things that may not be true. *NACADA Journal*, *15*(2), 26–33.

Pascarella, E. T., & Terenzini, P. T. (2005). *How college affects students: A third decade of research*. San Francisco : Jossey-Bass.

Pascarella, E. T., Truckenmiller, R., Nora, A., Terenzini, P. T., Edison, M., & Hagedorn, L. S. (1999). Cognitive impacts of intercollegiate athletic participation: Some further evidence. *Journal of Higher Education, 70(1), 1-26.*, *70*(1), 1–26.

Pike, G. R. (2006). The convergent and discriminant validity of NSSE scalelet scores. *Journal of College Student Development*, *47*(5), 550–563.

Pike, G. R., Kuh, G. D., & Gonyea, R. M. (2003). The relationship between institutional mission and students' involvement and educational outcomes. *Research in Higher Education*, *44*(2), 241–261.

Purdy, D. A., Eitzen, D. S., & Hufnagel, R. (1982). Are athletes also students? The educational attainment of college athletes. *Social Problems*, *29*(4), 439–448.

Purdy, D. A., & Others. (1983, October 27). *Transition into college sports: The freshman student-athlete*. Presented at the Meeting of the North American Society of Sport Sociology, St. Louis, MO.

Raudenbush, S. W. (1988). Educational applications of hierarchical linear models: A Review. *Journal of Educational Statistic*, *13*(2), 85–116.

Raudenbush, S. W., & Bryk, A. S. (1986). A hierarchical model for studying school effects. *Sociology of Education*, *59*(1), 1–17.

Raudenbush, S. W., & Bryk, A. S. (1987). Examining correlates of diversity. *Journal of Educational Statistics*, *12*(3), 241–269.

Raudenbush, S. W., & Bryk, A. S. (2002). *Hierarchical linear models: Applications and data analysis methods*. Thousand Oaks Calif. : Sage Publications.

Ryan, F. (1989). Participation in intercollegiate athletics: Affective outcomes. *Journal of College Student Development*, *30*(2), 122–128.

Sedlacek, W. E., & Adams-Gaston, J. (1992). Predicting the academic success of student-athletes using SAT and noncognitive variables. *Journal of Counseling and Development*, *70*(2), 724–727.

Sellers, R. M., & Kuperminc, G. P. (1997). Goal discrepancy in African American male student-athletes' unrealistic expectations for careers in professional sports. *The Journal of Black Psychology*, *23*(1), 6–23.

Shulman, J., & Bowen, W. (2001). *The game of life: College sports and educational values*. NJ: Princeton University Press.

Sport. (n.d.). *Dictionary.com Unabridged*. Retrieved from August 13, 2010, from Dictionary.com website: http://dictionary.reference.com/browse/sport

Steinfeldt, J. A., Reed, C., & Steinfeldt, M. C. (2010). Racial and athletic identity of African American football players at historically black colleges and universities and predominantly white institutions. *Journal of Black Psychology*, *36*(1), 3–24.

Symonds, M. L. (2009). Monitoring student engagement for intercollegiate athletics program review. *International Journal of Educational Management*, *23*(2), 161–171.

Tabachnick, B. G., & Fidell, L. S. (2007). *Using multivariate statistics* (5th ed.). Boston : Pearson/Allyn & Bacon.

Tenenbaum, G., & Eklund, R. C. (Eds.). (2007). *Handbook of sport psychology* (3rd Ed.). John Wiley & Sons, Inc., Hoboken, New Jersey.

Terenzini, P. T. (1987). A review of selected theoretical models of student development and collegiate impact. ASHE annual meeting paper. Presented at the Annual Meeting of the Association for the Study of Higher Education, Baltimore, MD.

Thelin, J. R. (1994). *Games colleges play: Scandal and reform in intercollegiate athletics*. Johns Hopkins University Press.

Ting, S.-M. (2009). Impact of noncognitive factors on first-year academic performance and persistence of NCAA Division I student athletes. *The Journal of humanistic education and development*, *48*(2), 215–228.

Tinto, V. (1975). Dropout from higher education: A theoretical synthesis of recent research. *Review of Educational Research*, *45*(1), 89–125.

Tinto, V. (1993). *Leaving college: Rethinking the causes and cures of student attrition* (2nd ed.). University of Chicago Press.

Tinto, V. (2000). Linking learning and leaving: Exploring the role of the college classroom in student departure. In J. M. Braxton (Ed.), *Reworking the student departure puzzle* (pp. 81–94). Nashville: Vanderbilt University Press.

Umbach, P. D., & Kuh, G. D. (2004). Disengaged jocks: Myth or reality. *Liberal Arts Online, Retrieved January 1, 2011 from http://www.liberalarts.wabash.edu/disengaged-jocks/*, *4*(4).

Umbach, P. D., Palmer, M. M., Kuh, G. D., & Hannah, J. S. (2006). Intercollegiate athletes and effective educational practices: Winning combination or losing effort? *Research in Higher Education*, *47*(6), 709–733.

Umbach, P. D., Palmer, M. M., Kuh, G. D., & Hannah, S. J. (2004). Intercollegiate athletes and effective educational practices: Winning combination or losing effort? Presented at the Annual Forum of the Association for Institutional Research (AIR), 44th, Boston, MA.

Umbach, P. D., & Wawrzynski, M. R. (2004). Faculty do matter: The role of college faculty in student learning and engagement. Presented at the Paper presented at the annual forum of the Association for Institutional Research, Boston, MA.

Vicente, R. (2006). *1999-00 – 2005-06 NCAA student-athlete race and ethnicity report*. National Collegiate Athletic Association. Retrieved from http://www.ncaapublications.com/p-4112-ncaa-student-athlete-race-and-ethnicity-report-1999-00-2006-07.aspx

Vittinghoff, E. (2004). *Regression methods in biostatistics: Linear, logistic, survival, and repeated measures models* (2nd ed.). New York: Springer.

Watson, J. C. (2003). *Overcoming the challenges of counseling college student athletes. ERIC/CASS Digest* (ERIC Document Reproduction Service No. ED 475387 No. EDO-CG-03-01). Greensboro, NC: ERIC Counseling and Student Services Clearinghouse, University of North Carolina at Greensboro.

Watt, S. K., & Moore III, J. L. (2001). Who are student athletes? *New Directions for Student Services*, *2001*(93), 7–18.

Wilson, G., & Pritchard, M. (2005). Comparing sources of stress in college student athletes and non-athletes. *Athletic Insight, [Online]*, *7*(1).

Wilson, T. M. (2008). *Women who endure: A grounded theory study of Black female former student-athletes* (Doctoral dissertation). Capella University. Retrieved from ProQuest Digital Dissertation. (AAT 3290664)

Winter, D., McClelland, D., & Stewart, A. (1981). *A new case for the liberal arts: Assessing institutional goals and student development*. Jossey-Bass, San Francisco.

Wolverton, B. (2008). Athletes' hours renew debate over college sports. (cover story). *Chronicle of Higher Education*, *54*(20), A1–A23.

Wooten, H., & Ray, J. (1994). Cutting losses for student-athletes in transition: An integrative transition model. *Journal of Employment Counseling*, *31*(1), 2–9.

Appendix

Appendix I: National Survey of Student Engagement 2006 Instrument

National Survey of Student Engagement 2006

The College Student Report

1 **In your experience at your institution during the current school year, about how often have you done each of the following? Mark your answers in the boxes. Examples: ☒ or ■**

	Very often	Often	Sometimes	Never
a. Asked questions in class or contributed to class discussions	☐	☐	☐	☐
b. Made a class presentation	☐	☐	☐	☐
c. Prepared two or more drafts of a paper or assignment before turning it in	☐	☐	☐	☐
d. Worked on a paper or project that required integrating ideas or information from various sources	☐	☐	☐	☐
e. Included diverse perspectives (different races, religions, genders, political beliefs, etc.) in class discussions or writing assignments	☐	☐	☐	☐
f. Come to class without completing readings or assignments	☐	☐	☐	☐
g. Worked with other students on projects **during class**	☐	☐	☐	☐
h. Worked with classmates **outside of class** to prepare class assignments	☐	☐	☐	☐
i. Put together ideas or concepts from different courses when completing assignments or during class discussions	☐	☐	☐	☐
j. Tutored or taught other students (paid or voluntary)	☐	☐	☐	☐
k. Participated in a community-based project (e.g., service learning) as part of a regular course	☐	☐	☐	☐
l. Used an electronic medium (listserv, chat group, Internet, instant messaging, etc.) to discuss or complete an assignment	☐	☐	☐	☐
m. Used e-mail to communicate with an instructor	☐	☐	☐	☐
n. Discussed grades or assignments with an instructor	☐	☐	☐	☐
o. Talked about career plans with a faculty member or advisor	☐	☐	☐	☐
p. Discussed ideas from your readings or classes with faculty members outside of class	☐	☐	☐	☐
q. Received prompt written or oral feedback from faculty on your academic performance	☐	☐	☐	☐
r. Worked harder than you thought you could to meet an instructor's standards or expectations	☐	☐	☐	☐
s. Worked with faculty members on activities other than coursework (committees, orientation, student life activities, etc.)	☐	☐	☐	☐
t. Discussed ideas from your readings or classes with others outside of class (students, family members, co-workers, etc.)	☐	☐	☐	☐
u. Had serious conversations with students of a different race or ethnicity than your own	☐	☐	☐	☐
v. Had serious conversations with students who are very different from you in terms of their religious beliefs, political opinions, or personal values	☐	☐	☐	☐

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

	Very much	Quite a bit	Some	Very little
a. **Memorizing** facts, ideas, or methods from your courses and readings so you can repeat them in pretty much the same form	☐	☐	☐	☐
b. **Analyzing** the basic elements of an idea, experience, or theory, such as examining a particular case or situation in depth and considering its components	☐	☐	☐	☐
c. **Synthesizing** and organizing ideas, information, or experiences into new, more complex interpretations and relationships	☐	☐	☐	☐
d. **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	☐	☐	☐	☐
e. **Applying** theories or concepts to practical problems or in new situations	☐	☐	☐	☐

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

a. Number of assigned textbooks, books, or book-length packs of course readings

None	1-4	5-10	11-20	More than 20
☐	☐	☐	☐	☐

b. 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
☐	☐	☐	☐	☐

c. Number of written papers or reports of **20 pages or more**

None	1-4	5-10	11-20	More than 20
☐	☐	☐	☐	☐

d. Number of written papers or reports **between 5 and 19 pages**

None	1-4	5-10	11-20	More than 20
☐	☐	☐	☐	☐

e. Number of written papers or reports of **fewer than 5 pages**

None	1-4	5-10	11-20	More than 20
☐	☐	☐	☐	☐

4 **In a *typical week*, how many homework problem sets do you complete?**

	None	1-2	3-4	5-6	More than 6
a. Number of problem sets that take you **more** than an hour to complete	☐	☐	☐	☐	☐
b. Number of problem sets that take you **less** than an hour to complete	☐	☐	☐	☐	☐

5 **Mark the box 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	Very much 7
☐	☐	☐	☐	☐	☐	☐

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

	Very often	Often	Some-times	Never
a. Attended an art exhibit, gallery, play, dance, or other theater performance	☐	☐	☐	☐
b. Exercised or participated in physical fitness activities	☐	☐	☐	☐
c. Participated in activities to enhance your spirituality (worship, meditation, prayer, etc.)	☐	☐	☐	☐
d. Examined the strengths and weaknesses of your own views on a topic or issue	☐	☐	☐	☐
e. Tried to better understand someone else's views by imagining how an issue looks from his or her perspective	☐	☐	☐	☐
f. Learned something that changed the way you understand an issue or concept	☐	☐	☐	☐

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

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

8 **Mark the box that best represents the quality of your relationships with people at your institution.**

a. Relationships with **other students**

Unfriendly, Unsupportive, Sense of alienation 1	2	3	4	5	6	Friendly, Supportive, Sense of belonging 7
☐	☐	☐	☐	☐	☐	☐

b. Relationships with **faculty members**

Unavailable, Unhelpful, Unsympathetic 1	2	3	4	5	6	Available, Helpful, Sympathetic 7
☐	☐	☐	☐	☐	☐	☐

c. Relationships with **administrative personnel and offices**

Unhelpful, Inconsiderate, Rigid 1	2	3	4	5	6	Helpful, Considerate, Flexible 7
☐	☐	☐	☐	☐	☐	☐

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

a. Preparing for class (studying, reading, writing, doing homework or lab work, analyzing data, rehearsing, and other academic activities)

☐ 0 ☐ 1-5 ☐ 6-10 ☐ 11-15 ☐ 16-20 ☐ 21-25 ☐ 26-30 ☐ More than 30
Hours per week

b. Working for pay **on campus**

☐ 0 ☐ 1-5 ☐ 6-10 ☐ 11-15 ☐ 16-20 ☐ 21-25 ☐ 26-30 ☐ More than 30
Hours per week

c. Working for pay **off campus**

☐ 0 ☐ 1-5 ☐ 6-10 ☐ 11-15 ☐ 16-20 ☐ 21-25 ☐ 26-30 ☐ More than 30
Hours per week

d. Participating in co-curricular activities (organizations, campus publications, student government, fraternity or sorority, intercollegiate or intramural sports, etc.)

☐ 0 ☐ 1-5 ☐ 6-10 ☐ 11-15 ☐ 16-20 ☐ 21-25 ☐ 26-30 ☐ More than 30
Hours per week

e. Relaxing and socializing (watching TV, partying, etc.)

☐ 0 ☐ 1-5 ☐ 6-10 ☐ 11-15 ☐ 16-20 ☐ 21-25 ☐ 26-30 ☐ More than 30
Hours per week

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

☐ 0 ☐ 1-5 ☐ 6-10 ☐ 11-15 ☐ 16-20 ☐ 21-25 ☐ 26-30 ☐ More than 30
Hours per week

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

☐ 0 ☐ 1-5 ☐ 6-10 ☐ 11-15 ☐ 16-20 ☐ 21-25 ☐ 26-30 ☐ More than 30
Hours per week

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

	Very much	Quite a bit	Some	Very little
a. Spending significant amounts of time studying and on academic work	☐	☐	☐	☐
b. Providing the support you need to help you succeed academically	☐	☐	☐	☐
c. Encouraging contact among students from different economic, social, and racial or ethnic backgrounds	☐	☐	☐	☐
d. Helping you cope with your non-academic responsibilities (work, family, etc.)	☐	☐	☐	☐
e. Providing the support you need to thrive socially	☐	☐	☐	☐
f. Attending campus events and activities (special speakers, cultural performances, athletic events, etc.)	☐	☐	☐	☐
g. Using computers in academic work	☐	☐	☐	☐

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

	Very much	Quite a bit	Some	Very little
a. Acquiring a broad general education	☐	☐	☐	☐
b. Acquiring job or work-related knowledge and skills	☐	☐	☐	☐
c. Writing clearly and effectively	☐	☐	☐	☐
d. Speaking clearly and effectively	☐	☐	☐	☐
e. Thinking critically and analytically	☐	☐	☐	☐
f. Analyzing quantitative problems	☐	☐	☐	☐
g. Using computing and information technology	☐	☐	☐	☐
h. Working effectively with others	☐	☐	☐	☐
i. Voting in local, state, or national elections	☐	☐	☐	☐
j. Learning effectively on your own	☐	☐	☐	☐
k. Understanding yourself	☐	☐	☐	☐
l. Understanding people of other racial and ethnic backgrounds	☐	☐	☐	☐
m. Solving complex real-world problems	☐	☐	☐	☐
n. Developing a personal code of values and ethics	☐	☐	☐	☐
o. Contributing to the welfare of your community	☐	☐	☐	☐
p. Developing a deepened sense of spirituality	☐	☐	☐	☐

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

☐ Excellent
☐ Good
☐ Fair
☐ Poor

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

☐ Excellent
☐ Good
☐ Fair
☐ Poor

14 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

15 **Write in your year of birth:** 1 9 _ _

16 **Your sex**
- ☐ Male
- ☐ Female

17 **Are you an international student or foreign national?**
- ☐ Yes
- ☐ No

18 **What is your racial or ethnic identification? (Mark 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

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

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

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

22 **Thinking about this current academic term, how would you characterize your enrollment?**
- ☐ Full-time
- ☐ Less than full-time

23 **Are you a member of a social fraternity or sorority?**
- ☐ Yes
- ☐ No

24 **Are you a student-athlete on a team sponsored by your institution's athletics department?**
- ☐ Yes
- ☐ No (Go to question 25.)

On what team(s) are you an athlete (e.g., football, swimming)? Please answer below:

25 **What have most of your grades been up to now at this institution?**
- ☐ A
- ☐ A-
- ☐ B+
- ☐ B
- ☐ B-
- ☐ C+
- ☐ C
- ☐ C- or lower

26 **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

27 **What is the highest level of education that your parent(s) completed? (Mark one box per column.)**

Father	Mother	
☐	☐	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.)

28 **Please print your major(s) or your expected major(s).**

a. Primary major (Print only one.):

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

THANKS FOR SHARING YOUR VIEWS!

After completing the survey, please put it in the enclosed postage-paid envelope and deposit it in any U.S. Postal Service mailbox. Questions or comments? Contact the National Survey of Student Engagement, Indiana University, 1900 East Tenth Street, Eigenmann Hall Suite 419, Bloomington IN 47406-7512 or nsse@indiana.edu or www.nsse.iub.edu.

Appendix II: National Survey of Student Engagement 2006 Codebook (Student-Level Index Scores)

National Survey of Student Engagement

The College Student Report

2006 Codebook

Student-Level Index Scores. To facilitate conversations about student engagement and its importance to student learning, collegiate quality, and institutional improvement, NSSE created five institution-level indicators or benchmarks of effective educational practice: (1) Level of academic challenge; (2) Active and collaborative learning; (3) Student-faculty interaction; (4) Enriching educational experiences; and (5) Supportive campus environment. Student-level index scores are the precursors to these five institution-level benchmarks. An index score is the student's average response to items within the index, after all items have been placed on a 100-point scale. Index scores are created for randomly sampled first-year and senior students that answered three-fifths or more of the items within the group. The benchmark score for an institution is the *weighted mean* of these student index scores. Not only can institutions replicate their benchmark scores with this information, but they can also perform intra-institutional comparisons (e.g., department, college, etc.) to dig deeper into their data. For more detailed information about how index scores and benchmarks are calculated, visit the NSSE Web site at www.nsse.iub.edu/html/2006_inst_report.htm.

Variable	*Description*	*Component Items*
AC	**Level of Academic Challenge**: Index that measures time spent preparing for class, amount of reading and writing, deep learning, and institutional expectations for academic performance.	readasgn, writemor, writemid, writesml, analyze, synthesz, evaluate, applying, workhard, acadpr01, envschol
ACa	**Level of Academic Challenge (adjusted)**: Same as AC, but adjusted for part-time enrollment status. This is the version given in your Benchmark Comparisons report. Because part-time students spend less time in classes, they are likely to report lower numbers for several items on *The College Student Report* (e.g., hours spent preparing for class, number of papers written, number of assigned books read). Using full-time/part-time ratios from the entire U.S. NSSE cohort, we adjust part-time student scores to make them resemble those of full-time students when we create the benchmarks. Thus schools with large populations of part-time students are not negatively impacted by this population.	readasgn, writemor, writemid, writesml, analyze, synthesz, evaluate, applying, workhard, acadpr01, envschol
ACL	**Active and Collaborative Learning**: Index that measures extent of class participation, working collaboratively with other students inside and outside of class, tutoring and involvement with a community-based project.	clquest, clpresen, classgrp, occgrp, tutor, commproj, oocideas
SFI	**Student-Faculty Interaction**: Index that measures extent of talking with faculty members and advisors, discussing ideas from classes with faculty members outside of class, getting prompt feedback on academic performance, and working with faculty on research projects	facgrade, facideas, facplans, facfeed, facother, resrch04
SFc	**Student-Faculty Interaction (comparative)**: Same as SFI, but excludes the 'resrch04' item (*rescaled in 2004*). Use for year-to-year comparisons with 2003, 2002, and 2001 administrations; not needed for comparisons with 2004 or 2005.	facgrade, facideas, facplans, facfeed, facother *(excludes resrch04)*
EEE	**Enriching Educational Experiences**: Index that measures extent of interaction with students of different racial or ethnic backgrounds or with different political opinions or values, using electronic technology, and participating in activities such as internships, community service, study abroad, co-curricular activities, and culminating senior experience. *Because question 7 was rescaled in 2004, year-to-year comparisons of EEE scores with years prior to 2004 are invalid.*	diffstu2, divrstud, envdivrs, cocurr01, itacadem, intern04, volntr04, lrncom04, forlng04, stdabr04, indstd04, snrx04
SCE	**Supportive Campus Environment** Index that measures extent to which students perceive the campus helps them succeed academically and socially, assists them in coping with non-academic responsibilities, and promotes supportive relations among students and their peers, faculty members, and administrative personnel and offices	envsocal, envsuprt, envnacad, envstu, envfac, envadm

* Slight revision from last year; ** Significant revision from last year so new variable name created; *** New variable

Appendix III: Concordance between ACT Composite Score and Sum of SAT Critical Reading and Mathematics Scores

SAT CR+M (Score Range)	ACT Composite Score	SAT CR+M (Single Score)
1600	36	1600
1540-1590	35	1560
1490-1530	34	1510
1440-1480	33	1460
1400-1430	32	1420
1360-1390	31	1380
1330-1350	30	1340
1290-1320	29	1300
1250-1280	28	1260
1210-1240	27	1220
1170-1200	26	1190
1130-1160	25	1150
1090-1120	24	1110
1050-1080	23	1070
1020-1040	22	1030
980-1010	21	990
940-970	20	950
900-930	19	910
860-890	18	870
820-850	17	830
770-810	16	790
720-760	15	740
670-710	14	690
620-660	13	640
560-610	12	590
510-550	11	530

Note: Derived using ACT sum.

SAT Writing (Score Range)	ACT English/Writing Score	SAT Writing (Single Score)
800	36	800
800	35	800
770-790	34	770
730-760	33	740
710-720	32	720
690-700	31	690
660-680	30	670
640-650	29	650
620-630	28	630
610	27	610
590-600	26	590
570-580	25	570
550-560	24	550
530-540	23	530
510-520	22	510
480-500	21	490
470	20	470
450-460	19	450
430-440	18	430
410-420	17	420
390-400	16	400
380	15	380
360-370	14	360
340-350	13	340
320-330	12	330
300-310	11	310