ABSTRACT

HALE, JIMMIE EDWIN. A Longitudinal Study of Academic Progress Rate as a Result of Team and Institutional Variables at NCAA Division I Schools. (Under the direction of Dr. James Bartlett).

This study explained Academic Progress Rate (APR) levels and differences in APR (DAPR) with team and institutional variables. Team variables included team gender, sport profile, and squad size. Institutional variables included individual variables aggregated to the institutional level. The data analyzed in this study was derived from the National Center for Education Statistics (NCES), *Peterson's Four Year Colleges*, and *The Princeton Review's Complete Guide to Colleges*. The APR data was created by the National Collegiate Athletic Association (NCAA) and released through the Interuniversity Consortium for Political and Social Research (ICPSR).

Institutional variables were consolidated into three factors by factor analysis. Hierarchical linear models were then developed for both APR and differences in APR. Samples were taken from 42,445 teams fielded by 387 Division I institutions from 2003-2004 until 2010-2011. For difference in APR, entering team characteristics and institutional factors into the model accounted for 8% of explainable team and school variances. Only team variables were included in the models for differences in APR. For APR, team variables and institutional factors reduced team and school variance by 18% and 51%, respectively. Sport profile, squad size, team gender, and aggregated factors relating to personal and financial

characteristics of students were included in the model predicting APR. The models for APR were consistent with those offered by Tinto (1975, 1987, 1993).

This study demonstrated significant relationships between team and institutional variables and APR scores. Also, though small, a significant relationship between team variables and differences in APR existed. The findings continued to clarify our understanding of the conditions conductive to academic success of student-athletes and lay the groundwork for strategies to improve APR scores.

A Longitudinal Study of Academic Progress Rate as a Result of Team and Institutional Variables at NCAA Division I Schools

by
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BIOGRAPHY

Jimmie Edwin Hale grew up in Elk Creek, Virginia. He is the older of two sons given to Bronson and Nancy Hale. After graduating from Independence High School in 1975, Jimmie obtained his Bachelor of Science degree in mathematics from James Madison University in 1979. He obtained his Master of Arts degree in mathematics from Appalachian State University in 2002.

Mr. Hale served as a teacher in North Carolina Public Schools for thirty years and has since served as a professor at Wilkes and Gaston Community Colleges as well as at Wingate University. His research interests include higher education and athletics. He is working towards a position that will allow him to continue teaching and learning about student-athletes and their paths to success.

ACKNOWLEDGMENTS

I would like to express my sincerest gratitude to the chair of my committee, Dr. James Bartlett. His patience, guidance, and insight were essential in the completion of this work and in my development as a student. I am also grateful to Dr. Timothy Hatcher for his guidance during my journey at North Carolina State. Dr. Bartlett and Dr. Hatcher were more than professors, they were models, proving the effectiveness of the principles they taught. I am also extremely grateful to committee members Dr. Diane Chapman and Dr. Kevin Brady for their insight, encouragement, and support.

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CHAPTER ONE

INTRODUCTION

How can we help student-athletes perform better academically? While athletic achievement has been celebrated, universities have often been criticized because academic progress of student-athletes has been ignored or circumvented (Splitt, 2011; Southhall, 2012). Much of the criticism has been well deserved, especially by student-athletes in revenue producing sports (Maloney & McCormick, 1993). Recent and past reports of low graduation rates, academic fraud, and early departure of soon to be ineligible athletes have taken a toll on the public's perception that the goal of college athletics is to enable student-athletes and not simply enable athletes (Zimmerman & Wickersham, 2012).

Historically academics and athletics at colleges and universities have been cast in adversarial roles, where the success of one results in the demise of the other. Thelin and Wiseman (1989) identified three sources of controversy between the two avenues of student achievement. Limited finances lead those aligned with the academic community to question if additional funds might be available without large marginal investments in athletics. Power, inherent with centrality to the institutional mission, results in competition for influence on university policy. Finally, a striking imbalance in achievement and notoriety fuels suspicions of favoritism and exploitation. Further complicating the relationship are changes fostered by commercialization of both institutions and the athletic programs that represent them (Altbach, 2001). Within this introduction the competitive relationship between academics and athletics will be discussed, the lack of balance in achievement, funding, and notoriety between the two areas will be noted and related to the student-athlete, and three challenges institutions face in addressing the problem will be outlined.

Fulks (2008) found only 19 of 119 athletic programs that compete at the highest level (Football Bowl Subdivision) were profitable. With athletics funded at approximately 6% of institutional budgets (Knight Commission, 2012), many feel the funds spent on athletics could be of more use in the educational sphere. Furthermore, they cite an opportunity cost incurred when private donations given to the university are earmarked for athletics as opposed to academics (Denhart, Villwock, & Vedder, 2009). Critics from the academic community include those who feel coaches and athletic administrators short change academic standards for student-athletes in the interest of winning athletic contests. Others feel the athletes themselves, especially those in high profile sports of football, men's basketball and baseball, are exploited by the university financially. Finally, there are those who feel athletic participation fosters a culture in which the importance of learning is diminished (Denhart, Villwock, & Vedder, 2009). Critics say athletics do not fit within the mission of higher education and serve to distract effort and attention. Benjamin (2004) wrote, "It is evident that the outcomes of college athletics programs are far removed from the academic values often espoused" (p.11). Paradoxically, Thelin (2011) describes higher education as an endeavor that has "become uncertain and unclear in its direction and mission" (p. xiii).

Advocates for athletics have argued that athletics are educational, entertaining, unifying, and that athletics generate direct and indirect revenue (Benjamin, 2004). Even in the absence of direction or utility, when an athletic team, particularly football, competes for a championship, more excitement and unity are created on and off campus than by any other collegiate event (Lucas, 2006). Athletic events often bring together unlikely entities within a university and create a sense of community that might not exist otherwise (Shulman & Bowen, 2001; Lucas, 2006). “It is possible that no other organization or group (academic or non-academic) on any campus,… provides the same level of euphoria and excitement that a sport’s program offers with a victory on the field” (Couch, 2011, p.27). It is undisputable that college athletics provide scholarships to many who could not afford college otherwise. Henderson, Olbrect, and Polachek (2006) found some evidence that former college athletes earn more than non-athletes even though many become high school coaches and settle for lower wages.

While society, to date, has largely failed to solve the problems of greed and pride, and chemistry may never be as popular as football, the lack of balance directly impacts the most important stakeholder: the student-athlete. Finding the proper balance between academics and athletics so that student-athletes not only perform but also learn has been a recurring problem for institutions (Gayles & Hu, 2009; Suggs, 2003a, 2003b). The lack of balance between academics and athletics has grown to the point where many observers feel the commercial structure of college athletics is not compatible with the mission of higher education (Sharp & Sheilley, 2008). The problem has frequently been improperly framed, however, with a lack of balance taking precedence to a lack of academic excellence in student-athletes. If the failings of pride, selfishness, and arrogance are put aside, only the goal of success of young adults remains. This goal of success does not apply to any singular endeavor but to each and every effort given. If the best way to approach student success is not with an either/or proposition but rather with a maximization of two desirable outcomes, the only plausible solution for imbalance involves raising the bar for academics. Three challenges stand before higher education as it attempts to enable students to be successful at both academics and athletics:

(1) Clearly establish the identity of the institution and define the roles of academics and athletics.

(2) Recruit student-athletes who personify the chosen identity of the institution.

(3) Devise and implement strategies that result in an institutional environment which promotes academic excellence for student-athletes.

An institutions' identity shapes it character. Identity refers to the long-term vision of what the university will do and what it will become. To a large degree, the identity of a university establishes what is expected from faculty and students (Kuh, 1993). Institutional goals are often accomplished only through an appreciation and delicate balance of competing interests of the groups that compose the institution. Institutional activities may be described as either formal or informal. Formal activities are those that contribute to the accomplishment of institutional goals. Informal activities possess no rational connection with institutional goals. Conflicts between formal and informal activities often result in negative outcomes for the institution. The determination of which activities are formal and which are informal lies within the chosen identity of the institution. (Mangold, Bean, &

Adams, 2003). The challenge that presents itself to institutions is that of defining themselves and composing themselves with faculty, coaches, and students who embody that vision.

Research shows selection of students affects student integration and institutional environment. Porter (2006) argued that attending school with high-ability students affected engagement. Peer effects explain why elite schools care so much about the quality of students they admit. Similarly, Miller and Kerr (2003) found recruiting student-athletes who excel in the classroom helps generate a more scholarly environment. Ferris, Finster, and McDonald (2004) found universities with more selective recruiting policies graduate both students and athletes at higher rates. Prospective student-athletes come with differing degrees of athletic and academic proficiency. Great students, who happen to be great athletes aren't always available, especially at less prominent schools. The challenge faced by institutions in selection of student-athletes goes beyond recruiting the best available. It is in understanding and managing the idea that the institution, itself, may be changed, for better or worse, by the students it chooses.

The most important factor in academic achievement and persistence is the level of integration of students into the academic and social communities of the institution (McCubbin, 2003; Mangold, Bean, & Adams, 2003). Pascarella & Terenzini (2005) stated that persistence patterns may be described as a series of intentions and commitments that change as students interact with the educational environment through academic and social experiences. As quantity and quality of these experiences increase, the student is more likely to remain at the institution (Tinto, 1975, 1987, 1993).

Wolniak, Pierson, and Pascarella (2001), Pascarella, Bohr, Nora, and Terenzini (1995), and Terenzini, Pascarella, and Blimling (1996) found no differences between and student-athletes and ordinary students in learning ability, cognitive development, or motivation. Although LeCrom et al. (2009) found student-athletes to behave differently than ordinary students and Sedlacek and Adams-Gaston (1992) found it useful to characterize student-athletes as non-traditional students, Cabrera, Nora and Castaneda (1993) wrote that only Tinto's Student Integration Model has been validated across different types of institutions with differing student populations, including non-traditional students. Metz (2004) also noted that Tinto's work evolved to include minority groups and non-traditional students.

Internal characteristics, along with external factors, combine to form a student's commitment to both the goal of attaining a degree and to the institution they attend. Goal and institutional commitments are shaped and modified by academic and social experiences at the institution. These experiences include faculty and peer interactions, academic achievement, and extracurricular activity. The extent, to which students are integrated, both socially and academically, is a function of both student effort and university strategies to elicit student participation. The resulting levels of academic and social integration, along with the modified goal and institutional commitment all influence student persistence (Tinto, 1975, 1987, 1993).

To solve the problem of raising the academic bar for student-athletes, it is appropriate to examine both systems and educational theory. Swanson and Holton (2008) stated that effective problem solving is made more efficient by application of theory. Sound theory directs energies and techniques to models that are proven and away from unsubstantiated claims and guesses. General Systems Theory was first described by Boulding (1956) and von Bertalanaffy (1972). General Systems Theory provides a basic thinking model of inputs, processes, outputs, and feedback. Systems and subsystems coexist, interact, and constantly change (Swanson, 1999). Systems thinking may be thought of as a conceptual framework that makes patterns clearer and allows us to see how to effectively change them (Senge, 1990).

Both Astin's (1993) I-E-O model (Figure 1) and Tinto's (1975) student integration model (Figure 2) describe higher education in a similar context, though no feedback loop is provided. Tinto (2010) later addressed the presence and importance of assessment and feedback. Input (characteristics of students entering the institution) not only affects output (academic achievement and persistence) but also the environment (institutional structure and strategies). Inputs to open systems are complex and their characteristics often cannot be accurately assessed or controlled. The system parts are systems and constantly change as they interact with each other and the environment (Birnbaum, 1988). The process segment of the open system (student integration with the institution) mediates between the input and output variables. Astin included the process of learning as part of the environment element.

Merriam, Caffarella, and Baumgartner (2012) confirm learning to be a process, influenced by the environment in which it occurs.

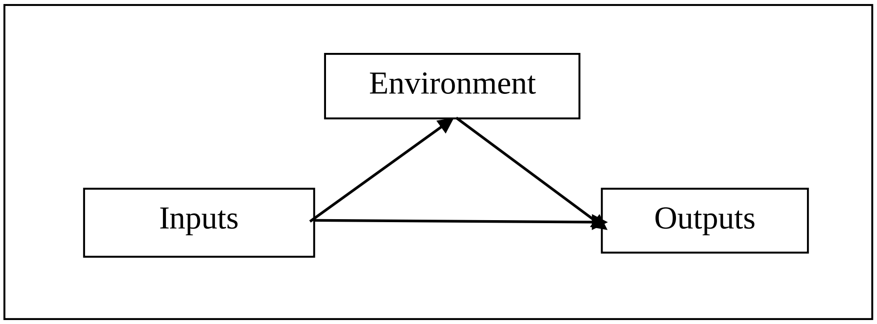

Figure 1. Astin's Input-Environment-Output (I-E-O) Model (Thurmond & Popkess-Vawter, 2001)

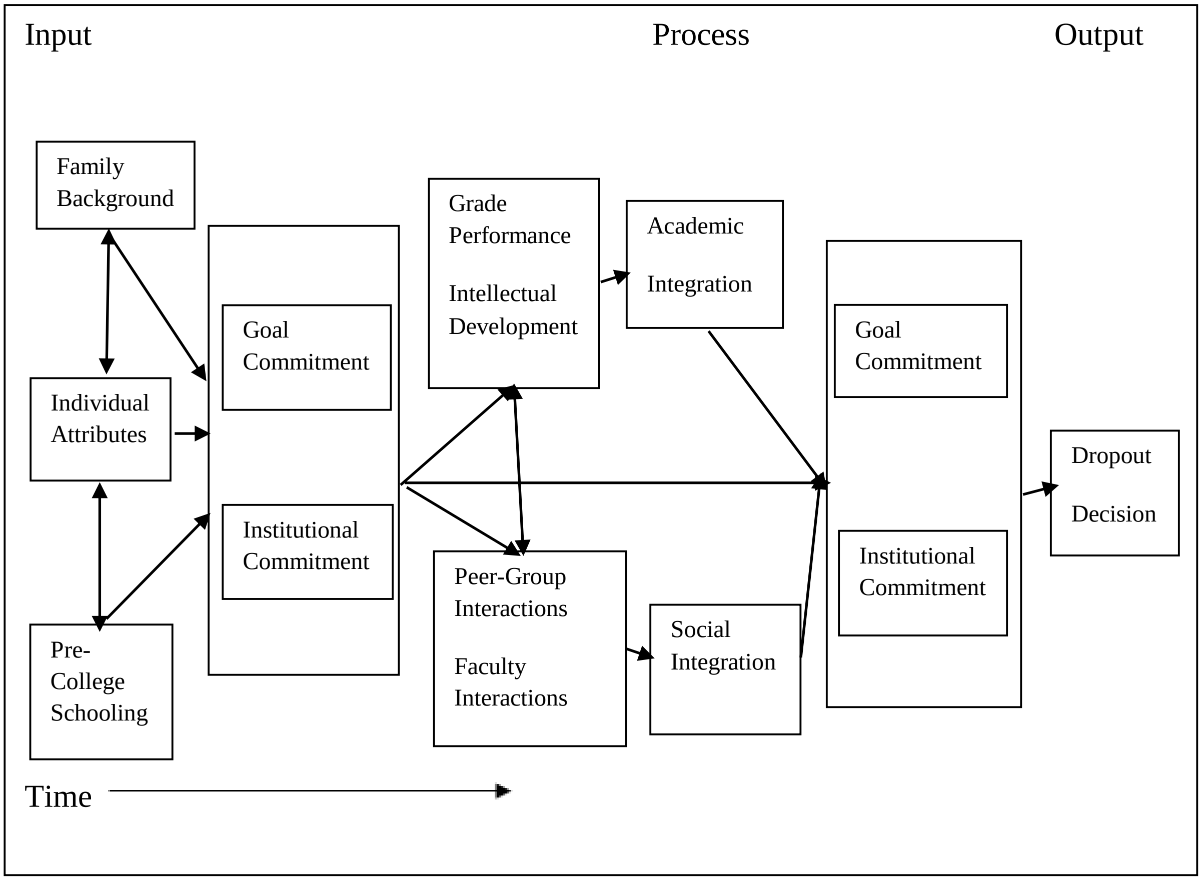

Figure 2. Tinto's Early Model (Tinto, 1975)

Within a systematic framework, Pascarella and Terenzini (2005) divide the theoretical approaches addressing student achievement and persistence into two groups: development and change. Learner (as cited in Pascarella and Terenzini, 2005, p. 17) described developmental theory as systematic, organized, and successive adaption. Adaption may be precipitated by physical growth, environmental changes, or relations with others. Developmental theory usually is rooted in psychological, educational, or possibly moral thought. Change theories are described as progression or regression in cognition, attitude, or behavior. Change theories focused on environmental and sociological factors.

Early research of academic achievement and persistence focused on developmental theories and the effects of student level variables on persistence. Academic success was seen as a function of students' individual attributes, skills and motivation. Academic failure was likewise seen as the result of deficits in those areas. "Students failed, not institutions" (Tinto, 2006, p.2). Recently, research has centered on the sociological or change theories and the effects of institutional characteristics on persistence, shifting accountability to institutions for educational outcomes (Fung, 2010).

Efforts by the National Collegiate Athletic Association (NCAA) to raise academic performance by student-athletes have mirrored research on achievement and persistence. Admission standards reflected the developmental approach in increasing the quality of academic preparation of student-athletes entering the system. Eligibility requirements, also reflecting the developmental approach, placed accountability for academic performance on the student. In 2003, the NCAA designated the Academic Progress Rate (APR) as the metric by which academic performance at the team level should be measured. APR was designed to place accountability of academic progress on both the individual and the institution and signaled a shift toward the environmental perspective of change theory. APR is a function of academic achievement demonstrated through continued eligibility, and in academic persistence. Integration into both the social and academic communities of any college community has been clearly proven to beneficial to both achievement and persistence. Other factors (e.g., family role, financial limitations, race, gender, residence, pre-college academic history) also affect achievement and persistence (Tinto, 2006).

Nature of Problem

Tinto (2006) wrote that all the theories and models that have been offered on student achievement and persistence have resulted in a more sophisticated understanding of a complex subject. Braxton (2002) wrote, "An understanding of the complexity of the context of college student learning is a necessary first step toward the improvement of the undergraduate college experience in general and college student learning in particular" (p. 4). It is clear that improving the process and environment of learning for all students, and especially student-athletes is a multifaceted and complex problem. It is also clear that meeting this challenge may require multiple approaches from different schools of thought. Tinto (1993) indicated college student achievement, retention are impacted by pre-college traits of student athletes as well as by student integration over time. Since Academic Progress Rate is determined by achievement and retention, it also stands to be impacted. Further, since levels of pre-college traits within the student body and the subset containing student-athletes, may be influenced by selection strategies and academic integration may be related to institutional policy and structure, accountability for academic achievement by student-athletes is now shared by the athletes and the institution which they attend.

Improvement in academic performance may then result from efforts by both student-athletes and institutions.

Statement of Problem

If students who represent a college or university as athletes do not achieve academically then not only are those students deprived of present and future opportunities, the college or university is poorly represented (Splitt, 2007). NCAA institutions have been very successful at recruiting and developing talented athletes who compete at a very high level. The same results have not always been achieved academically. The athletes who represent universities are expected to be students, progressing toward a meaningful degree. The problem to be solved, then, was to identify the factors involved in student-athletes' progress that contribute significantly to an environment that fosters success. This environment may also be used as an enticement to future recruits targeted by the institution.

Statement of Purpose

The purpose of this study was to explain annual changes in single year Academic Progress Rate (APR) with annual changes in team and institutional variables. This study also explained variance in team Academic Progress Rate scores with team and institutional variable levels. Team variables included team gender, sport type, and squad size. Institutional variables included individual variables aggregated to the institutional level. Institutional variables included age, ethnicity, institutional gender, high school GPA, SAT/ACT scores, institutional control, conference affiliation, percentage of students receiving federal aid, percentage of students receiving state aid, percentage of students receiving institutional aid, percentage of students receiving student loans, level of instate tuition, level of out of state tuition, academic support expenditures, entrance requirements concerning high school GPA, entrance requirements concerning high school rank, curriculum differentiation, faculty per acre, instructional expenditure level, percentage of full-time faculty, student/ faculty ratio, research orientation, dormitory capacity, locale, students per acre, and student services expenditures. In order to determine the most effective way to increase APR, it is important to understand those changes in team variables and institutional variables that have the greatest impact on changes in APR. The study was longitudinal in the aspect that repeated measurements are taken on the same units over one year increments. The units were not individuals but institutions (Hair et al., 2006).

McLaughlin (2012) employed hierarchical linear modeling to examine the variance associated with team APRs from the 2009-2010 year using both team level and institutional level variables. McLaughlin (2012) was successful in explaining a significant portion of the variance in APRs achieved during a single year. McLaughlin (2012) recommended future research using an expanded dataset. This study proposed to explain variances in longitudinal changes in APR over a seven year interval using an expanded dataset consisting of annual changes in theoretically selected variables.

Definition of Terms

The Interuniversity Consortium for Political and Social Research (ICPSR), established in 1962 at the University of Michigan in Ann Arbor, is a membership-based organization providing access to the world's largest archive of computer-based research and instructional data for the social sciences.

IPEDS is the Integrated Postsecondary Education Data System. NCES is the primary federal component for collecting and analyzing educational data. Contained within NCES is the Integrated Postsecondary Education Data System (IPEDS). IPEDS is a system of surveys designed to collect data from all primary providers of postsecondary education.

HLM is hierarchical linear modeling, a statistical technique that models data acquired from more than one level. The units of analysis are at the lowest level and are nested within higher levels.

APR is Academic Progress Rate, a metric developed to track the academic achievement of teams during each academic term. *APR* is the percentage of eligibility and retention points earned to total points available. The percentage is multiplied by 1000 to eliminate the decimal point. *APR* is reported by the NCAA as a four year rolling average but in this study only one year calculations were used to achieve the longitudinal effect. *DAPR* is the difference in consecutive single year *APR* scores for a collegiate team. DAPR may show magnitude numerically or direction with positive indicating a gain and negative indicating a reduction. *DAPR* is the dependent variable in hierarchical equation models.

Team Variables are variables that are unique to teams included in the study. *Team Variables* are designated as Level 1 variables and will be used as predictors in the random effects model. *Team Variables* include: *Sport Profile, Squad Size,* and *Team Gender.*

Sport Profile is a categorical variable. *Sport Profile* indicates the sport in which each particular team competes. *Sport Profile* is dichotomized as 1 or 0; 1 reflects a high profile sport, 0 reflects all other sports. High profile sports include football, men's basketball, and baseball (NCAA, 2012a).

Squad Size is defined as the number of team members. It is a continuous variable derived from the ICPSR dataset.

Team Gender is the gender of team members. *Team Gender* is dichotomized as 1 or 0; 1 reflects female, 0 reflects male

Institutional Variables include variables unique to institutions but not to specific teams nested within them. *Institutional Variables* also include individual variables aggregated to the institutional level. *Institutional Variables* are designated as Level 2 variables and will be used as predictors in the intercepts-as-outcomes model.

Student Variables are individual variables aggregated to the institutional level. *Student Variables* include: *Age of Students (AGE), Ethnicity (ETH), Gender (GEN), High School GPA (GPA),* and *SAT-AC (SAT).*

Age of Students is a continuous variable derived from the IPEDS dataset representing the percentage of full-time students of age 24 or less.

Ethnicity is a continuous variable derived from the IPEDS dataset representing the percentage of minority students as compared to full-time students. Minority status includes the categories of American Indian, Asian, Hispanic, Black, and unknown race.

Gender is a continuous observed variable representing the percentage of male undergraduate students derived from the IPEDS dataset.

High School GPA is a continuous observed variable representing academic preparedness of students entering an institution. It is taken from *Peterson's Guide to Universities* and *The Princeton Review's Complete Book of Colleges*, and serves as a measure of institutional selectivity.

SAT-ACT is a continuous observed variable representing the score which marks the 25th percentile of the combined verbal and math SAT scores derived from the IPEDS dataset. ACT composite scores are converted to an equivalent scale (Marco, Abdel-Fattah, & Baron, 1992) and substituted if SAT scores are unavailable. It is an indicator of the degree of competitiveness to which an institution can attract qualified students (Alon & Tienda, 2007).

Financial Variables represents the overall financial costs and resources of the students attending an institution. *Financial Variables* are composed of eight observed variables from the IPEDS dataset: *Control (CON), NCAA Subdivision (DIV), Federal Grant (FED), State Grant (SG), Institutional Gran (IG), Student Loan (LOAN), In-State Tuition (IN-ST),* and *Out-of-State Tuition (OUT-ST).*

Control is a categorical variable derived from the IPEDS dataset which indicates the source of funding for an institution's administration. *Control* divides the population into four subgroups: public, private not for profit, private for profit, and not available. *Control* and its planned contrast variables are represented by three dummy variables, *CON(PUBLIC), CON(PRI-NO PRO),* and *CON(PRI-PRO).* The planned contrast variables are coded in orthogonal coding method. Further explanation of the coding used for *Control* is provided in Table 3.

NCAA Subdivision is a categorical variable based on football postseason participation. It features a four-level scale which includes: Football Bowl Series (average attendance = 15,000 and 85 scholarships), Football Championship Series (63 scholarships), Division I (no football), and other (ice hockey and single sport conferences). *NCAA Subdivision* and its planned contrast variables are represented by three dummy variables, *DIV(FBS), DIV(FCS),* and *DIV(NOFB).* The planned contrast variables are coded in orthogonal coding method. Further explanation of the coding used for *NCAA Subdivision* is provided in Table 3.

Federal Grant is the percentage of full-time, first-time, undergraduate students attending an institution who receive federal grant aid. This percentage indicates the average socioeconomic status of the student body in an institution because the federal grants, such as Pell grants, are need based financial aid (Fung, 2010; Pike, Smart, Kuh, & Hayek, 2006). It is a continuous observed variable from the IPEDS dataset.

State Grant is the percentage of full-time, first-time, undergraduate students attending an institution who receive state/local grant aid. It is a continuous observed variable from the IPEDS dataset.

Institutional Grant is the percentage of full-time, first-time, undergraduate students attending an institution who receive institutional grant aid. It is a continuous observed variable from the IPEDS dataset.

Student Loans is the percentage of full-time, first-time, undergraduate students attending an institution who receive student loans. It is a continuous observed variable from the IPEDS dataset.

In-State Tuition is a continuous observed variable from the IPEDS dataset representing the cost of attendance for in-state residents.

Out-of-State Tuition is a continuous observed variable from the IPEDS dataset representing the cost of attendance for out of state residents.

Academic environment is the institutional structure that results in opportunities provided for interaction within the academic community. *Academic integration* can be measured in terms of the student's grade performance and interaction with the academic community. *Academic environment* is represented by nine observed variables from the IPEDS dataset: *Academic Support Expenditures (ASE), Admit GPA (AD-GPA), Admit Rank (AD-RANK), Curriculum differentiation (CUR), Faculty/Acre (FAC/A), Instructional*

Expenditures (IE), Percentage of Full-time Faculty (%FAC), Research Orientation (REA), and *Student-Faculty Ratio (S/F).*

Academic Support Expenditures is the average amount of academic support expenditures per full-time equivalent student enrolled in an institution. It is a continuous observed variable derived from the IPEDS dataset.

Admit GPA is a categorical variable that refers to the admission policy for entering first-time undergraduate students. *Admit GPA* and its planned contrast variables are represented by three dummy variables, *AD-GPA(REQUIRED), AD-GPA(RECOMMENDED),* and *AD-GPA(NEITHER)* which are coded to include the categories: required, recommended, neither required nor recommended, and other (do not know, not reported, or not applicable). The planned contrast variables are coded in orthogonal coding method. Further explanation of the coding used for *Admit GPA* is provided in Table 3.

Admit Rank is a categorical variable that refers to the admission policy for entering first-time undergraduate students. *Admit Rank* and its planned contrast variables are represented by three dummy variables, *AD-RANK(REQUIRED),, AD-RANK(RECOMMENDED),* and *AD-RANK(NEITHER)* which are coded to include the categories: required, recommended, neither required nor recommended, and other (do not know, not reported, or not applicable). The planned contrast variables are coded in orthogonal coding method. Further explanation of the coding used for *Admit Rank* is provided in Table 3.

Curriculum differentiation is the number of majors offered within the institution's curriculum. *Curriculum differentiation* is measured by counting the number of undergraduate majors with at least one student completing degree requirements using the Classification of Instructional Program codes (National Center for Education Statistics, 1990, 2000, 2010) in the IPEDS Completions survey.

Faculty/Acre is a continuous variable representing institutional density. It is derived by dividing the IPEDS variable, number of full time instructional faculty (equated 9 month contract), by the geographic area of the main campus in acres. The area measurement is taken from the 2004 through 2011 editions of *Peterson's Four-Year Colleges*. To account for missing entries or occasions where the acreage reported in *Peterson's Four-Year Colleges* differed by more than ten percent from both the previous and following year, the

average of the previous and following year was imputed. Research of university websites revealed differences were most often the result of reporting total real estate holdings of the university in lieu of campus area. Students and professors are more likely to meet on a main campus than in an outlying area.

Instructional Expenditures is the average amount of instructional expenditures per full-time equivalent student enrolled in an institution. It is a continuous observed variable derived from the IPEDS dataset.

Percentage of Full-time Faculty is a continuous variable derived from the IPEDS dataset. It is the ratio of all full-time staff with faculty status to all faculty members (both full-time and part-time).

Research Orientation is a continuous observed variable derived from the IPEDS dataset. It is graduate and first professional students as a percentage of all students.

Student-Faculty Ratio is defined as the ratio of full-time students enrolled to full-time instructional faculty in an institution. It is a continuous observed variable derived from the IPEDS.

Social environment is the institutional structure that results in opportunities provided for interaction within the social community. *Social integration* is a function of extracurricular activity and peer-group interaction. *Social environment* is measured by four observed variables from the IPEDS dataset: *Dormitory Capacity (DC), Locale (LOC),*

Student/Acre (STU/A), and *Student Service Expenditures (SSE)*.

Dormitory Capacity is the maximum number of students that the institution can provide residential facilities for, whether on or off campus. *Dormitory Capacity* is a continuous observed variable from the IPEDS dataset.

Locale is a categorical variable derived from the degree of urbanization variable in the IPEDS dataset. It features a five-level scale: city, suburb, town, rural, and not available.

Locale represents the amount of amount of external opportunities available in the community where the institution is located. More urbanized the communities provide more external opportunities. *Locale* and its planned contrast variables are represented by three dummy variables, *LOC(CITY), LOC(SUBURB), LOC(TOWN),* and *LOC(RURAL).* The planned contrast variables are coded in orthogonal coding method. Further explanation of the coding used for *Locale* is provided in Table 3.

Student/Acre is a continuous variable representing institutional density. It is derived by dividing the grand total of all students, taken from the IPEDS dataset, by the geographic area of the main campus in acres. The area measurement is taken from the 2004 through 2011 editions of *Peterson's Four-Year Colleges.* To account for missing entries or occasions where the acreage reported in *Peterson's Four-Year Colleges* differed by more than ten percent from both the previous and following year, the average of the previous and following year was imputed. Research of university websites revealed differences were most often the result of reporting total real estate holdings of the university in lieu of campus area. Students and professors are more likely to meet on a main campus than in an outlying area.

Student Service Expenditures is the average amount of expenditures per full-time equivalent student enrolled in an institution expended for admissions, registrar activities, and activities whose primary purpose is to contribute to students' emotional and physical well-being and to their intellectual, cultural, and social development outside the context of the formal instructional program. It is a continuous observed variable derived from the IPEDS dataset.

Research Questions

The goal of understanding which team variables and institutional factors correlate with changes in annual differences in Academic Progress Rate (DAPR) and in levels of Academic Progress Rate (APR) led to the following research questions:

RQ#1: Which annual changes in team variables explain the variance in annual differences in Academic Progress Rate scores?

RQ#2: Which annual changes in institutional variables explain the variance in annual differences in Academic Progress Rate scores?

RQ#3: Which team variables explain the variance in team Academic Progress Rate levels?

RQ#4: Which institutional variables explain the variance in team Academic Progress Rate levels?

Significance of Study

Academic Progress Rate (APR) rates have trended upward (NCAA, 2012a; 2010a). Empirically attaching changes in student and institutional variables to APR gains is important. If particular variables may be identified as key correlates to success, student athletes, coaches, and universities stand to benefit. Pascarella and Terenzini (2005) and Melendez (2006) stated the student-athlete and the subculture to which they belong are overlooked in many college persistence theoretical constructs. Analyzing the factors which contribute to persistence patterns of student-athletes and ultimately to APR provides a research-based perspective from which to develop strategies for improvement (Vander Schee, 2008).

Berger (2001) found that organizational behaviors of colleges can be used to improve student retention. Understanding which institutional characteristics correlate to increases in APR allows universities to plan accordingly. Teams that post a four year rolling average of less than 925 are subject to penalties that include: loss of practice time, elimination of spring football, reduced schedules, financial aid reductions, coach-specific penalties, restricted membership, and multiyear bans on postseason competition (NCAA, 2012a). A climate that is conductive to success can be marketed to prospective recruits and donors. Current student-athletes, most of who will not play professionally, may benefit through development of an environment that is associated with degree attainment. Prospective student-athletes benefit with more informed choices of universities during the recruiting process.

Theoretical Framework

Academic progress rate (APR) is a function of academic achievement and student persistence. Team and institutional variables affect both achievement and persistence. Vincent Tinto's (1975, 1987, 1993) student integration model used the combination of an individual's motivation and academic ability and an institution's academic and social characteristics to explain both academic achievement and persistence (Cabrera, Castaneda, Nora, & Hengstler, 1992). At the center of Tinto's model is the idea that both academic and social integration act as mediating variables between predisposed characteristics and persistence. Integration should be distinguished from involvement. Tinto defined integration as the congruence of attitudes and values combined with the effort to meet both formal and informal membership requirements of certain subgroups (Pascarella & Terenzini, 2005). This theoretical approach explains the importance of personal identification and acceptance into academic and social communities where students "believe they are a part of the academic and social systems of the university" (Milem & Berger, 1997, p.389).

Students enter college with unique sets of internal characteristics and external factors which predispose them to remain in college. Internal characteristics include student background, pre-college education and individual attributes. Student background includes socioeconomic status, educational expectations, and parents' education levels. Individual attributes include age, race and gender. Pre-college education factors relate to high school GPA, high school rank, and standardized test scores. External factors involve finances and family considerations. External forces that may cause a student to withdraw include competing obligations and multiple roles as well as financial and residential issues.

Internal characteristics, along with external factors, combine to form a student's commitment to both the goal of attaining a degree and to the institution they attend. Goal and institutional commitments are shaped and modified by academic and social experiences at the institution. These experiences include faculty and peer interactions, academic achievement, and extracurricular activity. The extent, to which students are integrated, both socially and academically, is a function of both student effort and university strategies to elicit student participation. The resulting levels of academic and social integration, along with the modified goal and institutional commitment all influence student persistence (Tinto, 1975, 1987, 1993). Pascarella & Terenzini (2005) summarized that persistence patterns may be described as a series of intentions and commitments that change as students interact with the educational environment through academic and social experiences. As quantity and quality of these experiences increase, the student is more likely to remain at the institution (Tinto, 1993).

Because behavior, intentions, and commitments continually change over time, a longitudinal approach was selected to study Academic Progress Rate (APR), which depends largely on student persistence. Tinto (1993) stated that as student characteristics (social, economic, personal abilities) change over time, so do the students departure patterns. Tinto's (1975; 1987; 1993) student interaction theory offered a longitudinal foundation on which to explain factors related to achievement, persistence and APR. Tinto's revised model is shown in Figure 3.

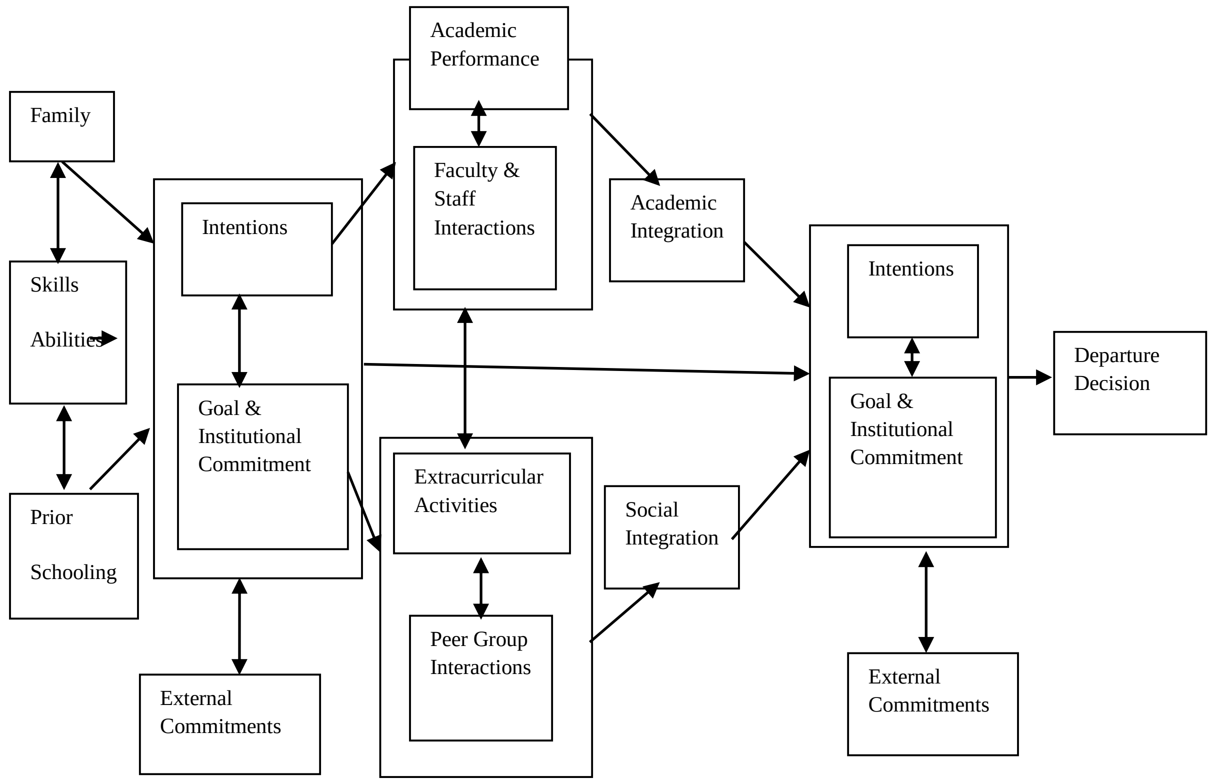

Figure 3. Tinto's student integration model (Tinto, 1993).

While subsequent research has revealed college student retention to be more complex than Tinto’s original model (Tinto, 2006), the fundamental concepts that student persistence is a function of pre-college characteristics mediated by external factors and academic and social integration remains. The degree to which an individual is integrated into the academic and social communities of a university is at the heart of Tinto’s model (McCubbin, 2003).

Mangold, Bean, & Adams (2003) used linear regression to study student-athletes graduation rates at ninety-seven universities. They stated that socially, student-athletes should experience high levels of integration as they participate in activities that bring them together in pursuit of shared goals. Adler and Adler (1985) observed a college basketball program for four years to determine the relationship between athletic participation and academic performance. Bowen and Levin (2003) studied backgrounds, academic qualifications, and college outcomes of athletes and their classmates at thirty-three academically selective colleges. Both Adler and Adler and Bowen and Levin found that as student-athletes live, travel, and compete together, they develop strong bonds among themselves which often develop into very close communities. Bean (2005) suggested that a high level of social connectedness is obvious for student-athletes which aids in establishing a social attachment to the school. Paradoxically, Bowen and Levin (2003) found that as student-athletes become isolated within those communities, they find difficulty in being involved in other institutional settings. Academically, achievement was found to affect persistence of student-athletes in a meta-analysis of 109 studies by Robbins et al. (2004).

Shulman and Bowen (2001) surveyed 90,000 students from thirty selective colleges in the 1950s, 70s, and 90s. Shulman and Bowen found student-athletes often suffer from insufficient precollege preparation. Bowen & Levin substantiated those findings in 2003. Gayles and Hu (2009) used the NCAA's Basic Academic Skills Study (BASS) to survey 410 freshmen at twenty-one universities. Factor analysis and multi-regression analysis were used to document student-athletes' failure to balance social interactions with academic life. The demands of time and effort associated with intercollegiate athletics diminish the academic integration and academic performance of the student (Bowen & Levin, 2003; Shulman & Bowman, 2001; Gayles, 2009: Gayles & Hu, 2009). Whether engaging with the academic or social communities, Tinto's approach explains the importance of students' fit into, the university community (Couch, 2011). Milem and Berger (1997), studying 718 freshmen longitudinally to test Tinto's theory of student departure and Astin's theory of development, and Braxton, Hirschy, and McClendon (2011), who propose a revision of Tinto's theory using a multidiscipline approach, both found that when students believe they are part of the university community, the personal self-efficacy that is developed translates into both academic and social integration and, ultimately, persistence. Student-athletes compose a subset of the university with a unique social community that offers fertile ground for establishing social integration. Within the athletic community, social integration is unique, above all other extracurricular programs in higher education (Shulman & Bowman, 2001). Integration into the academic community has proven to be more difficult for student-athletes. Pascarella and Terenzini (1991) wrote that

Tinto's model provided a framework in which to link academic and social integration. These linked relationships provide greater opportunities for student-athletes to be involved in the academic community and a basis from which to formulate retention strategies (Braxton, Hirschy, & McClendon, 2004; Kuh, Kinzie, Schuh, & Whitt, 2005; Milem & Berger, 1997).

Conceptual Framework

The conceptual framework is derived from the model provided by Tinto (1975, 1987, 1993). Tinto related predisposed individual characteristics of college students with achievement and persistence, as mediated by academic and social integration. Pascarella and Terenzini (1977) surveyed 1008 Syracuse University freshmen prior to, at midterm and following their freshman year. Their longitudinal study, using multiple regression analysis confirmed Tinto's assertions about the importance of social and academic integration and, in particular faculty-student interactions. Pascarella and Terenzini repeated their initial study in 1979 and 1980, each time surveying 1905 freshmen longitudinally. Using discriminant analysis and an expanded set of variables, they were able to support the validity of Tinto's model. .

The conceptual framework for this study involves independent and dependent variables related to three research questions. A single dependent variable is APR change, referring to longitudinal changes in academic progress rate recorded for collegiate athletic teams, within the United States, from 2004 until 2010. Independent variables are organized into team variables, and institutional variables. Two criteria governed selection of independent variables; that they apply to the research questions and that they fit within both Tinto's model and are supported by previous research.

Team variables will be extracted and entered into a hierarchical linear model analysis as Level 1 variables. Team variables are included in the schematic model detailed by Figure 4 at a different level because their influences permeate the entire longitudinal process. Though institutional variables are organized in a structure similar to Tinto's constructs, they will be entered collectively into the model as Level 2 variables.

The conceptual framework developed in Figure 4 provides the basis for the method of this study and identifies how longitudinal differences in predisposed variables and longitudinal differences in mediating integration variables affect longitudinal differences in APR.

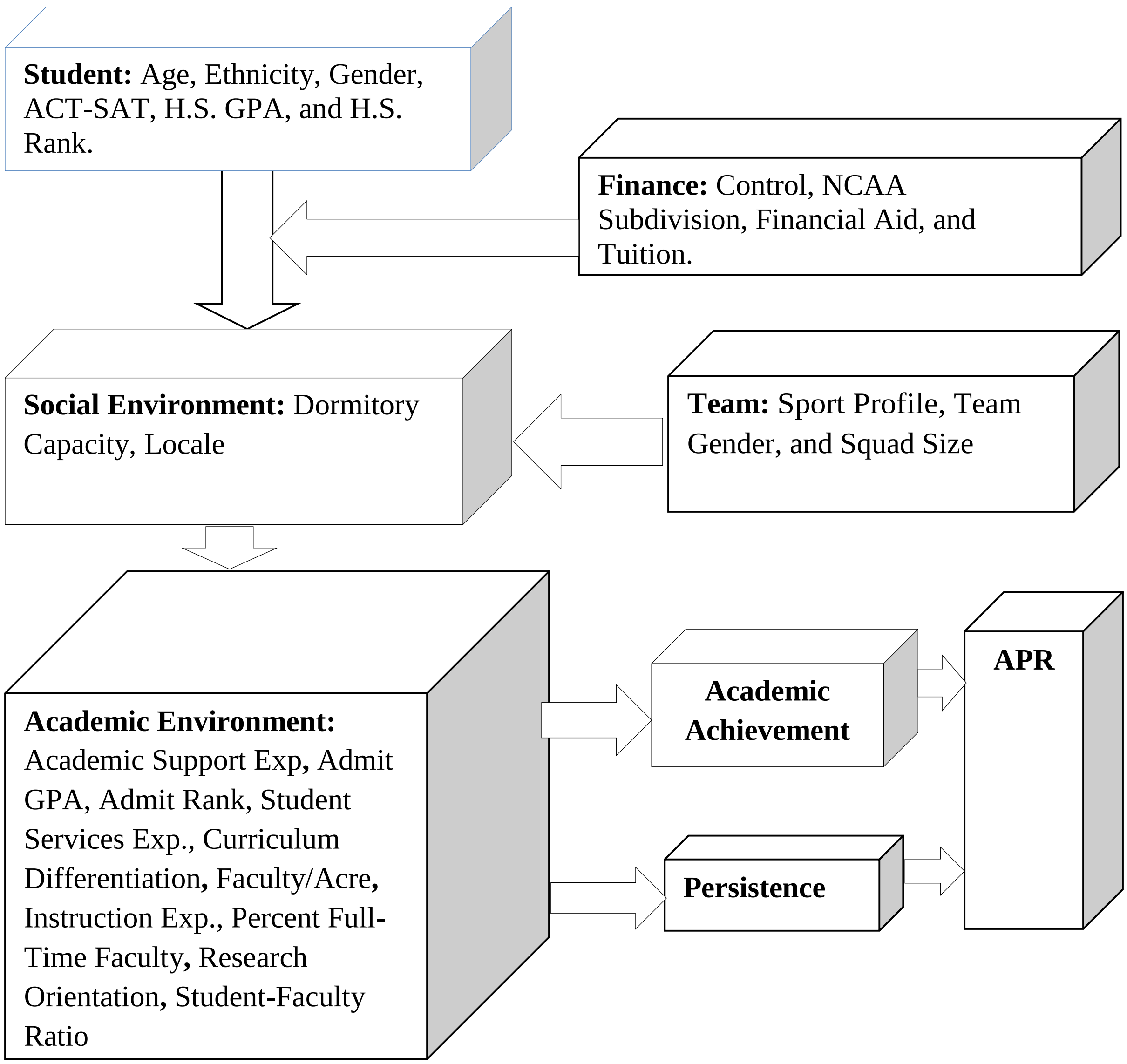

Figure 4. APR Conceptual Model

Limitations

The study is limited first, by the availability of team variables. Three team variables were derived from the ICPSR dataset from 2003 to 2010. Additional team level variables would allow a closer fit with Tinto's model. Second, although IPEDS is the most comprehensive national dataset available for institutional data of higher education, it is a multipurpose dataset and may not contain the best information specific to student-athlete APR (Fung, 2010). While the goal of the study is to explain variance in Academic Progress Rate (APR) scores with team and institutional data, the inclusion of individual data would generate a more complete picture and possibly allow intervention at the student-athlete level.

Academic Progress Rate (APR) is only calculated for student-athletes who receive athletically related financial aid at Division I schools. Walk-on athletes and other student-athletes who receive no financial aid were not considered. The National Collegiate Athletic Association (NCAA) is divided into Division I (the largest programs that provide the most athletically related financial aid for student-athletes), Division II (limited financial aid) and Division III (no athletically related financial aid). Division I is divided into the Football Bowl Subdivision (120 schools who compete for postseason play outside the NCAA structure), the Football Championship Division (122 schools that compete to participate in the NCAA's postseason playoffs), 98 schools who do not sponsor football (NCAA, 2012g), and 35 schools that compete in Division I ice hockey or single sport conferences. This study will only consider teams from Division I.

Delimitations

Only single gender teams were included in the study because of the small number of mixed gender teams in the population. Thirty-eight rifle teams will be deleted in the interest of parsimony. Teams with missing data were also be list wise deleted as advised by Gibson and Olejnik (2003).

Organization of the Study

The study was organized into five chapters. The introduction introduced the major concepts to be studied. Chapter two is a review of relevant literature relating to Academic Progress Rate (APR), the variables used to group the data, the independent variables selected to predict APR, and the theoretical bridge that connects them. Each variable is related to APR through a review of existing literature and a hypothesis detailing the expected impact. Chapter three outlines the methodology that will be used to answer the four research questions. Variables will be examined and procedures will be documented. Chapter four examines the results obtained. Hypotheses will be supported or denied support, research questions will be answered and models will be presented and validated. Chapter five offers a discussion of those results and any conclusions drawn as a result of the study. References follow and conclude the study.

CHAPTER TWO

LITERATURE REVIEW

The goal of this study was determine longitudinal changes in individual variables aggregated to institution level, team variables, and institutional variables which significantly impact longitudinal changes in Academic Progress Rate (APR). Much like an equality sign in an algebraic equation, the theoretical frame work serves as the bridge between the dependent variable and the independent variables.

The literature is presented in three sections: (1) a brief history of the National Collegiate Athletic Association (NCAA) and a discussion of its role in academic achievement and the development of APR, (2) a review of the development of the theoretical frame work of this study, (3) a synthesis of findings relating institutional variables to student-athletes' academic achievement and retention and therefore, changes in APR.

The National Collegiate Athletic Association and Academic Progress Rate

Early collegiate athletics were regarded as nothing more than joint physical education classes between universities (Coakley, 2004). Later, at the beginning of the 20th century, collegiate athletics became more serious, requiring the supervision of adults (Eitzen & Sage, 2003). As interest in collegiate athletics grew, organizations were formed to provide structure, rules, and a framework in which participation was limited to student-athletes. The

Intercollegiate Athletic Association of the United States (IAAUS) was formed to increase the safety of football in 1905 after a season in which 18 players died and 149 were injured (Yeager, 1991). It became the National Collegiate Athletic Association (NCAA) in 1910 (NCAA, 2012e; Barr, 2005).

The first 25 years of the National Collegiate Athletic Association (NCAA) were marred by widespread violations of the requirement that athletes retain an amateur status and by illegal alumni contributions (Helman, 1989). The NCAA lacked both the manpower and legislative authority to enforce academic integrity across institutions (McLaughlin, 2012). Rampant cheating by member institutions lead to an investigation by the Carnegie Foundation and a report entitled, “American College Athletics” released in 1929. Academic and recruiting abuses as well as payments to athletes were documented. The commercialization of collegiate athletics was identified as a significant problem and recommendations to eliminate ticket sales and paid coaches were ignored (Savage, 1929). Forty stadiums had been erected in the 1920s and public demands for a competitive product resulted in a concession by the NCAA in 1934 to allow individual institutions to control their own athletic programs (Zimbalist, 1999).

The National Collegiate Athletic Association (NCAA) was reformed in 1939 and given the power to expel any institution that did not meet minimal standards of conduct (Helman, 1989). By 1942 the NCAA had grown to 314 members and included almost every large college or university in the country (Washington, 2004). World War II weakened the NCAA’s efforts to gain national control of collegiate athletics and in 1944 freshmen were declared eligible to offset the loss of athletes. When the war ended, member institutions unanimously approved the Sanity Code in 1948, eliminating athletic scholarships and subjecting athletes to the same academic standards as non-athletes (Ratliff, 1951). Due to multiple violations and a lack of support for enforcement, the Sanity Code was repealed in 1951. Collegiate athletics returned to the status of 1934 where individual institutions were asked to control their own programs (Marx, 2006).

The 1950s and 1960s saw little control over financial aid or admission standards for athletes. Concern over special admission for athletes resulted in adoption of the 1.6 Rule by the NCAA in 1964 (Zimbalist, 1999). The 1.6 Rule basically, required incoming freshmen to have a high school GPA, class rank, and standardized test core that would predict a college GPA of 1.6, to receive an athletic scholarship (Helman, 1989). The 1.6 Rule was criticized primarily because of the discriminatory nature of standardized tests. Attempts to modify the rule for minority student-athletes only created confusion. With the reestablishment of freshman eligibility in 1972, the 1.6 Rule was replaced with the 2.0 Rule which simply required a high school GPA of 2.0 (Zimbalist, 1999).

Increased television coverage of college athletics and incidents related to academically unqualified athletes in the early 1980s, refocused public attention on academic integrity (Zimbalist, 1999). In 1983 the NCAA passed Proposition 48 which required a high school GPA of 2.0 in 11 core subjects, and reinstated a minimum standardized test score (Edwards, 1984). Farrell (1996) and Peltier and Laden (1999) suggested that Proposition 48 increased graduation rates among college athletes.

In 1989 the Knight Commission was formed to address the integrity of collegiate athletics. In its report, *Keeping Faith with the Student-Athlete*, the Knight Commission echoed earlier concerns about rule violations, lack of academic integrity, and increased commercialization (Knight Commission, 1991). As a result of the Knight Commission report and renewed discriminatory complaints about Proposition 48, Proposition 16 was introduced in 1996. Proposition 16 contained higher minimum requirements than Proposition 48 but allowed prospective student-athletes to gain eligibility through a sliding scale or combination of GPA and standardized test scores (Barr, 2005).

Admission standards were again raised in 2002 with NCAA Bylaws 14.3 and 14.4 increasing the number of high school core subjects to 14 with a minimum GPA of 2.0. Freshmen athletes were required to complete 24 credit hours with a minimum GPA of 1.8 to remain eligible. Finally, the NCAA required completion of 40, 60, and 80 percent of requirements for a specified degree for athletes to remain eligible after their second, third, and fourth years, respectively (NCAA, 2005). In 2015, high school recruits will need a 2.3 GPA on 16 core courses, 10 of which must be completed by the end of their junior year. Junior college transfers will be required to post a 2.5 GPA on transferrable credits (NCAA, 2012f).

Academic dishonesty, poor academic performance, attrition, and underdeveloped career skills (Benford, 2007; Gerdy, 2006; Ridpath, 2008) remained problematic. Criticism from the Knight Commission continued (Knight Commission, 2004). Suggs (2003a, 2003b) questioned the balance between athletics and academics in higher education. Perhaps the harshest critiques and most influential calls for reform came from Shulman and Bowen (2001) and Bowen and Levin (2003) who found that athletes routinely received preferential treatment in admission and, as a result found themselves less prepared for college than their peers. They also found that student-athletes created a separate subculture insulated from the larger campus culture. With graduation rates of student-athletes diving to embarrassing lows, the NCAA acted in 2003 to motivate institutions to do more by introducing its newest effort to reform collegiate athletics (Lucas & Lovaglia, 2005). The centerpiece of the reform effort was a new measure called the Academic Progress Rate (McLaughlin, 2012).

The academic reform incentive/disincentive plan or Academic Progress Rate (APR) was initially assessed in 2005 and implemented in 2006 (Johnson, Wessel, & Pierce, 2012). The APR is produced by a formula that condenses student-athlete eligibility and retention factors into a single number that provides a clearer picture of the academic culture on each Division I sports team in the country (NCAA, 2012c). Previous academic measures used by the NCAA were initial eligibility variables, determined before student-athletes entered college or graduation rates, determined six years after admission. The NCAA also monitored GPA and percentage of degree completion each semester but they were specific to individual student-athletes and did not explain team academic culture (Brown, 2005).

The Academic Progress Rate (APR) is calculated for all student-athletes receiving financial aid for athletic ability (NCAA, 2010b). Each term a student athlete may earn one point for remaining academically eligible and one point for remaining at the institution. Eligibility and retention were chosen as factors of APR because they were the best predictors of graduation, the most important goal of the NCAA (Brown, 2005). A point is earned if a student–athlete transfers and enrolls at another four year institution. When a student-athlete graduates, one point is earned. Student athletes who remain eligible may be granted waivers for signing a professional contract or competing in the Olympics. Student-athletes who return to school to complete their degree earn a bonus point awarded in the term the degree is official. Eligibility points are earned by meeting minimum standards for GPA, credit hours earned, and percentage of progress toward a degree. Minimum standards for GPA are 1.8 after the first year, 1.9 after the second year, and 2.0 thereafter. Minimum credit hour requirements are completion of 24 credit hours prior to the second year of collegiate enrollment. With few exceptions students must be enrolled in 12 credit hours each term and pass 6 of those. Additionally, the student must have completed an average of 12 credit hours for each term at the institution or have completed 24 credit hours since the beginning of the previous fall term. Finally, the NCAA percentage of progress toward a degree was not changed remaining at a required completion of 40, 60, and 80 percent for athletes to remain eligible after their second, third, and fourth years, respectively (NCAA, 2011). Team APR is calculated by dividing total points earned by a team during the year by total possible points and multiplying by 1000 to eliminate the decimal.

$$\text{Single year APR} = \frac{\text{Team sum of points (eligibility + retention) earned}}{\text{Team sum of points (eligibility + retention) possible}} * 1000.$$

Each single year Academic Progress Rate (APR) score is then averaged with the previous three years APR scores to obtain a rolling four-year average. Contemporaneous penalties are levied to teams that score below 925 and have one or more players become ineligible and leave school. As much as ten percent of scholarships may be lost. A team may not re-award the scholarship to another player for one year. Contemporaneous penalties are intended to identify immediate problems and move teams to retain players. More severe historical penalties may be imposed to teams that repeatedly fail to meet the minimum standard of 900 which will progressively increase to 930 by 2015. Historical penalties include limited practice time, exclusion from post-season competition, and loss of membership privileges (NCAA, 2010b, 2012d). When a school fails to meet APR standards, it may be encouraged or even required to present an academic improvement plan to the NCAA. Schools' resource levels and progress toward improving academic missions are considered by the NCAA when penalties are determined (NCAA, 2012d). Data collected over the first eight years (2003-2011) of APR compilation showed a steady rate of two percent of teams penalized. Table 1 shows APR scores for all men's sports over this period.

Table 1.

Average APRs by Sport for Men's Teams *(Single-Year APRs in Sports with 50 or More Teams)*

SPORT	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10
Baseball	933	935	941	945	964	966	967
Basketball	929	928	929	932	948	950	952
Cross Country	959	961	962	966	967	971	978
Football	930	930	933	940	948	949	948
Golf	963	960	962	962	973	978	974
Ice Hockey	971	972	967	971	980	981	982
Lacrosse	969	972	976	973	975	975	976
Soccer	954	953	953	961	969	969	970
Swimming	973	962	965	970	973	977	974
Tennis	959	966	959	967	969	970	976
Track (Indoor)	951	951	949	956	959	965	965
Track (Outdoor)	951	952	950	956	961	966	967
Wrestling	944	938	944	947	965	959	962

Notes: Analyses based on N= 5828 squads that sponsored the sport within Division I during all eight years.

Retention calculation changed in 2007-08 to grant point adjustments for certain transfer students. (NCAA, 2012b)

Table 1 indicates a slight upward trend in Academic Progress Rate (APR) scores with a large increase in all sports between 2006-2007 and 2007-2008 when retention calculation was changed. NCAA president Mark Emmert said a flattening out or even some slight decreases over time are not unexpected (NCAA, 2012a). Are student athletes doing better academically? In 2010 the NCAA said they were with 79 percent of Division I athletes earning degrees (NCAA, 2010a). Emmert concurred, stating the APR is resulting in real, measurable impacts (NCAA, 2012a).

Baseball, football and men's basketball consistently posted the lowest scores. Single year APR, eligibility, and retention totals for baseball, football, and men's basketball over the 2003-2010 intervals are presented in Table 2.

Table 2.

APR, Eligibility and Retention Trends

APR	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10
Baseball	933.2	935.3	941.4	944.6	964.4	965.7	966.6
Men's Basketball	929.4	928.4	928.8	932.5	948	949.8	951.6
Football	930.1	930.4	933.1	940.3	947.6	948.9	948

ELIGIBILITY	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10
Baseball	940.6	938	940.2	950.4	968.3	967.6	972.3
Men's Basketball	936.5	935.3	935.9	947.3	958.1	956.4	960.7
Football	921.2	919.5	921.8	929.1	934.3	938.3	936.9

RETENTION	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10
Baseball	919.2	923.5	930.6	928.4	947.1	952.6	952.1
Men's Basketball	917	910.5	909.2	907.1	928.1	934.8	932.7
Football	933.7	933.3	935.9	941.5	949.6	949.7	949.6

Notes:1.Analyses based on 274 baseball squads, 323 men's basketball squads, and 230 football squads, from schools that sponsored the sport within Division I during all seven years.

2. APR retention calculation changed beginning in 2007-08 to grant point adjustments for certain transfer students.

Change did not affect eligibility rate calculation. (NCAA, 2012b)

The focus of this study is in determining which student-athlete and institutional variables impact eligibility and retention and ultimately, Academic Progress Rate (APR). To connect student athletes to APR, it is important to initially, examine retention theory as it applies to all students. The discussion will then narrow to the factors that apply to the subgroup of student-athletes.

Theoretical Framework

Theory may be used to frame the issues institutions face and inform strategies they propose in providing an environment that enables student-athletes to integrate into academic and social communities. There must be an inter-play between theory and practice in that theory is used to recommend solutions to educational problems and practice allows for assessment and reapplication of theory (Harper & Quaye, 2009). The study of retention of college students has spanned four decades, several books and countless articles. Theory has grown more complex as it has been applied and amended to fit a complex problem. In spite of multiple efforts, retention numbers have not improved as expected. It is therefore not unreasonable to ask what else may be done (Tinto, 2006).

Pascarella and Terenzini (2005) grouped theories and models of student development and change into two broad families. Developmental theories and models addressed the nature and process of growth within the student although external forces are often mentioned as components within these models. This family had been dominated by psychological stage theories. Student retention was seen as the product of internal skills and motivation.

Students failed, not institutions (Tinto, 2006). The second family focused more on the environmental or sociological origins of student change. The view of retention started to take into account the role of the institution in students' decisions to stay or leave. These origins may be student-related (such as prior academic achievement or socioeconomic status), structural (such as institutional size or selectivity), or environmental (academic or social climate created by faculty and students on campus) (Pascarella and Terenzini, 2005).

Chickering

One of the most prominent developmental theorists was Arthur Chickering who identified seven vectors of student development. Each vector was assigned both direction, though spiral or stepped in nature, and magnitude. The seven vectors were: achieving competence, managing emotions, autonomy, relationships, establishing identity, developing purpose, and developing integrity (Chickering, 1969). Chickering and Reisser (1993), summarizing twenty-five years of studies, created a revised model to apply to all college students, regardless of age or background. The "Seven Principles for Good Practice in Undergraduate Education" were developed. The principles were student-faculty contact, student-peer contact, active learning, prompt feedback, time on task, high expectations, and respect for diverse talents and ways of learning. Though Chickering was considered a developmental theorist, it is worth noting that his principles of student-faculty contact and student-peer contact were adopted later by sociological theorists as constructs of academic and social engagement.

Astin

Bridging the gap between developmental and sociological thought, Astin's (1993) I-E-O model stated persistence is the result of interactions between inputs, students' precollege attributes, and the environment in which they reside. Astin examined eighty-two longitudinal outcomes and their relationship with academic performance and retention. Twenty-five thousand freshmen at two hundred four year universities were surveyed both in the fall of 1985 and 1989. Faculty members were also surveyed in 1989. Astin sought to understand how college impacted student behavior, including persistence, over and above the general maturation and environmental factors that would have occurred if the student did not attend college. Astin found the more heavily involved students to be the most affected and involvement at any level to have a positive effect on persistence. Simply put, Astin's theory of student development said students learn by becoming involved. Astin's work was consistent with Pace's (1982) work on the quality of student effort. Pace (1982) used the College Student Experience questionnaire to survey 12,000 students at forty colleges over a three year period. Students rated themselves on use of college facilities, personal and social opportunities, and quality of effort. Pace found that, for college students, the most important factor in student achievement and ultimately, persistence, was not who they were or where they were, but what they did. "Quality" (pp.2) effort was found to be what counts in achieving in college.

Tinto

Vincent Tinto is the most frequently cited scholar on college student retention (Harper & Quaye, 2009). Tinto (1975) sought to provide a model that explained the longitudinal process of student departure within a particular college or university. Earlier developmental models of student persistence spoke of all individuals who left college as a single group, and labeled them dropouts (Tinto 1975). Tinto's student integration model was similar to Astin's (1977) involvement and Pace's (1982) quality of effort and also drew from Spady (1970). Spady's methodological analysis, critique, and synthesis of empirical literature cited Durkheim's (1951) theory of suicide which categorized reasons people commit suicide and suggested that one of the reasons individuals commit suicide is lack of integration into society. Tinto, similarly, categorized reasons for lack of persistence and found students often leave school because of a lack of friends at the institution (Tinto, 1993).

Tinto (1982) found Durkheim's model insufficient due to its lack of consideration of individual traits. Tinto theorized that each student brought certain predisposed characteristics which included family background, pre-college education, and individual skills and abilities which strongly contributed to their persistence. According to Tinto, students are subsequently integrated, to varying degrees, into the university's academic and social communities through experiences and interactions with peers and faculty. Individual traits along with levels of integration determine levels of institutional and goal commitment which prompt the decision of whether to remain in school. Tinto claimed academic and social integration, along with institutional and goal commitment were not separate but related

(Tinto, 2006). Tinto (2000) wrote that academic and social integration enhance the quality of student effort and, as a result, student engagement. This represented the converse of Pace (1982), one of Tinto's foundational models.

Some scholars questioned whether social and academic integration applied in general. Corman, Barr, & Caputo, (1992) critiqued American and Canadian research and found the American research narrowly focused on an institutional definition of attrition with policy recommendations aimed at students who have already demonstrated an ability to succeed academically. Others questioned whether integration into the college environment was important for minority groups. Severiens & Wolff (2008) surveyed 523 students at four universities. The surveys concerned indicators of integration and academic performance. Using structural equation modeling, Severiens and Wolff found minority students performed at a lower level using the same approach to learning.

Support came from those who found academic and social integration operates across racial and ethnic boundaries. Cabrera & Nora (1994) surveyed 879 freshmen in 1990 at a predominantly white, doctorial, Midwestern institution and followed with focused interviews with students at Arizona State University. Using structural equation modeling, Cabrera and Nora found non-minority students alienated by the university more often than minority students but for different reasons. Minority students were alienated by perceived prejudice, non-minority students were alienated by a lack of university commitment. Cabrera, Nora, Terenzini, Pascarella, and Hagedorn, (1999) studied 1454 incoming freshmen at eighteen universities in the fall of 1992. Using the National Survey of Student Learning and IPEDS data, Cabrera et al. found unpreparedness did not contribute to differences in academic performance between ethnic groups. Also, disengagement instead of perceived prejudice inhibits academic outcomes of minority students. Perceptions of prejudice impact the outcomes of both minority and non-minority students and finally, minority persistence is shaped, not by prejudice, but by positive relationships with faculty and peers. Nora and Cabrera (1996) found similar results, sampling 831 freshmen through surveys and student transcripts. Bean and Metzner (1985), in an extensive review of literature, found that environmental variables had a greater impact on student attrition than social integration for older, non-residential students.

Where it was originally argued that retention required students to break away from past communities, the ability to remain connected grew to be considered essential. Nora (2001), in a review of literature, examined how family relations impacted academic and social integration, institutional and goal commitment, and finally, commitment. Cabrera, Nora, Pascarella, and Hagedorn, (1999), and Nora & Cabrera (1996) had taken issue with Tinto's premise that in the first stage of college life, a student must break from ties to family and significant others in order to fully integrate into the university communities. Nora (2001) found "abundantly clear evidence" (pp. 51) that the support system provided by a student's family and friends is a positive factor in persistence.

Academic and social integration result when students, each with unique internal and external traits, are inducted into the university communities. Institutional structure and programs provide opportunities for students to interact with faculty and peers and facilitate their induction. Braxton and Brier (1989) examined organizational attributes and interactional attributes effects on student attrition. Using path analysis Braxton and Brier found organizational factors to affect attrition. Braxton, Vesper and Hossler (1995), tested a longitudinal panel of 263 drawn from a population of 4,923 first-time freshmen. Using structural equations modeling analysis, they found that both academic and social integration were positively influenced by the meeting of educational expectations. Pascarella, Terenzini and Wolfle (1986) examined three longitudinal questionnaires and academic records of 763 college freshmen to determine if a two-day summer orientation might affect first year persistence while controlling for student background characteristics. Surprisingly, orientation contributed only marginally to persistence but significantly to social integration which, in turn, contributed significantly to persistence. Pascarella and Terenzini (1977) tested frequency of student-faculty interaction and found retained freshmen to have a significantly higher rate than those who chose to leave. Not all types of interaction resulted in the same level of social or academic integration with those concerned with academic matters being the most helpful. Academic integration was measured with grade point average (GPA) and an academic integration scale score. Academic and social integration were found to be independent for all students and different for those who chose to leave college. Pascarella and Terenzini (1979) repeated their study using different measures and again found student-faculty interaction to be the greatest contributor to persistence. Social integration was measured by frequency of extracurricular activities, students' perceptions of institutional experience, and number of faculty interactions. GPA was not used as a measure of academic integration but a predisposed characteristic. Pascarella and Terenzini (1980), using factor, multivariate, and discriminant analysis, were able to support the predictive validity of Tinto's model. Student-faculty interaction was again the strongest contributor to the variance in persistence. Rendon (1994) interviewed 132 freshmen from four universities. Neither universities nor students were selected at random but chosen to facilitate a diverse sample. Rendon found faculty contact both inside and outside the classroom to contribute to learning and persistence and also serve to validate students as members of the academic community.

Later, Tinto found academic integration to be less important than social integration in predicting early retention and not independent but nested within social integration. Academic integration surpassed social integration as students grew closer to earning a degree (Tinto, 2006). Although involvement and integration are conceptually similar, there is a key qualitative difference between them. Involvement only requires presence; integration requires action, purpose, and collaboration (Kuh, 2003). Integration is participation in effective practices, both inside and outside the classroom. Integration is formed from two components: the amount of time and effort invested and the strategy an institution uses in organizing and deploying resources to instruct and support students (Kuh, 2007). Tinto wrote that integration emerged from quality involvement or engagement with faculty and peer students and that it was the single most significant predictor of persistence (Tinto, 2006).

Bean

Bean is often mentioned in the same breath as Tinto because, although their works originate from different theoretical bases, both arrive at the idea that persistence is a function of student integration into the university communities. While Tinto associated a student's decision to leave college to suicide and friendship, Bean (1980) collected questionnaires from 1,111 freshmen and used multi-regression and path analysis to relate student persistence to the turnover of industrial workers and pay. Bean (1985) built on Price and Mueller's (1981) model, using ordinary linear regression within path analysis to examine 1,406 students' intentions to stay or leave as explanations of student's beliefs and attitudes as predictors of persistence. Bean's (1985) student attrition model was very similar to Tinto's model in attributing persistence to academic and social integrative constructs. Cabrera, Castaneda, Nora, and Hengstler (1992) used a three stage strategy to test convergence between Tinto's integration model and Bean's attrition model. The study used questionnaires submitted by 466 freshmen. Both models were found valid in attaching student persistence to individual and institutional variables with success relative to the measure chosen. There was considerable overlap in the theoretical frameworks of Tinto's student integration model and Bean's student attrition model and the models were found to be complementary as opposed to mutually exclusive. Cabrera, Nora, and Castaneda (1993) followed, examining 466 freshmen with questionnaires and transcripts taken in the spring and fall of 1989. Using structural equation modeling, an integrated model was produced which accounted for 45% of the variance in student persistence.

Bean (2005) offered a refined model that centered on pre-college and in-college experiences, attitudes, and behaviors which interact to predict student persistence. Three prominent themes emerged: social, academic, and financial factors contribute to student retention. Student acceptance of leadership and service positions on campus creates a sense of obligation and responsibility which strengthens institutional commitment and promotes retention. Bean recognized the campus environment as an important source of faculty and peer interaction. Again, Bean's conclusions were similar to those of Tinto but Tinto had not considered financial factors. As a result of Bean's work, Tinto would recognize a deficiency in his own model and change it to include financial factors as external variables which affect both goal and institution commitment (Tinto, 2006). Tinto's revised model serves as the theoretical framework for this study.

Both Tinto and Bean essentially combined internal individual factors, external individual factors, academic integration and social integration into a mixture that produced institutional commitment, goal commitment and ultimately persistence. Internal and external factors are unique to each student and their impact on persistence has been the subject of research. Bean and Metzner (1985) concluded that retention variables for subgroups of college students were likely to differ at different types of institutions. Braxton and Hirschy (2005) proposed separate models for residential and commuter students and noted that the diversity of student subgroups requires different theories of student persistence.

Braxton

Braxton (2000) called Tinto's theory "nearly paradigmatic" (p.2) in the study of college student departure. Later, Braxton and Hirschy (2005) said Tinto's theory was "the most studied, tested, revised, and critiqued" (p.66) explanation of student departure in the literature. Tinto was not without critics, however, and those who did not agree generally fell into two groups: those who wished to amend and improve the theory to include diverse subgroups: Cabrera, Castaneda, Nora, and Hengstler (1992), Braxton (2000), and those who proposed new theoretical constructs designed to change institutional practice to accommodate diverse subgroups: Berger (2001), Kuh & Love (2000), Rendon, Jalomo, & Nora (2000), Zepke & Leach (2005).

Braxton, Sullivan, and Johnson (1997) reviewed both multi-institutional and single-institutional literature to partially validate Tinto's work and recommended future empirical study of the effect of social integration on persistence. Noting the complexity of the problem of increasing college persistence, Braxton, Sullivan, and Johnson labeled it the "departure puzzle" (p. 107). Braxton (2000) called for a revision of Tinto's theory using empirical research or a complete abandonment and pursuit of new constructs from other theoretical perspectives. Braxton and McClendon (2001) and Braxton and Mundy (2001) both reviewed literature and offered recommendations for institutional practices that might reduce student attrition. The recommendations were categorized according to their consistency with Tinto's three principles of effective retention: (a) commitment to the education of all students, (b) commitment to the welfare of students, and (c) commitment to the integration of students into the university's academic and social communities. Helland, Stallings, and Braxton (2002) use path analysis to study a positive relationship between social integration, academic expectations, commitment, and ultimately persistence of 718 freshmen and Braxton (2003) identified persistence as an essential gateway to student success. In 2005, Braxton and Hirschy defined student attrition as an" ill-defined problem" (p.61), requiring a number of possible strategies in lieu of a single solution. Parallel to Bean's thoughts, Braxton named financial elements as predictors of student retention. Braxton advocated including organizational, psychological, and sociological factors in addition to those originally included by Tinto to build a more comprehensive analysis. In essence, Braxton found the explanation of student retention to be more complex than originally thought. Braxton, Hirschy, and McClendon (2011) in a synthesis of critiques found a number of factors explain student persistence and they are not easily categorized into a narrow set of constructs.

As time passed, Tinto responded to the research of Bean (1985), in recognizing financial factors, Nora (2001) in severing external relations, Kuh, Kinzie, Schuh, and Whitt (2005) in engagement, and Braxton (2000) in acknowledging the complexity of predicting student persistence given the number of variables involved and the number of subgroups of students to be considered. Tinto (2006) acknowledged that his initial theory was simplistic and not as applicable to diverse subgroups as to residential students from majority backgrounds. Since its inception in 1975 multiple applications and amendments to fit student backgrounds and university settings of increasing complexity has resulted in a series of models from different disciplines that claim to more accurately represent diverse subgroups of students. Though he always held to his original assertion that academic and social integration are the primary predictors of persistence, Tinto's (1982, 1993, 1997, 2002) work moved from understanding why students leave to why they remain enrolled (Anderson, Stephenson, Millward, & Rio, 2004). Responsibility for offering a quality learning environment, opportunities for integration, and ultimately student persistence were placed squarely on the institutions and the classroom became the most effective venue for integration (McCubbin, 2003). Tinto's longitudinal approach to student persistence provided a foundation for research and a framework for institutions in the development of academic and social programs. Furthermore, understanding the factors that influenced persistence provided a contextual framework from which to address retention strategies.

Independent Variables

Research has documented that student-athletes are different from other students. Aldelman (1994), in a 15 year longitudinal study of 22,562 members of the class of 1972, found that student-athletes graduate at relatively the same rates as non-athletes but it generally takes longer for student-athletes to complete a bachelor's degree. Pascarella, Bohr, Nora, and Terenzini (1995) said expanding understanding of the effects of environmental factors in order to determine how institutional characteristics influence achievement for different kinds of students is a potentially important research direction which has largely been ignored. Reason (2009) found in a review of persistence literature that the study of various subcultures, including student-athletes, remains an area that requires attention.

Mangold, Bean, & Adams (2003) analyzed data relating to graduation rates within athletic programs at 97 of the 112 institutions that fielded both football and men's basketball teams from 1996 to 1998. They found that while athletic success actually benefits social integration, it detracts from academic integration and, ultimately, graduation rates.

Three team variables and twenty-six institutional variables were derived from Tinto's model and researched to determine what relationships exist between them and student persistence in literature.

Team Variables

Purdy, Eitzen, and Hufnagel (1982) studied more than two thousand athletes over ten years at Colorado State University and found that athletes were less prepared and less successful than other students in college. T-tests revealed that all athletes did not perform equally. Football and basketball athletes were the least prepared and, as expected, had the poorest academic performance. Gayles and Hu (2009) used the 2002 Basic Academic Skills Study published by the NCAA and regression analysis to find that similar academic related activities produced smaller academic gains for athletes competing in high profile sports. High profile sports were identified as football, men's basketball, and baseball. Participation in high profile sports is expected to negatively impact APR. LaForge and Hodge (2011) outlined a practice employed by institutions to influence the APR rate through roster management. Squad-list management can increase APR when a student is in academic danger by encouraging and assisting the student-athlete to transfer before becoming ineligible. Squad-list management practices are also made by reducing the financial aid packages available to students who are weaker academically to only cover books and therefore eliminate the student athlete from inclusion in the APR calculation.

Bonnette and Daniel (1990) explained how roster management and the use of false ceilings in squad-size may allow institutions to maintain current sports offerings and comply with Title IX proportionality requirements. Roster management is controversial but has been accepted by the Office for Civil Rights and upheld in the courts (*Neal v. Board of Trustees of California State Universities*, 1999). Pennington (2002) suggested, because of Title IX, walk-ons (non-scholarship athletes) in men's sports are often turned away while those in women's sports are welcomed. Exceptions occur in most frequently in football where rosters are deeper and walk-ons are recruited. Increases in squad size are expected to positively impact APR.

LeCrom, Warren, Clark, Marolla, and Gerber (2009) studied the effect of scholarship, support, gender, and sport-type on student-athlete retention. Records for student-athletes representing eight universities during the 2001 to 2005 time period were examined. ANOVA, discriminant analysis, and binary logistic regression were employed to find females' achievement and persistence was significantly higher than males. Melendez (2006) used questionnaires and scholastic records of 207 athletes and non-athletes as data for a multi-variable analysis to find females demonstrated higher academic integration, social integration, goal and institutional commitment. Melendez suggested identification with professional athletes, most of which are men, may explain part of the differences found. Female team gender is expected to positively impact APR.

Institutional Variables

Student Variables

Student variables include: *Age of Students, Ethnicity, Gender, High School GPA,* and *SAT-ACT.* Hirschorn (1988) and Kasworm (2003) defined traditional age at 25 and under. Spitzer (2000) sampled 355 full-time undergraduates at a private liberal arts college. Using multiple regression, Spitzer found nontraditional (older, commuting) students had higher GPAs. Goenner and Smith (2003) found average age negatively related to persistence. Contributing factors include the time interval between high school and college classes and an increase in outside commitments for older students. Increases in average student age are expected to negatively impact Academic Progress Rate (APR).

Stoecker, Pascarella and Wolfle (1988), in a nine year multi-institutional study surveyed 10,326 college students, finding that race and gender related to persistence. Different factors affected each subgroup. Socioeconomic status and high school academic success were related to retention of African-American men. Selectivity and institutional prestige were related to persistence of African-American women. Family social status and high school academic success were related to retention of white men and, finally, family social status, selectivity and choice of major related white women's choice to remain in school. Lewallen (1993) used a national survey, the Cooperative Institutional Research Program (CIRP). It was administered to 27, 064 college students, in the fall of 1985 and, again in the fall of 1989. The longitudinal study showed ethnicity to be a factor in graduation rate. Nora, Barlow, and Crisp (2005) used National Postsecondary Student Aid Study (NPSAS) data concerning 2,906 freshmen in 1997 and regression analysis to show that female six-year graduation rates were twenty points higher than males. Furthermore, Whites (36%) graduated at only slightly higher rates than Blacks (32%) or Hispanics (34%).

Gaston-Gayles (2004) studied 211 college athletes from eight varsity team sports at a Midwestern university. Student-athletes were surveyed using the Student Athletes' Motivation Toward Sports and Academics Questionnaire (SAMSAQ). Gaston-Gayles used forward step-wise regression to find minority students experience more problems in the academic domain because of less academic preparation at the pre-college level. Research on retention rates of college athletes in 2004 showed 68% of African-Americans graduated within six years compared to an overall graduation rate of 82% (NCAA, 2011b). Gaston-Gayles and Hu (2009) studied 410 freshmen from twenty one colleges using the 1996-97 Basic Academic Skills Study (BASS), designed by the NCAA. Regression analysis revealed little difference in engagement for men and women or for athletes and non-athletes but that female student-athletes were more actively engaged with non-athletes than males or non-athletes. Increases in percentage of minority students are expected to negatively impact Academic Progress Rate (APR) while increases in percentage of male students are expected to negatively impact APR.

Bean (2005) wrote that the academic theme of retention begins during pre-college education. Pre-college education factors relate to high school GPA, high school rank, and standardized test scores. Gaston-Gayles (2004) found American College Testing (ACT) scores positively associated with academic performance. Wolgemuth *et al*. (2006) used regression analysis to study the fall 1996 entering freshman class at a Midwestern research university, finding ACT scores as the best predictor of early collegiate success and ultimately graduation rate. Bean and Metzner (1985) developed a conceptual model for retention of nontraditional students that included high school performance factors such as high school GPAs. Pascarella and Terenzini (1991) reviewed and synthesized research, also finding high school GPAs as predictors of student retention. Tinto (1975), in his initial formulation of a model of students' decisions to leave school, included high school GPAs as a predisposed variable that affects initial commitment.

Standardized test scores were found to positively correlate to persistence for both athletes and non-athletes by Hood, Craig, & Ferguson (1992). Admissions and registrar data, as well as a survey were analyzed for athletes and matching, non-athletes at the University of Iowa in 1982. Athletes were found to have lower preadmission scores and achieve less academically at college. When matched with non-athletes with similar preadmission scores, however, athletes achieved at the same levels in college classes. Maloney and McCormick (1993) studied Clemson University students enrolled in the 1988-1989 academic year. Academic performance for each semester was computed for revenue sport athletes, non-revenue sport athletes, and non-athletes. Maloney and McCormick found that student athletes trailed traditional students by 150 points on average SAT scores and by 20% in class rank upon entrance into college. Revenue sport athletes recorded lower academic marks than non-athletes in season and marginally better marks in the off-season. Non-revenue sport athletes and non-athletes recorded similar marks both in season and in the off-season. Bowen and Levin (2003), investigating the admissions and academic experiences of Ivy League student-athletes, stated that those entering college with rigorous academic credentials (i.e. high school GPA, high school class rank) were less likely to leave school than those with moderate or less rigorous backgrounds. Adler and Adler (1985) examined the relationship between athletic participation and academic performance through a study of a major college basketball program from 1980 to 1984. They wrote that athletic participation requires a significant time commitment, especially those that are high profile like men's basketball or football. As freshman optimism is replaced by the growing demands of athletic involvement, student-athletes with less than adequate backgrounds are more likely to underperform academically and give-up on career goals by changing their major. Both Bowen and Levin (2003) and Shulman and Bowen (2001) concluded that student-athletes, admitted primarily because of athletic abilities, most likely struggle during their first year. Increases in average high school GPA and in average SAT/ACT scores are expected to positively impact Academic Progress Rate (APR).

Financial Variables

Financial variables include Institutional Control, NCAA Subdivision, financial aid, tuition levels, and family. Competing obligations, such as jobs or family, and multiple roles contribute to a student's decision of whether to leave or stay. Other factors such as financial position and residence also influence persistence (Marx, 2006).

Astin and Osegura (2004) analyzed three decades of national samples of college freshmen and found students' socioeconomic status to affect educational resources available and, in turn, educational expectations. Tinto (2010) listed educational expectations as a factor in academic success of student-athletes. Socioeconomic status was also correlated to academic preparedness. Stampen and Cabrerra (1988) used Markov analysis to study cross sectional and longitudinal data from four states to find socioeconomic status of student-athlete families to be a factor in persistence and financial aid to be an equalizer, increasing the probability that qualifying students remain in college.

Astin and Osegura (2005) reviewed literature on institutional control and found somewhat inconsistent results suggesting private rather than public institutions produced higher graduation rates. Ferris, Finster, and McDonald (2004) studied Division I graduation rates obtained from the NCAA Graduation Rates Reports from 1992-1993 to 2001-2002. Using pair-wise comparative analysis, athletes' graduation rates at each university were compared to students graduation rates. They found that more selective universities graduate athletes and students at a higher rate. Elite private universities produced the top four and eight of the top ten graduation rates for both athletes and students over that period. Ferris, Finster, and McDonald reasoned that elite private institutions typically admit academically prepared students, provide a favorable academic environment that promotes achievement, and strongly emphasize the economic benefits of graduating from a “brand name” (p.562) institution. Large public universities and small regional universities attract a different type of student who is less likely to graduate and who incurs little or no costs if he or she transfers. Transfers do lower the university’s graduation rate, however. Athletes’ graduation rates were not found to differ from other students’ rates. Private institutional control is expected to positively impact Academic Progress Rate (APR).

McLaughlin (2012) associated conference affiliation and NCAA subdivision with the money, pressures, and notoriety inherent with the national exposure of college athletics and expected a negative correlation. McLaughlin, using the Integrated Postsecondary Education Data System (IPEDS) data and hierarchical linear modeling (HLM), was surprised to find conference affiliation not significant and recommended further study. Clotfelter (2011) wrote that students at universities with high profile sports programs tend to be more affluent and tend to spend less time studying. Heydorn (2009) used the NCAA Federal Graduation Rate Database for members of the 2000-2001 cohort to track 2004 graduation rates of students and student-athletes in the Big Ten and Missouri Valley Conferences. Heydorn found the differences between graduation rates for students and student-athletes were 11.60 at Big Ten schools compared to -2.14 at Missouri Valley schools where student-athletes actually graduated at a higher rate than non-athletes. Identification as a Football

Championship Series institution is expected to negatively impact Academic Progress Rate (APR).

Personal financial issues seem simple; those who can't afford to pay are more likely to leave. Literature indicates a more complex relationship, however. Bean (2005) wrote that finances are important for those who can't pay and not for those who can. Tinto (2006) said that student finances affect access to higher education. Hossler, Ziskin, Gross, Kim, and Cekic (2009) summarized literature to propose that a benefit of financial aid is that it allows funding for academic and social integration. Pascarella, Pierson, Wolniak, and Terenzini (2004) said financial aid may fail to affect retention because it is "insufficient rather than ineffective" (pp. 280).

Braunstien, McGrath, & Pescatrice (2001) studied data representing 636 Iona College freshmen in 1991-1992 and 615 freshmen in 1993-1994. Using logistic regression they found financial aid had no significant impact on persistence. Students from families with greater income did persist at higher rates. Academic achievement was the most significant factor found in affecting persistence. Cabrera, Nora, and Castaneda (1992) surveyed 466 college freshmen in the spring of 1989. Academic transcripts and financial aid records were also referenced. Structural equation modeling was used to conclude that financial aid equalized opportunities between wealthy and low-income students and also aided integration of low-income students into academic and social communities. Nora, Cabrera, Hagedorn, and Pascarella (1996) surveyed 3,900 freshmen involved in taking the National Center on Teaching and Learning Assessment at twenty-six universities and colleges. Participants completed four instruments and questionnaires during a three hour testing session in the fall of 1992. Stepwise logistic regression revealed need for financial aid was not a significant factor for persistence of minority students. White students who perceived they could not continue college without financial aid were more likely to drop out, however. Ishitani and DesJardins (2002) used a sample of 3450 students from twenty-six institutions constructed from the Beginning Post-secondary Students Longitudinal Study: Second Follow-up (BPSLS). The study was longitudinal in that monthly enrollment status was examined from August, 1989 until June, 1994. Ishitani and DesJardins found not only that whether a student receives financial aid impacts persistence, but also that when the aid is received determines whether the student will remain in school as well. Dowd and Coury (2006) used logistic regression and two national surveys, the National Postsecondary Student Aid Study (NPSAS) for 1989-1990 and the Beginning Postsecondary Students, Second Follow-up (BPS 90/94), to study students at two year institutions over five years. Student loans were found to negatively affect persistence. DuBrock (1999) studied 6,711 freshmen in the 1993-1994 academic year at Arizona State University. Using an institutional dataset and logistic regression, DuBrock found a positive correlation between financial aid and retention but a negative, although insignificant, correlation between student loans and persistence. Increases in percentage students receiving federal aid, receiving state/local aid , receiving state/local aid , and receiving federal loans are expected to negatively impact Academic Progress Rate (APR).

St. John (2002) reviewed research that indicated that tuition affects first-time enrollment and persistence. Nora, Barlow, & Crisp (2005) also found tuition level was a factor in persistence with students paying higher, out of state rates choosing to leave more frequently. DuBrock (1999) concurred, finding out of state students (44% retained) almost twice as likely to leave as instate students (72% retained). St. John, Andrieu, Oescher, and Starkey (1994) used the National Postsecondary Student Aid Study (NPSAS) and logistic regression to assess the influence of financial factors on persistence. The survey included 59,886 students at 1,074 institutions and was administered in the fall of 1987. St. John, Andrieu, Oescher, and Starkey found tuition explained as much of the variance in persistence as all of the other variables in the model. The study showed that each $1,000 increase in tuition reduced the probability of retention by 2.6 percent. Bean (2005) wrote that wealthy students not only have the means to pay for tuition but also for the additional costs associated with social integration. Increases in both level of in-state tuition and level of out of state tuition are expected to negatively impact Academic Progress Rate (APR).

LeCrom, Warren, Clark, Marolla, and Gerber (2009) found no significant evidence that finances affect student-athlete retention. Letawsky, Schneider, Pedersen, and Palmer (2003) administered the Intercollegiate Student-Athlete Questionnaire to 126 freshmen athletes at a NCAA Division I university. Results found the most important factor for student-athletes in choosing and remaining at a college was degree program options followed by head coach, support services, nature of community where the university was located, and athletic tradition. Financial aid was one of the least influential factors.

Academic Environment Variables

Toutkoushian and Smart (2001) used data provided by the Cooperative Institutional Research Program (CIRP) surveying 2,269 freshmen at 315 institutions in 1986 and again, in 1990. Factor analysis and multiple regression related academic support expenditures with lowered levels of student achievement. Ryan (2005) used national samples from the Integrated Postsecondary Education Data System (IPEDS) and the National Survey of Student Engagement (NSSE) to provide data from 142 colleges and universities. Ordinary least squares regression revealed a negative, if insignificant, relationship between academic support expenditures and student engagement. Blanc, DeBuhr, & Martin (1983) described and empirically evaluated the effectiveness of an academic support program at an urban institution of 11,000 students. Blanc, DeBuhr, & Martin explained that schools which allocate more resources to academic support often serve a less capable student body which results in a disadvantage in end results. For other universities academic support represents a relatively large investment in a limited number of students which speaks to the perceived lack of effectiveness. Peterfreund, Rath, Xenos, and Bayliss (2007) analyzed 12,000 institutional records to compare participants and non-participants in supplemental instruction classes at San Francisco State University over a six-year period. They recorded positive impacts in terms of increased student performance despite the lower academic indicators of the participants. Increases in academic-support expenditure level are expected to negatively impact Academic Progress Rate (APR).

Goenner and Snaith (2003) sampled 258 research institutions and using multivariate regression analysis studied four-year, five-year, and six-year graduation rates. High school class rank and high school GPA both emerged as positive, significant predictors of graduation rates. Use of entrance requirements concerning high school GPA and high school class rank are expected to positively impact Academic Progress Rate (APR).

Porter (2006) used the 1996 Beginning Postsecondary Students, (BPS 96:01), a panel study of college students conducted by the National Center for Educational Statistics (NCES), data from the 1995-1996 Integrated Postsecondary Education Data System (IPEDS), and *Barron's and Peterson's College Guidebook* data from the 1995 edition to measure curriculum differentiation at 329 institutions. Analysis with hierarchical linear modeling (HLM) resulted in a negative correlation between curriculum differentiation and student engagement. Porter concluded that curriculum differentiation is the easiest characteristic for an institution to change. Financial pressures often result in colleges broadening their curriculum in an effort to market to more prospective students. Astin (1993) suggested the form and content of the curriculum make little difference in student achievement and persistence. The manner in which the curriculum is implemented is much more important. Curriculum size and content are often subject to political compromise and institutions and their students would be better served if the efforts expended in curriculum planning were refocused on the delivery system. Increases in curriculum differentiation are expected to negatively impact Academic Progress Rate (APR).

Chickering and Reisser (1993) wrote that accessibility is one of the four components of student-faculty relationships. They note the ratio of the number of people on campus to the number of physical settings is important. As institutions increase in size the number of people grows faster than the number of physical settings which lowers the possibilities and rewards for interactive exchanges. Porter (2006) measured institutional density with faculty per acre. Porter found a positive correlation between faculty per acre and student engagement, reasoning that the key variable is not size but size and geography. Therefore, faculty per acre is a more accurate indication of the probability of meeting a professor on campus than total number of faculty employed. Increases in faculty per acre are expected to positively impact Academic Progress Rate (APR).

Gansemer-Toph and Schuh (2006) studied 466 institutions, with 2001 enrollment data provided by the Integrated Postsecondary Education Data System (IPEDS), graduation data from the *US News and World Report*, and selectivity data from *Barron's Profiles of American Colleges of 2001*. Multi-regression analyses were able to establish that institutional selectivity and instructional expenditures positively affected retention and graduation rates. Those expenditures that affected academic integration were found to be most beneficial. Ryan (2004) studied 363 universities using the Integrated Postsecondary Education Data System (IPEDS) and ordinary least squares regression analysis. Ryan found a positive and significant relationship between instructional and academic support expenditures and graduation rates. Conversely, Pike, Smart, Kuhn, and Hayek (2006) used a nationally representative sample of 298 colleges, drawing from the 2000-2001 Integrated

Postsecondary Education Data System (IPEDS), the 2000, 2002, and 2004 National Survey of Student Engagement (NSSE), *The College Student Report* (Spring, 2001), and *US News and World Report's* America's Best Colleges, 2001. Pike, Smart, Kuhn, and Hayek used ordinary least squares regression analysis to find that increased instructional expenditures do not guarantee student success. Instead they found a complex relationship between student engagement and instructional expenditures moderated by institutional control, student's year in school, and type of engagement. Scott, Bailey, and Keens (2006) examined instructional expenditure levels for public and private institutions and found evidence suggesting that public institutions are doing more with less funding. Their findings were less than conclusive due to the lack of precision in measuring the impact of expenditures on completion rates. Increases in instructional expenditure level are expected to positively impact Academic Progress Rate (APR).

Astin (1993) found student/faculty interaction to have significant positive correlations with every academic outcome. Astin also said that students' interaction with faculty increased both student and faculty satisfaction and was particularly effective when faculty expressed interest in the student's wellbeing as opposed to only academic progress. Pascarella and Terenzini (1976) studied 379 Syracuse University freshmen using the Adjective Rating Scale questionnaire. Principal component factor analysis and stepwise discriminant analysis associated interaction with faculty with persistence. Pascarella and Terenzini (1977) found similar results the following year. Sedulacek and Adams-Gaston (1992) found the noncognitive variables, self-concept and presence of academic and community support, to contribute the most to explaining variance in first-semester grades.

Comeaux, (2005) used the 2000 Cooperative Institutional Research Program (CIRP) and the 2004 College Student Survey (CSS) in a longitudinal study of 459 football and men's basketball players at a predominantly white institution. The sample was not random and not nationally representative. Block stepwise regression was employed to find interaction with faculty was a predictor of GPA. Faculty who expressed interest in the professional aspirations of male athletes in revenue producing sports made a strong contribution whereas faculty who only advocated graduate school did not. Crawford (2007) surveyed 277 Division IA athletes. The sample was taken at a single university and not random. A pilot study was conducted with a limited sample analyzed by factor analysis. The main study followed using ANOVA to show athletes interacted with faculty at different rates. Revenue sport athletes and upperclassmen interacted more frequently. No difference was recorded for gender.

Astin (1984, 1993) wrote that the number of faculty employed may be less important than the quality of those on campus. Benjamin (1998) concurred, using Department of Education data to show full-time tenure track faculty are more engaged with students and that diminished student opportunity results from declining public funding. Goenner and Snaith (2003) found student/faculty ratio and percentage of full time faculty associated with retention. Increases in percentage of full-time faculty are expected to positively impact Academic Progress Rate (APR) while increases in student-faculty ratio are expected to negatively impact APR.

Astin (1993) wrote that the research orientation of the faculty has a substantial negative effect on satisfaction, instruction, development, growth, and persistence. The student orientation of the faculty, on the other hand, has a more substantial effect on student success than any other institutional variable. Astin examined a national sample of more than 200 institutions and found major public universities tended to be research oriented and small private colleges tended to be student oriented and a small number of affluent. The few institutions that could combine a strong orientation toward both research and students were primarily selective private institutions and smaller private research universities.

Fairweather (2002) surveyed 25,780 full-time and part-time faculty at 817 two and four year colleges and universities. The 1992-1993 National Survey of Postsecondary Faculty (NSOPF) was administered, followed by t-tests and comparisons of weighted percentage distributions. Fairweather found that few faculty members are able to maintain high levels of research and teaching concurrently. Fairweather maintained that both research and teaching are important and, at different times, faculty should be encouraged to devote time and energy to each. Fox (1992) conducted a national sample of social science faculty. The sample included 3,968 randomly selected faculty who responded to four mailed questionnaires. Multiple regression was employed to find a dichotomy between research and teaching: that research and teaching do not represent similar functions of academic investment, but produce different, conflicting outcomes.

Porter (2006) used hierarchical linear modeling to show that institutional structures affect student engagement. Porter’s treatment of institutional variables was different; theory based, and designed to avoid deficiencies in previous studies. Porter found institutions classified as research oriented to negatively affect student engagement. Classification as research oriented institution is expected to negatively impact Academic Progress Rate (APR).

Social Environment Variables

Tinto defined integration as the extent to which a student's attitudes and values align with a particular subgroup and the effort extended to meet membership requirements of that subgroup (Tinto, 1975). The attitudes, values, beliefs and norms of athletics are unlike any other community within the institutional setting (Shulman & Bowen, 2001). The intense integration into the small tightly knit athletic community is unlike any other on a college campus (Pascarella & Tenenzini, 2005). Rendon, Jalomo, & Nora (2000), in a critical analysis of Tinto's student departure theory, suggested as students become more involved in the campus environment they become more engaged in their own education. With high levels of commitment, initially, to their team and sport, athletes also experience high levels of involvement with the institution and with teammates. Astin (1985) wrote that high level campus involvement activities, including intercollegiate athletics increased persistence.

Parham (1993) suggested that the quest and reception of approval throughout their athletic careers follows athletes to collegiate settings. Rivera (2004) said student-athletes' need for approval transfers from family to college coaches, who serve as surrogate family and though the break from family occurs, the dependence on support is perpetuated.

Sedulacek and Adams-Gaston (1992) surveyed 105 freshmen student athletes at a NCAA Division I institution. The Noncognitive Questionnaire, an instrument used to success of nontraditional students, along with demographic and attitude questionnaires were used to predict first semester grades using stepwise multiple regression. The study found self-efficacy and support from community, family, or individuals to provide the greatest impact on academic success.

Couch (2011) examined 1,456 freshmen student-athletes, who received financial aid from 1995 to 2009, in order to predict persistence patterns at faith-based institutions. Data was drawn from university records and analyzed using backward stepwise logistic regression analysis. Couch recommended evaluating academic influences among student-athletes both prior to and while attending college. Involvement in athletics does not guarantee student persistence but student-athletes are in a position to share in the values and attitudes of the institutional community and are required to conduct themselves within the formal and informal expectations for team membership. Student athletic participation provides the ideal context for high levels of student integration. Research has not been conclusive, however. Student-athletes have been both labeled as unique in the strength of their social integration (Mangold, Bean, & Adams, 2003; Adler and Adler, 1985; Bowen and Levin, 2003; Bean, 2005) and as isolated from the university community (Bowen & Levin, 2003).

Astin (1977), in a ten year longitudinal study of over 200,000 students at 300 institutions, found that involvement and interactions in athletics was of particular benefit in the development of friendships. As students identify with others within an institution, they create a network of relational support for themselves (Braxton, Hirschy, and McClendon, 2011). The effect is the same but more intense for student-athletes (Kuh & Love, 2000). The peer subculture created around athletic participation provides student-athletes with a set of norms and values that affect subsequent behavior including persistence (Adler & Adler, 1985). Bowen and Levin, (2003) discussed a “peer effect” (p.63) among student-athletes which influenced selection of major and their commitment to academic achievement.

Astin (1984), presenting his student involvement theory, stated that the most important environmental factor in retention is the student’s residence, repeating his findings from 1977. Living in a campus residence is a positive factor in retention over all types of institutions and among all types of students. “It is obvious that students who live in residence halls have more time and opportunity to get involved in all aspects of campus life. Indeed, simply by eating, sleeping, and spending their waking hours on the college campus, residential students have a better chance than do commuter students of developing a strong identification and attachment to undergraduate life” (p.523). Astin (1997), in a longitudinal study of 52,898 freshmen at 365 baccalaureate institutions, used Cooperative Institutional Research Program (CIRP) surveys and institutional records to track graduation rates. Astin repeated the 1977 and 1984 findings for residence and persistence. Ziskin, Hossler, and Kim (2009) used online questionnaires to survey retention coordinators at 274 institutions in five states. Multiple regression analysis revealed that the percentage of freshmen living on campus in residence halls emerged as a significant positive factor in retention. Increases in dormitory capacity are expected to positively impact APR.

Tinto (1987), synthesizing earlier research on student departure, found urban schools to provide more remedial opportunities for students and weaker infrastructure than institutions in other settings. Students at urban settings tend to transfer more often and place less importance on completion. Scott, Bailey and Kienzl (2006) documented the role of individual and institutional variables on graduation rates of students at public and private universities in the United States and England. They analyzed data from the 1991 cohort over a six year interval using regression analysis. Urbanization was significant in the model developed for public institutions. It was not significant in the model developed for private institutions. Location in an urban environment is expected to positively impact Academic Progress Rate (APR). Zhao, Kuh, and Carini (2005) used the 2001 National Survey of Student Engagement (NSSE) to survey 71,260 college students at 317 institutions. T-tests and multivariate ordinary least squares regression revealed that institutional density has both positive and negative effects on student success, especially for international students. While an increase in social integration benefits institutional commitment, a danger is present when socialization becomes more important than academic achievement. Turley and Wodtke (2010) used the 1999-2000 National Postsecondary Student Aid Survey (NPSAS) and the 2005-2006 Integrated Postsecondary Education Data System (IPEDS) dataset to survey freshmen at 372 institutions. Multivariate analyses were used to find institutional density did significantly affect minority students and students at liberal arts colleges. Porter (2006) noted that differences found in students at liberal arts colleges may be due to research orientation in lieu of social integration. Porter also found that as student density, measured by students per acre of campus, increased, student engagement decreased. Increases in students per acre are expected to negatively impact Academic Progress Rate (APR).

Ryan (2004) found no significant positive outcome from student services expenditures and suggested they may produce a decreasing rate of graduation. Ryan wrote that student services expenditures may be, in large part admissions and financial aid expenditures or used in areas where universities have little training or expertise. Ryan (2005) followed to show that administration expenditures were negatively related to student engagement. Pike, Smart, Kuh, and Hayek (2006) found that expenditures for student services substantially impacted student engagement. They also cautioned, however, that, " money does not seem to be an important factor in creating a supportive, affirming, campus environment...Apparently, whether students feel appreciated, understood, and nurtured is not something that a college or university can necessarily purchase with financial resources" (p.866). Increases in student services expenditures are expected to negatively impact Academic Progress Rate (APR).

Conclusion

This review of scholarly literature began with a brief history of the National Collegiate Athletic Association (NCAA) and the development of Academic Progress Rate (APR), the variable it has chosen to measure academic performance of teams competing in intercollegiate athletics. Annual change in APR is the dependent variable in this study. The early work of Chickering was followed by the theories of Astin and Tinto which, in turn, were refined by the works of Bean and Braxton. Tinto's theory serves as the bridge from APR to the independent variables selected for this study. The dataset will be regressed and divided by five categorical variables, chosen not at random, but from previous study. Three team variables and twenty-six institutional variables were chosen based on Tinto's framework. They will be entered into a hierarchical regression model to predict the dependent variable (APR). Existing literature was reviewed for each variable and a hypothesis followed, detailing its expected relationship with APR.

Astin (1997), in a commemoration of the thirtieth anniversary of the Cooperative Institutional Research Program (CIRP) survey, examined trends in the changing character of American college students. Astin noted students have moved toward "gender convergence" (p. 4), a decline in gender differences, and toward materialism, with increased competition for grades, worry about finances, and increased stress.

Tinto (1997), reflecting on twenty-five years of work on persistence of college students, wrote that we have learned:

1. Involvement matters.
2. Academic and Social integration influence persistence.
3. Academic and social integration operate differently for different students and settings.
4. There are many pathways to integration.
5. Involvement matters most during the first year of college.

Much has been written about college students' achievement and persistence. Tinto's model holds "paradigmatic status as a framework" (p. 1) for understanding student persistence and has elicited more research than any competing model to explain students' academic success (Braxton, Hirschy, & McClendon, 2011). Since achievement and persistence are the factors that compose Academic Progress Rate (APR) for student-athletes, application of the model should inform us about the variables that affect their status and progress toward a degree. Considering Astin's thoughts that students are constantly changing, pinpointing one or two variables that work in every situation seems like hitting a moving target. For the problem of APR, as for many others we face, the process may be more important than the solution.

CHAPTER THREE

METHOD

Academic achievement would logically be the primary goal of higher education. The importance of success in athletic contests with other universities pales in comparison to the importance of preparing students to pursue career and civic goals. Two venues are often considered to increase the academic performance of student-athletes.

The first involves increased selectivity in regard to the input variable. While there is merit to identifying and searching for recruits who exhibit predisposed traits that indicate an increased likelihood of success, problems arise in the availability and sustainability of that potential. Each institution must make a choice between student-athletes or athlete-students. Once the choice has been made, the path becomes clearer.

A second path to increasing academic success for student-athletes involves improving student integration into both the academic and social communities. Quality of involvement remains the most promising avenue for success. Identifying which variables contribute most to increased integration and invoking strategic practices to maximize those variables may prove to be beneficial to academic achievement, student persistence and, ultimately, Academic Progress Rate (APR).

The purpose of this study was to utilize both paths by identifying individual characteristics, although aggregated, as well as team and institutional conditions that correlate with Academic Progress Rate and positive changes in Academic Progress Rate. Models were constructed, using longitudinal changes in team and institutional variables to predict changes in Academic Progress Rate (APR) and using annual levels of team and institutional variables to predict APR. The models were based on the basic structure of Tinto's (1993) student integration model. This chapter describes the methods used by discussing the population, research design and analysis of the data, research questions, validity and reliability, assumptions, and limitations.

Data

The data analyzed in this study was derived from four sources, the National Collegiate Athletic Association (NCAA), the National Center for Education Statistics (NCES), *Peterson's Four Year Colleges*, and *The Princeton Review's Complete Guide to Colleges*. The Academic Progress Rate (APR) data was created by the NCAA and released through the Interuniversity Consortium for Political and Social Research (ICPSR). APR, school name, sport profile, squad size, and conference affiliation were all selected from ICPSR.

Submission of data from member institutions of the National Collegiate Athletic Association (NCAA), is due annually, within six weeks of the first day of fall semester classes. Failure to submit complete and accurate data results in ineligibility for postseason participation in the offending year and subsequent ineligibility in future years pending a formal review which may include a probationary period, midyear submissions of data, and on-campus visitation (NCAA, 2011b). NCAA data for this study was collected from a survey authored by Thomas S. Paskus entitled, "NCAA Division I Academic Progress Rate, 2012". The survey was retrieved from ICPSR and was created to provide public information on Division I athletes from 2003-2004 through 2010-2011and to enable efficient analyses of these data and allow linkage to other educational data. Some data were blanked to ensure confidentiality (ICPSR, 2013).

The Integrated Postsecondary Education Data System (IPEDS) is a compilation of a system of surveys collected annually from more than 6,700 institutions by NCES.   NCES is the primary federal entity for collecting and analyzing data related to education. The Higher Education Act of 1965, as amended, requires any institution that participates in or applies for any federal student financial aid program to report data in seven areas: institutional characteristics, graduation rates, enrollment, financial aid, fall enrollment, university finances, and human resources (20 USC 1094, Section 487(a) (17) and 34 CFR 668.14(b)(19)). IPEDS has a strong record of validity and reliability (NCES, 2008). The IPEDS datasets are public data and can be downloaded from the National Center for Education Statistics (NCES) website without a licensing agreement.

Peterson's Four-Year Colleges and *The Princeton Review's Complete Guide to Colleges* include information on accredited four-year undergraduate institutions in the United States and Canada. The NCAA, IPEDS, *Peterson's Four-Year Colleges,* and *The Princeton Review's Complete Guide to Colleges* variables used in this study are merged into one SPSS data file for analyses.

Population

The population for this study included 44,891 teams from National Collegiate Athletic Association (NCAA) Division I institutions that competed from 2003-2004 until 2009-2010. Because of the small number of teams and the variance in composition with respect to gender, 154 co-ed rifle teams were removed, leaving 44,737 teams representing 387 institutions. The dataset used in this study is a national dataset and includes 100% of Division I teams competing from 2003-2004 until 2009-2010. No sampling was needed because the study includes all data in the population.

Variables

The dependent variables were Academic Progress Rate (APR) and change in APR. Change in APR was calculated by taking the difference in a team's APR scores for consecutive years. To simplify, consider the difference in the 2003-2004 and the 2004-2005 academic years to be year 2004 difference. For each APR score missing within the NCAA dataset, two changes in APR entries were not calculated and, since APR is the dependent variable, those cases were excluded from the study.

Academic Progress Rate (APR) is the parameter chosen by the NCAA to measure academic eligibility and persistence of student-athletes on Division I teams. The APR score for each team is calculated by dividing the sum of retention and eligibility points earned by team members receiving federal financial aid divided by the sum of retention and eligibility points possible for those student-athletes. The quotient is then multiplied by 1000 to eliminate the decimal (NCAA, 2010b). A perfect score of 1000 indicates every athlete remained eligibility and was retained or graduated. The return of former student-athletes and completion of their degree results in a bonus point added to the APR equation for the term in which the degree was earned.

If student-athletes fail to remain eligible or continue to be retained, the Academic Progress Rate (APR) score is lower. Waivers are granted for special circumstances. The NCAA provides adjustments for student-athletes who transfer with adequate grade point averages and those who leave in good academic standing for professional athletics careers. If four year rolling averages of APR scores fall below 925 (930 in 2012-2013), teams may be penalized. Penalties include: practice time replaced by academic support hours, decreased competition, coaching suspensions, financial aid reductions, or restricted NCAA membership (NCAA, 2012d).

Porter (2006) found institutional structures to affect student engagement using hierarchical linear modeling. Porter noted that selection bias may be the one of the biggest problems faced by educational researchers. Students are not randomly assigned to universities and as noted in Astin's model, different student inputs result in different outputs for universities. While literature has shown little effect on student performance from the degree of selectivity by the university (Pascarella & Terenzini, 2005), student performance is affected by the quality of peers (Winston & Zimmerman, 2004) who may self-select. Porter addressed selection bias by including multiple variables inherent to the selection process and allowing non-linear relationships into the models. Similarly this study included multiple variables such as high school grade and rank and need for financial aid in addition to common indicators such as gender race and SAT scores. Also, dummy variables representing categorical variables were allowed (Porter, 2006).

Categorical variables and their planned contrast variables were coded in an orthogonal coding method. The sum of the coefficients for their respective elements must equal zero (Maxwell & Delaney, 2004). Table 3 presents the orthogonal planned contrast variables and their values. In order for categorical variables to correspond to the appropriate change in APR, categorical variables from the initial year of the two year interval were used. That is, APR difference in year 2004 corresponded to categorical variables from 2003-2004.

Table 3

Orthogonal Planned Contrast Variables

Categorical Variables	Contrast Variables			
Admit GPA	AD-GPA (REQUIRED)	AD-GPA (RECOMMENDED)	AD-GPA (NEITHER)	
Required	3	0	0	
Recommended	-1	2	0	
Neither Required nor Recommended	-1	-1	1	
Other	-1	-1	-1	
Admit Rank	AD-RANK (REQUIRED)	AD-RANK (RECOMMENDED)	AD-RANK (NEITHER)	
Required	3	0	0	
Recommended	-1	2	0	
Neither Required nor Recommended	-1	-1	1	
Other	-1	-1	-1	
Control	CON(PUBLIC)	CON(PRIVATE-NP)	CON(PRIVATE-P)	
Public	3	0	0	
Private (not for profit)	-1	2	0	
Private (for profit)	-1	-1	1	
Not available	-1	-1	-1	
Locale	LOC(CITY)	LOC(SUBURB)	LOC(TOWN)	LOC(RUR)
City	4	0	0	0
Suburb	-1	3	0	0
Town	-1	-1	2	0
Rural	-1	-1	-1	1
Not available	-1	-1	-1	-1
NCAA Subdivision	DIV(FBS)	DIV(FCS)	DIV(NOFB)	
Football Bowl Series	3	0	0	
Football Championship Series	-1	2	0	
Division 1	-1	-1	1	
Other	-1	-1	-1	

From Tinto's (1993) model, variables representing team characteristics and institutional variables were taken from the datasets previously described. Team and institutional variables were dated similar to Academic Progress Rate (APR) differences. Differences in variables from the 2003-2004 year and the 2004-2005 year were labeled 2004. Variables presumed to represent relevant team qualities included: sport profile, squad size, and team gender. Table 4 provides information about team variables, their sources, relevant hypothesis, and the level of analysis.

Table 4

Operationalization of Variables Used to Study the Effects of Team Characteristics on APRs

Variable	Hypothesis	Hypothesized Direction of Relationship	Data Source
Sport Profile	H1a	(-)	NCAA
Squad Size	H_1b	(+)	NCAA
Team Gender	H_1c	(+)	NCAA

Variables presumed to reflect the institutional environment included individual variables aggregated to the institutional level. Those variables included: age, ethnicity, institutional gender, high school GPA, SAT/ACT scores, institutional control, conference affiliation, percentage of students receiving federal aid, percentage of students receiving state aid, percentage of students receiving institutional aid, percentage of students receiving student loans, level of instate tuition, level of out of state tuition, academic support expenditures, entrance requirements concerning high school GPA, entrance requirements concerning high school rank, curriculum differentiation, faculty per acre, instructional expenditure level, percentage of full-time faculty, student/ faculty ratio, research orientation, dormitory capacity, locale, students per acre, and student services expenditures. Table 5 provides information about institutional variables, their sources, expected impact, and the level of analysis.

Table 5

Operationalization of Variables Used to Study the Effects of Institution Characteristics on APRs

Construct	Expected Direction of Relationship	Data Source
Age of Students	(-)	IPEDS
Ethnicity	(-)	IPEDS
Gender	(+)	IPEDS
High School GPA	(+)	Peterson & Princeton
SAT-ACT	(+)	IPEDS
Control	(+)	IPEDS
NCAA Subdivision	(-)	ICPSR
Federal Grant	(-)	IPEDS
State Grant	(-)	IPEDS
Institutional Grant	(-)	IPEDS
Student Loans	(-)	IPEDS
In-State Tuition	(-)	IPEDS
Out of State Tuition	(-)	IPEDS
Academic Support Expenditures	(-)	IPEDS
Admit GPA	(+)	IPEDS
Admit Rank	(+)	IPEDS
Curriculum differentiation	(-)	IPEDS
Faculty/Acre	(+)	IPEDS
Instructional Expenditures	(+)	IPEDS
Percentage of Full-time Faculty	(+)	IPEDS
Research Orientation	(-)	IPEDS
Student-Faculty Ratio	(-)	IPEDS
Dormitory Capacity	(+)	IPEDS
Locale	(+)	IPEDS
Student/Acre	(-)	IPEDS
Student Service Expenditures	(-)	IPEDS

Research Design and Data Analysis

The research design involved a quantitative ex-post facto study of historical data related to NCAA athletic teams from 2003-2004 to 2009-2010 (Sproull, 2002). The use of a quantitative design model was appropriate considering the research questions explain how variables affect another variable (Creswell, 2008).

Preliminary analyses of data included accounting for missing data and outlier procedures. Missing data for both students and schools in a national study was unavoidable. Documenting missing data procedures is important for replication of findings. Some (Perna, 2004) have argued for mean substitution for missing data when possible. Others (Allison, 2002) have argued for list wise deletion. In particular, Gibson and Olejnik (2003) found that only list wise deletion performed well in estimating random effects when data was missing at Level 2 in a two level hierarchical data structure. Since independent t-tests of data with missing values and data with no missing values yielded significant differences, both list wise deletion and mean substitution were used in this study.

Outliers were retained since the purpose of this study was to explain longitudinal differences in Academic Progress Rate (APR) with longitudinal differences in independent variables. To eliminate the largest differences would be counter to that purpose. Data screening involved obtaining descriptive statistics including: frequency tables, scatter plots, skewness, kurtosis, means, and standard deviations. Analyses of each variable were used to examine central tendency, variability, linearity, and normality. Bivariate analyses examined linearity. Liou, Lawrenz, Madsen, Braam, and Medhanie (2009) used factor analysis in conjunction with hierarchical linear modeling to analyze data which contained a large number of independent variables. Liou et al. found it impractical to use a large number of individual items to conduct hierarchical linear modeling. They wrote that factor analysis had long been a powerful tool to converge factors. Exploratory factor analysis was used in this study to reduce the twenty-seven independent variables into a manageable number of constructs. Given that the number of variables was less than 30 and the number of cases was greater than 250, constructs were assessed using Kaiser's rule (constructs whose eigenvalues are greater than 1 should be retained) if communalities were greater than .70 and mean communality was greater than .60. The scree test was used if communalities were less than .70 but greater than .30 (Mertler & Vannatta, 2002).

Hierarchal linear modeling was used to efficiently analyze multilevel data involving large numbers of students and institutions. Teams are nested within institutions and share values on variables, making teams within an institution more similar. It must be assumed that observations are not independent and variances are not equal across the population. Team variables also differ from institutional variables in numbers of observations and units of analysis. Since team and institutional variables were included in the analyses, hierarchical linear modeling (HLM) was the appropriate statistical technique (Raudenbush & Bryk, 2001).

After cases with missing data were removed, a separate intercept was estimated for each school. Constructs were grand mean centered to reduce collinearity and add clarity. Grand mean centering involves calculating the mean for a variable and subtracting it from each observation. The mean of the resulting differences is therefore, zero. Grand mean centering allows comparison of residual variance across variables and simplicity since controlling for either continuous or dichotomous variables is achieved by holding the variable at the zero level (Hofmann & Gavin, 1998).

Research Questions

This study examined variance in Academic Progress Rate (APR) and changes in APR by answering the following research questions:

RQ#1: Which annual changes in team variables explained the variance in annual differences in Academic Progress Rate (APR) scores?

RQ#2: Which annual changes in institutional variables explained the variance in annual differences in Academic Progress Rate (APR) scores?

RQ#3: Which team variables explained the variance in team Academic Progress Rate (APR) levels?

RQ#4: Which institutional variables explained the variance in team Academic Progress Rate (APR) levels?

Hypotheses

The following hypotheses supported the research questions in this study:

H_{1a}: Participation in high profile sports negatively impacted changes in difference in Academic Progress Rate (APR).

H_{1b}: Increases in squad size positively impacted changes in difference in Academic Progress Rate (APR).

H_{1c}: Female team gender positively impacted changes in difference in Academic Progress Rate (APR).

H_2: Institutional variables organize into factors which impacted changes in difference in Academic Progress Rate (APR).

H_{3a}: Participation in high profile sports negatively impacted changes in Academic Progress Rate (APR).

H_{3b}: Increases in squad size positively impacted changes in Academic Progress Rate (APR).

H_{3c}: Female team gender positively impacted changes in Academic Progress Rate (APR).

H_4: Institutional variables organize into factors which impacted Academic Progress Rate (APR).

Least squares regression begins with a simple relationship: Data = Fit + Residual. Data is the dependent variable (DAPR/APR) from any case in the data set. Fit is a sum of an intercept, a value obtained if all the independent variables are zero, and independent variables multiplied by regression coefficients. Residuals are portions of the dependent variable not accounted for by the analysis (Mertler & Vanetta, 2002).

Data in social sciences is often found on multiple levels where independent variables are nested within groups. This situation is problematic for least squares regression because the variables within nests tend to be similar, violating the requirement of independence. Relationships may also exist between variables such that one variable is affected by the level of another. This interaction between variables must be considered in developing a model to predict the dependent variable. Hierarchical linear models allow us to account for those circumstances.

Hierarchical linear models begin with the null or empty model that is very similar to the least squares regression model. Predictors are omitted and only intercepts are allowed to vary across cases. Dependent variables are averaged for each group. The group average is subtracted from each dependent variable to produce a residual amount. Each dependent variable may be expressed as a sum:

Dependent Variable = Group Mean + Level 1 Residual

Group means are averaged to produce a grand mean. The grand mean is similarly subtracted from each group mean to produce a residual amount. Each group mean may be expressed as a sum:

Group Mean = Grand Mean + Level 2 Residual

Substituting:

Dependent Variable = Grand Mean + Level 2 Residual + Level 1Residual

or

$$Y_{ij} = \gamma_{00} + u_{0j} + r_{ij}$$

Where:

Y_{ij}: Dependent Variable for case *i* found in group *j*.

γ_{00}: Grand Mean

r_{ij}: Level 1 Residual for case *i* found in group *j*.

u_{0j}: Level 2 Residual for group *j*.

Since the grand mean stays constant among all groups and cases, it is a fixed effect. Due to the nested nature of the data, it is likely that the residuals vary among groups (level 2) and cases (level 1). The residuals are random effects. Since both fixed and random effects are potentially included as predictors, the model is a mixed effect model.

The grand mean is tested for significance, using the null hypothesis that all group means are the same and yielding a level 2 residual of zero. Level 1 and level 2 residuals may also be tested, using the null hypotheses that they are equal to zero. If residuals from either level are zero, simple regression analysis would be required. Although the variances will be replaced in subsequent models, they are useful starting points in determining whether further analyses will be informative (Nezlek, 2008). From the null model, an intraclass correlation (ICC) statistic may be computed by:

ICC = Level 2 Residual / (Level 2 Residual + Level 1 Residual)

The ICC indicates the percentage of variance in the dependent variable that is attributable to differences in groups. Attention now turns to explaining the variance in level 1 and level 2 residuals. Similar to the process used to center the dependent variable, level 1 variables may be averaged and partitioned into sums of the population mean and the level 1 residual. Both the fixed and random effects of Level 1 variables are then regressed with the dependent variable to generate slopes (the amount of change expected in the dependent variable when a one unit change occurs with the either component of the level one variable). Predictions are generated for the dependent variable and a new grand mean, residuals, and slopes from the fixed and random portions of the level one variables form the Random Coefficient Model. Now the relationship may be stated as:

Dependent Variable = Grand Mean + (Fixed Level 1 Regression Coefficients * Level 1 Variables - Level 1 Variable Means) + Level 2 Residual + (Random Level 1 Regression Coefficients * Level 1 Variables - Level 1 Variable Means) + Level 1 Residual

or

$$Y_{ij} = \gamma_{00} + (\gamma_{10} * Xij) + u_{0j} + (u_{1j} * Xij) + r_{ij}$$

Where:

Y_{ij}: Dependent Variable for case *i* found in group *j*.

γ_{00}: Grand Mean

$\gamma_{10}, \gamma_{20}, \gamma_{30}$: Fixed Level 1 regression coefficients

Xij: Level 1 Variables

r_{ij}: Level 1 Residual for case *i* found in group *j*.

u_{1j}, u_{2j}, u_{3j}: Random Level 1 regression coefficients

u_{0j}: Level 2 Residual for group *j*.

The grand mean, and the fixed effects coefficients are tested for significance using the null hypothesis that their value is zero. Testing for significance of the residuals, that their variance, among both groups and cases, is greater than zero is problematic for two reasons. First, though the estimates of the variance of residuals are accurate, the standard errors for the variance of residuals are sometimes not (Maas & Hox, 2004). Second, a confidence interval is difficult to construct because it is doubtful that the distribution of the variance in residuals is normal (Snijders & Bosker, 2012). A remedy to these concerns is use of *z*-tests or Wald's tests which employ Satterthwaite degrees of freedom related to the number of cases instead of the number of groups and a chi-square distribution (Newsom, 2013). Another option is to compare -2 log likelihood values for the null and random coefficient models. Log likelihood values indicate the degree to which the model predicts the sample data. Multiplying by -2 results in a statistic called deviance which can be used to compare the relative fit of a model with the data (Aguinis, Gottfredson, & Culpepper, 2013).

In the third model, the Intercepts and Slopes as Outcomes model, both Level 1 variables and Level 2 variables are entered. Level 2 variables are unique to their group and do not vary for the cases within. For that reason, they are fixed effects. It is possible that the nature or strength of the relationship between a level 1 variable and the dependent variable change as a function of a higher level variable. Since the relationship is a function of a level 2 variable it should also not vary between groups and is a fixed effect. The cross-level effect is most commonly noted in HLM (Preacher, Curran, & Bauer, 2006). The resulting relationship is:

Dependent Variable = Grand Mean + (Fixed Level 1 Regression Coefficients * Level 1 Variables - Level 1 Variable Means) + (Level 2 Regression Coefficients * Level 2 Variables) + (Cross-level Regression Coefficients * Interaction between Level 1 and Level 2 Variables) + Level 2 Residual + (Random Level 1 Regression Coefficients * Level 1 Variables - Level 1 Variable Means) + Level 1 Residual

or

$$Y_{ij} = \gamma_{00} + (\gamma_{10} * Xij) + (\gamma_{01} * Wj) + (\gamma_{11} * Xij * Wj) + u_{0j} + (u_{1j} * Xij) + r_{ij}$$

Where:

Y_{ij}: Dependent Variable for case *i* found in group *j*.

γ_{00}: Grand Mean

$\gamma_{10}, \gamma_{20}, \gamma_{30}$: Level 1 regression coefficients

Xij: Level 1 Variables

$\gamma_{01}, \gamma_{02}, \gamma_{03}$: Level 2 regression coefficients

(Factor1)j, *(Factor2)j*, *(Factor3)j:* school level factors

$\gamma_{11}, \gamma_{22}, \gamma_{33}$: Cross-level regression coefficients

Wij: Level 2 Variables

r_{ij}: Level 1 Residual for case *i* found in group *j*.

u_{1j}, u_{2j}, u_{3j}: Random Level 1 regression coefficients

u_{0j}: Level 2 Residual for group *j*.

Means and slopes were tested for significance as in previous models. Both statistically significant and theoretically sound elements were included in the final model which generated the prediction equation. Research questions were answered by the elements that were included in the final model. The minimum level for assigning significance for fixed effects was .04, derived from Kotrlik, and Higgins': (2001) formula: $n = t^2 * s^2 / d^2$. Sample size (n) was 11583, t was 1.96 allowing an alpha of .025 in each tail, and the standard deviation of the dependent variable at 46.92 gave the acceptable margin of error for each of twenty-six independent variables ($d = 26 * \alpha$) at .045. Random effects were considered significant if $p < .10$ as advised in Nezlek (2008).

Limitations

Due to the limits of available, comprehensive data, individual student level data were not included in the model which may have lowered the predictive power. The purpose of the model was to predict changes in Academic Progress Rate (APR) using team and institutional variables which required a national dataset. Only IPEDS provided data on all institutions and it only included individual level variables aggregated to the institutional level. Other datasets can be used to provide student level variables but lack the size necessary for multilevel modeling techniques or use surveys based on convenience samples and fail to be nationally representative (Porter, 2006). Institutional variables used in this model included individual variables aggregated to the institutional level. Theory holds that as institutions differ in student inputs they also differ in outputs. Without appropriate measures of individual characteristics, it was difficult to determine how much of the variance in change in Academic Progress Rate (APR) was determined by differences in student-athletes and how much was due to the institutions. Individual variables aggregated to institutional levels can be misleading (Porter, 2006).

Even with measures in place to reinforce aggregate individual data, athletic teams are even smaller subsets of the student populations. If students are not randomly assigned to universities because of their selection processes (Astin & Lee, 2003), then teams may be even more susceptible to selection bias.

CHAPTER FOUR

RESULTS

Chapter four begins with a review of the purpose for the study, followed by a description of pre-analyses screening procedures. Descriptive statistics and discussions of outliers, variable transformations, missing data, and covariance are included. Factor analysis was employed and, finally, relevant constructs were entered into the HLM model. Deviance, fixed effects, and covariance parameters were provided and results were described in context with the associated hypotheses.

The purpose of this study was reflected in four research questions: Which annual changes in team variables contributed to the variance in annual differences in Academic Progress Rate (APR) scores? Which annual changes in institutional variables contributed to the variance in annual differences in Academic Progress Rate (APR) scores? Which team variables contributed to the variance in Academic Progress Rate (APR) scores? Which institutional variables contributed to the variance in Academic Progress Rate (APR) scores? To answer the first two research questions, three team level variables and twenty-six institutional-level variables were analyzed for changes in APR. Institutional variables were subjected to factor analyses in an effort to produce a smaller number of relevant institutional factors that could be entered into a hierarchical linear model. Two-level intercepts-as-outcomes models were developed, using 3 independent factors and significant team level variables.

Difference in APR Models

Pre-analyses Screening

The study sample was restricted to 44,891 National Collegiate Athletic association (NCAA) Division one teams competing from 2003-2004 until 2010-2011. One hundred fifty-four coed rifle teams were excluded because of the variance in composition with respect to gender and the small number of teams. Two thousand, two hundred and ninety two Academic Progress Rate (APR) scores were missing leaving single-year APR scores for 42,445 teams representing 387 institutions during that time interval. Due to the longitudinal nature of this study, APR scores and independent variable values for consecutive years were required in order to calculate a difference. Single year data were converted into annual differences. In instances where teams were not fielded in consecutive years differences could not be calculated. Missing differences, therefore, were identified as missing data and resulted in the exclusion of an additional 6,315 cases relating to differences in the dependent variable and the exclusion of 219 differences related to the exclusion of the rifle teams. Thirty-five thousand, nine hundred, eleven differences remained.

Data in social and behavioral sciences are often nested in clusters within larger groups or hierarchical in nature. In this study athletic teams are clustered within schools. Because of the hierarchical nature, cases within a cluster are often correlated. Analysis of such data requires consideration of these correlations to get accurate results. Hierarchical linear modeling (HLM) was developed to describe the hierarchical structure of this kind of data (Yaun & Bentler, 2003). Byrk and Raudenbush (1987) wrote that HLM allows an integrated approach for studying the structure of individual growth. Van Der Leaden (1998) concluded that the hierarchical approach to repeated measures data, similar to that used in this study, permits the formulation of two-level models, and possibly the formulation of higher-level models where the effect of organization on growth might be studied.

Hierarchical Linear Modeling (HLM) is robust against violations of normality (Van Der Leden & Busing, 1994), and while both independent samples t-tests (Green & Salkind, 2011) and factor analysis (Mertler & Vannatta, 2002) do not require normal distribution when sample size is sufficiently large, solutions may be enhanced if the variables are normally distributed. Real data are often not normally distributed (Schafer & Graham, 2002) and normality is exceedingly rare in education in psychology (Micceri, 1989). Skewness and kurtosis are typically larger than those for a normal distribution (Yaun & Bentler, 2003). As shown in Table 6, the skewness and kurtosis of many of the independent, institutional variables included in the study, did not fall within the guidelines, ±2 and ±7 respectively, established by Curran, West and Finch (1996) and by Chaffin and Rheil (1996) for robustness to nonnormality in factor analysis.

For variables with skewness that fell outside ±2 square root, logarithmic, and inverse transformations were applied. The square root transformation after adding a constant to raise the minimum value to 1 (Osborne, 2002) was found to be the most effective for: differences in percent of minority students, instructional expenses, percent of graduate students, students per acre, and student service expenditures. Reflection of square roots after reflection and constant addition (Osborne, 2002) was most effective for: difference in faculty per acre, and student faculty ratio. Transformation results are shown in Table 6.

Table 6.

Descriptive Statistics for Difference in APR Study Variables after Transformation

	Before			After	
	Skew	Kurtosis	Transformation	Skew	Kurtosis
Difference in % age 24 or less(AGE)	-2.02*	67.74*	none	-2.017*	67.74*
Difference in % of minority students (ETH)	3.18*	69.95*	sqrt.	-0.49	34.08*
Difference in % male students (GEN)	-1.12	11.56*	none	-1.12	11.56*
Difference in GPA (GPA)	-0.05	143.35*	none	-0.05	143.35*
Difference in SAT (SAT)	1.81	14.17*	none	1.81	14.17*
Difference in % receiving federal aid (FED)	-0.54	22.95*	none	-0.54	22.95*
Difference in % receiving state grants (SG)	0.95	16.51*	none	0.95	16.51*
Difference in % receiving institutional grants (IG)	0.91	11.84*	none	0.91	11.84*
Difference in % receiving student loans (LOAN)	0.1	21.38*	none	0.1	21.38*
Difference in in-state tuition (IN_STATE)	-0.13	57.18*	none	-0.13	57.18*
Difference in out-of-state tuition (OUT_STATE)	-0.3	23.45*	none	-0.3	23.45*
Difference in academic support expenditures (ASE)	-6.74*	301.46*	none	-6.737*	301.46*
Difference in no of majors (CUR)	0.27	20.99*	none	0.27	20.99*
Difference in Faculty/Acre (FAC_A)	-28.16*	1004.93*	sqrt.(reflection)	-8.615*	576.18*
Difference in instructional expenditures (IE)	5.75*	91.21*	sqrt.	-0.33	67.32*
Difference in % full-time faculty (FAC)	-0.65	14.71*	none	-0.65	14.71*
Difference in % graduate students (REA)	2.24*	39.50*	sqrt.	-0.38	32.88*
Difference in Student/Faculty ratio (SF)	-6.86*	181.07*	sqrt.(reflection)	1.1	111.91*
Difference in % dormitory capacity (DC)	-1.74	74.25*	none	-1.74	74.25*
Difference in Students/Acre (STU_A)	9.29*	194.00*	sqrt.	-1.9	262.77*
Difference in student service expenditures (SSE)	5.83*	95.57*	sqrt.	-1.8	120.91*

* = outside guidelines by Curran, West, and Finch (1996).

Missing Data

No data was missing for team variables but 11,583 cases relating to differences in institutional level independent variables contained missing data entries. An examination of the number and percentage of missing cases for each variable is shown in Table 7. Of 35,911 cases, 11583 (32%) were found to be missing no data entry.

Table 7

Frequencies of Difference in APR Study Variables

	Valid	Missing	% Missing
Level 1 Variables			
Sport Profile		0	0
Squad Size		0	0
Team Gender		0	0
Level 2 Continuous Variables			
Difference in % age 24 or less(AGE)	29890	6021	16.77
Difference in % of minority students (ETH)	35890	21	0.06
Difference in % male students (GEN)	35890	21	0.06
Difference in GPA (GPA)	24644	11267	31.37
Difference in SAT (SAT)	34234	1677	4.67
Difference in % receiving federal aid (FED)	35707	204	0.57
Difference in % receiving state grants (SG)	35707	204	0.57
Difference in % receiving institutional grants (IG)	35707	204	0.57
Difference in % receiving student loans (LOAN)	35707	204	0.57
Difference in in-state tuition (IN_STATE)	35845	66	0.18
Difference in out-of-state tuition (OUT_STATE)	35845	66	0.18
Difference in academic support expenditures (ASE)	24687	11224	31.26
Difference in no of majors (CUR)	35911	0	0
Difference in Faculty/Acre (FAC_A)	35892	19	0.05
Difference in instructional expenditures (IE)	24687	11224	31.26
Difference in % full-time faculty (FAC)	24910	11001	30.63
Difference in % graduate students (REA)	34683	1228	3.42
Difference in Student/Faculty ratio (SF)	35867	44	0.12
Difference in % dormitory capacity (DC)	35619	292	0.81
Difference in Students/Acre (STU_A)	35890	21	0.06
Difference in student service expenditures (SSE)	24687	11224	31.26

The difference in Academic Progress Rate (APR) data set was divided into two groups: one missing no data entries and another, missing one or more data entries. Independent t-test statistics, comparing the means of missing and non-missing data for each variable, indicated the variables were missing at random (MAR) as opposed to missing completely at random (MCAR). T-test results may be found in Table 8. An explanation of the differences found in the t-test results may be found in the nature of the nested data. Particular schools may not report some statistics such as standardized test scores, especially when those scores are not used as a factor in admission. As a result, the missing data tend to be more school specific than team specific. The factor analyses and resulting models were developed using two data sets, one employing deletion of cases with missing data and another using imputation to remedy missing data.

Table 8.

T-test results for Valid and Missing Difference in APR Data

		Mean	St. Dev.	t	p
Difference in % age 24 or less(AGE)	Valid	-0.01	0.97	-1.40	0.16
	Missing	0.01	1.32		
Difference in % of minority students (ETH)	Valid	4.23	0.19	-7.82	0.00*
	Missing	4.25	0.29		
Difference in % male students (GEN)	Valid	0.10	0.68	0.65	0.52
	Missing	0.10	0.76		
Difference in GPA (GPA)	Valid	1.27	10.51	1.15	0.25
	Missing	1.07	16.56		
Difference in SAT (SAT)	Valid	4.28	35.41	3.85	0.00*
	Missing	2.75	33.55		
Difference in % receiving federal aid (FED)	Valid	1.08	5.30	7.03	0.00*
	Missing	0.61	7.08		
Difference in % receiving state grants (SG)	Valid	0.89	10.21	10.35	0.00*
	Missing	-0.23	8.27		
Difference in % receiving institutional grants (IG)	Valid	1.41	9.78	2.11	0.03*
	Missing	1.19	8.69		

Table 8 Continued

Difference in % receiving student loans (LOAN)	Valid	0.94	6.35	5.29	0.00*
	Missing	0.50	9.36		
Difference in in-state tuition (IN_STATE)	Valid	451.19	376.71	-76.88	0.00*
	Missing	963.84	884.10		
Difference in out-of-state tuition (OUT_STATE)	Valid	993.59	997.18	-19.48	0.00*
	Missing	1209.44	946.26		
Difference in academic support expenditures (ASE)	Valid	158.58	292.20	0.52	0.60
	Missing	152.18	1380.47		
Difference in no of majors (CUR)	Valid	0.30	3.79	-1.46	0.14
	Missing	0.36	3.48		
Difference in Faculty/Acre (FAC_A)	Valid	-4.33	0.03	-2.36	0.02*
	Missing	-4.33	0.19		
Difference in instructional expenditures (IE)	Valid	92.05	4.09	0.64	0.52
	Missing	92.00	7.53		
Difference in % full-time faculty (FAC)	Valid	-0.09	2.45	-1.00	0.32
	Missing	-0.06	2.83		
Difference in % graduate students (REA)	Valid	3.46	0.15	-9.49	0.00*
	Missing	3.47	0.20		
Difference in Student/Faculty ratio (SF)	Valid	-4.48	0.13	-1.19	0.23
	Missing	-4.48	0.24		
Difference in % dormitory capacity (DC)	Valid	106.36	723.22	5.31	0.00*
	Missing	68.12	402.44		
Difference in Students/Acre (STU_A)	Valid	13.71	0.24	-6.76	0.00*
	Missing	13.74	0.58		
Difference in student service expenditures (SSE)	Valid	62.38	2.12	3.40	0.00*
	Missing	62.25	3.88		

*= significant difference in means at the .05 level.
Equal variances not assumed.

List-wise Deletion Models for Difference in APR

Exploratory Factor Analysis

Exploratory factor analysis resulted in the selection of a three factor solution as the best fit for both data and theory. The analysis began with thirty-seven independent variables, including dummy variables. A dummy variable indicating control of the institution was found to contain only one value for all cases after cases with missing data were deleted. With no variance in one variable, the remaining two were left as reciprocal variables. The variable with no variance and one of the reciprocal variables were removed from the analysis. Thirty five variables remained and using guidelines requiring five variables per factor (Hair, 2006), models with three to seven factors were examined. Minimum loadings of .300 were required for inclusion of variables in the model (Hair, 2006). A total of seventeen out of thirty-five variables were used in the three factor model.

The three factors were named: SELECT(DAPR-LD), FINANCE(DAPR-LD), and SOCIAL(DAPR-LD). SELECT(DAPR-LD) contained four variables. Four variables were acceptable to form a factor since loadings for all were greater than .600 (Mertler & Vannatta, 2002). Those variables included two dummy variables from institutional selection policy concerning GPA and two dummy variables from institutional selection policy concerning high school rank. FINANCE(DAPR-LD), contained eight variables, representing institutional density, tuition levels, instructional expenditures, and institutional control. Loadings within the FINANCE factor ranged from .666 to .412. The five SOCIAL(DAPR-

LD) variables indicated NCAA subdivision, locale, and percentage of male students at the university. Loadings ranged from .351to -.684.

The three factors combined to explain just less than 40% of the variance among the institutional variables included in the sample. Theoretically, the three factors coincided with Tinto's constructs of pre-college student variables, financial variables, and academic and social environmental variables. Detailed information about the factor loadings and the percentage of variance explained may be found in Tables 9 and 10.

Table 9.

Total Variance Explained for Difference in APR (List-wise Deletion) Factors

	Initial Eigenvalues			Rotation Sums of Squared Loadings		
Factor	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.525	14.855	14.855	2.417	14.215	14.215
2	2.310	13.587	28.442	2.412	14.191	28.406
3	1.960	11.531	39.973	1.966	11.567	39.973
4	1.699	9.992	49.965			
5	1.428	8.400	58.364			
6	1.326	7.797	66.162			
7	1.029	6.052	72.214			
8	.978	5.752	77.966			
9	.928	5.457	83.422			
10	.656	3.859	87.281			
11	.517	3.040	90.322			
12	.502	2.953	93.275			
13	.446	2.625	95.900			
14	.280	1.645	97.545			
15	.222	1.303	98.849			
16	.130	.763	99.611			
17	.066	.389	100.000			

Table 10.

Factor Loadings for Difference in APR (List-wise Deletion)

	Component		
Variable	FINANCE (DAPR-LD),	SELECT (DAPR-LD),	SOCIAL (DAPR-LD),
Difference in in-state tuition (IN_STATE)	.666	-.234	.226
Difference in instructional expenditures (IE)	.612	.062	-.092
Difference in Faculty/Acre (FAC_A)	.596	.181	-.296
Difference in Students/Acre (STU_A)	.573	.188	-.320
Control of Institution (CON(PRIVATENP))	.569	-.033	.183
Difference in out-of-state tuition (OUT_STATE)	.446	-.209	.185
Difference in student service expenditures (SSE)	.431	.027	-.003
Difference in academic support expenditures (ASE)	.412	.033	.065
Admission Policy, GPA recommended (AD_GPA(RECOMMENDED))	.089	.808	.100
Admission Policy, GPA required (AD_GPA(REQUIRED))	-.077	-.786	-.059
Admission Policy as to Class Rank recommended (AD_RANK(RECOMMENDED))	-.028	.684	.021
Admission Policy, Class Rank neither required or recommended (AD_RANK(NEITHER))	.060	-.666	.038
NCAA Subdivision, Football Championship Series (DIV(FCS))	.037	.066	-.684
Locale of Institution, City (LOC(CITY))	.061	.165	.600
Locale of Institution, Town (LOC(TOWN))	-.112	-.123	-.590
NCAA Subdivision, No Football (DIV(NOFB))	.008	-.095	.575
Institutional Gender (GEN)	-.007	.015	.351

DAPR-LD is Difference in Academic Progress Rate List-wise Deletion. Shaded values include loadings used in analyses.

Team variables and institutional factors were examined for excessive intercollinearity. Collinearity is a major threat to the robustness of meta-analytic regression analyses, including HLM (Santiago, Wadsworth, & Stump, 2011). A condition index greater than 30 indicates a moderate to strong collinearity between factors (Belsley, Kuh, & Welch, 1980). Table 11 shows the highest condition index in this sample was substantially less at 3.363 and that collinearity was not a problem in this model.

Table 11.

Collinearity Diagnostics for Difference in APR List-wise Deletion Model Variables

Dim.	Eigen-value	Condition Index	Variance Prop.						
			(Constant)	SPORT PROFILE	SQUAD SIZE	TEAM GENDER	SELECT (DAPR-LD),	FINANCE (DAPR-LD),	SOCIAL (DAPR-LD),
1	1.841	1.000	0.08	0.04	0.00	0.07	0.00	0.00	0.00
2	1.056	1.320	0.00	0.22	0.20	0.03	0.04	0.01	0.27
3	1.008	1.352	0.00	0.01	0.20	0.00	0.09	0.57	0.15
4	1.000	1.357	0.00	0.00	0.00	0.00	0.72	0.21	0.06
5	0.978	1.372	0.00	0.01	0.40	0.00	0.14	0.18	0.24
6	0.954	1.390	0.00	0.28	0.20	0.05	0.00	0.03	0.27
7	0.163	3.363	0.92	0.44	0.00	0.85	0.00	0.00	0.00

DAPR-LD is Difference in Academic Progress Rate List-wise Deletion.

Model Analysis

In this study athletic teams were nested within universities. The goal in this section is to correlate changes in Academic Progress Rate with changes in factors and covariates describing both teams and their universities. It was not possible to group all teams into a single pool because teams at some universities tend to be more alike. Furthermore, relationships may exist between school and team variables such that one variable is affected by the level of another. This interaction between school and team variables must be considered in developing a model to predict APR scores. Hierarchical linear models allow us to account for that circumstance.

Three models were generated to predict differences in Academic Progress Rate (DAPR) scores. The null model contained no team or institutional level predictors and was used to establish an intercept and determine the amount of variance in difference in APR scores attributable to differences in schools. The second model, the random coefficient model used level-1 or team variables while controlling for level-2 or institutional predictors. The third model, the intercepts and slopes as outcomes model used both team level and institutional level factors generated by the factor analysis, as well as the cross-level interactions between them, to predict the dependent variable. The models provided indicators of statistical significance for intercepts and slopes which allowed the establishment of the final model, or prediction equation.

Null Model

The null model or intercept only model assessed the degree of variance in difference in Academic Progress Rate (DAPR) scores among institutions. Difference in APR scores were the differences in consecutive single year APR scores for collegiate teams. Difference in APR scores were averaged for each school in each year of the study. Annual difference in APR school means were then averaged to compute a grand mean. The grand mean composed the fixed effects portion of the model and was the mean of all school means for the dependent variable when team and school variables were held at zero. Referred to as the intercept, the grand mean was tested for significance using the null hypothesis that all school means are the same resulting in no variance to explain. Random effects included the totals of unexplained team level and school level errors or residuals. The null model was:

Dependent Variable = Grand Mean + School Level Residual + Team Level Residual

Table 12 outlines results. Thirty five thousand, nine hundred, eleven annual differences in APR were reduced to 11,583 by list-wise deletion of cases with missing values. The remaining 11583 differences were grouped by institution and year into 728 groups. The grand mean of 2.66 indicated an average increase of 2.66 points at each institution each year.

The team level residual was 2115.17 and the school-level residual was 88.73. From the null model an intra-class correlation statistic was computed:

ICC = School Level Residual / (School Level Residual + Team Level Residual)

The result was an intraclass correlation of 0.04 indicating that 4% of the amount of the variance in annual Academic Progress Rate (APR) differences was attributable to differences in schools and 96 % of the variance resulted from differences in teams. Aguinis, Gottfredson, & Culpepper (2013) reviewed literature to find ICC values commonly fall between .05 and .30. Nezlek (2008) warned that no ICC greater than zero is too small to proceed with multilevel analysis when multilevel data are examined.

Table 12.

Difference in APR HLM Results Null Model (List-wise Deletion)

Fixed Effect	Coefficient	Standard Error	p
Grand Mean	2.66	0.56	<.0.001*
Random Effect	Variance Component	Standard Error	
Team Level Residual	2115.17	12.08	
School Level Residual	88.73	28.68	
Additional Information			
ICC	0.04		
-2 log likelihood	121922.54		

* = significant at the .05 level

Random Coefficient Model

The Random Coefficient Model allowed the introduction of team level variables to predict annual differences in Academic Progress Rate (DAPR). Team variables were averaged for 11,583 cases. Differences in the actual values of the team variables and the average for all cases formed new variables. As a result each team variable was divided into a mean and a difference. Regression analysis was employed resulting in two coefficients or slopes (effect on annual APR difference caused by a one unit increase in a team variable) attached to each team variable. The slope was therefore divided into two parts: the effect resulting from the mean (fixed) and the effect resulting from the difference (random). Both the fixed and variable effects were tested for significance with the null hypothesis that they are zero and do not affect the dependent variable (difference in APR).

After entering team level variables, the relationship was stated as:

DAPR/APR = Grand Mean + (Fixed Team Level Regression Coefficients * Team Variables – Team Variable Means) + School Level Residual + (Random Team Level Regression Coefficients * Team Variables – Team Variable Means) + Team Level Residual

Table 13 outlines results. Of the three team level variables entered into the random coefficient model, only difference in squad size (γ_{20} = -1.77, t = -12.37, $p < 0.001$) offered a statistically significant fixed relationship with difference in Academic Progress Rate (DAPR) scores. When controlling for institutional level variables, a one unit increase in difference in squad size was associated with a 1.77 point decrease in APR for all teams. The decrease was in the opposite direction of that which was hypothesized. Both SPORTPROFILE ($u_{1j,}$ = 741.87, Wald Z = 6.84, $p < 0.001$) and TEAMGENDER (u_{3j} = 345.30, Wald Z = 6.35, $p < 0.001$) were significant as random effects. Difference in squad size was significant in predicting difference in APR averages for schools while SPORTPROFILE and TEAMGENDER were significant predictors of APR among teams.

Snijders and Bosker (1984) argued that the proportional difference in variance between the two models is not a good way to measure the importance of the introduction of independent variables. A better measurement is the proportional difference in mean squared prediction error, given by the quotient Pseudo R^2 or $(\sigma^2_{null} - \sigma^2_{model})/\sigma^2_{null}$. Using the Pseudo R^2 statistic, the random effects model explained an additional 8% in regard to team variance, -12% in additional school level variance, and 7% in additional total variance.

Deviance decreased from 121922.54 to 121595.02, a difference of 327.52, which was greater than 12.59, the difference allowed in a chi-square distribution with 6 degrees of freedom as advised by Newsom (2013). This difference was significant at the .05 level and indicated the model fit was different and better than the fit of the null model.

Table 13.

Difference in APR HLM Results Random Coefficient Model (List-wise Deletion)

Fixed Effect	Coefficient	Standard Error	p
Grand Mean	2.65	0.56	<0.001*
SPORTPROFILE	0.74	1.7	0.665
Difference in Squad Size (DSS)	-1.77	0.14	<0.001*
TEAMGENDER	-0.75	1.2	0.534

Random Effect	Variance Component	Standard Error	p
Team Level Residual	1952.5	29	<0.001*
SPORTPROFILE	741.87	108.52	<0.001*
Difference in Squad Size (DSS)	1.03	0.67	0.124
TEAMGENDER	345.3	54.4	<0.001*
School Level Residual	98.66	12.1	<0.001*

Additional Information			
-2 log likelihood	121595.02		
Pseudo R^2 Team	0.08		
Pseudo R^2 School	-0.12		
Pseudo R^2 Total	0.07		

* = significant at the .05 level

Intercepts and Slopes as Outcomes Model

In the third model, the Intercepts and Slopes as Outcomes model, both team level variables and constructs formed from combinations of school level variables are entered. As in the previous model, team level variables were grand mean centered; that is they were split into two parts representing the mean of the variable over all teams within a school and the difference from that mean for any particular team. Regression analysis was employed to produce slopes for team variables similar to the previous model as well as slopes for school variables. Cross-level coefficients also were considered to account for any effect a school variable might have on a team variable. The resulting relationship was:

DAPR/APR = Grand Mean + (Fixed Team Level Regression Coefficients * Team Variables – Team Variable Means) + (Fixed School Level Regression Coefficients * School Factors) + (Cross-level Regression Coefficients * Interaction between Team Variables and School Factors) + School Level Residual + (Random Team Level Regression Coefficients * Team Variables – Team Variable Means) +Team Level Residual

Table 14 outlines results similar to those found in the previous model. Of the three team level variables, only difference in squad size (γ_{20} = -1.78, t = -12.43, p < 0.001) offered a statistically significant fixed relationship with difference in Academic Progress Rate scores. A one unit increase in difference in squad size was associated with a 1.78 point decrease in APR for all teams. The decrease was in the opposite direction of that which was hypothesized. Both SPORTPROFILE ($u_{1j,}$ = 754.48, Wald Z = 6.89, p < 0.001) and TEAMGENDER (u_{3j} = 351.19, Wald Z = 6.41, p < 0.001) were significant as random effects. As before, difference in squad size was significant in predicting difference in APR averages for schools while SPORTPROFILE and TEAMGENDER were significant predictors of APR among teams. The cross-level coefficient for Difference in squad size (DSS) and SELECT(DAPR-LD) (γ_{21} = -0.43, t = -2.98, p = 0.003) was significant meaning that teams with higher values associated with the SELECT(DAPR-LD) composite factor, were associated with smaller squad size. Using the Pseudo R^2 statistic, the random effects model explained an additional 8% in regard to team variance, -12% in additional school level variance, and 7% in additional total variance.

Deviance decreased from 121922.54 in the null model to 121561.14, a difference of 361.4, which was greater than 28.87, the difference allowed in a chi-square distribution with 18 degrees of freedom as advised by Newsom (2013). This difference was significant at the .05 level and indicated the model fit was different and better than the fit of the null model.

Table 14.
Difference in APR HLM Results Intercepts and Slopes as Outcomes Model (List-wise Deletion)

Fixed Effect	Coefficient	Standard Error	p
Grand Mean	2.66	0.57	<0.001*
SPORTPROFILE	0.66	1.71	0.700
Difference in Squad Size (DSS)	-1.78	0.14	<0.001*
TEAMGENDER	-0.73	1.20	0.721
SELECT(DAPR-LD)	0.41	0.57	0.543
FINANCE(DAPR-LD)	0.21	0.59	0.468
SOCIAL(DAPR-LD)	-0.32	0.56	0.568
Difference in Squad Size (DSS) *SELECT(DAPR-LD)	-0.43	0.15	.003*
Difference in Squad Size (DSS) *FINANCE(DAPR-LD)	0.11	0.12	0.392
Difference in Squad Size (DSS) *SOCIAL(DAPR-LD)	-0.01	0.14	0.969
SPORTPROFILE*SELECT(DAPR-LD)	-0.40	1.73	0.817
SPORTPROFILE*FINANCE(DAPR-LD)	0.21	1.78	0.905
SPORTPROFILE*SOCIAL(DAPR-LD)	-2.41	1.69	0.155
TEAMGENDER*SELECT(DAPR-LD)	0.30	1.21	0.802
TEAMGENDER*FINANCE(DAPR-LD)	0.20	1.22	0.990
TEAMGENDER*SOCIAL(DAPR-LD)	-0.71	1.19	0.553

Random Effect	Variance Component	Standard Error	p
Team Level Residual	1950.52	28.91	<0.001*
SPORTPROFILE	754.48	109.55	<0.001*
Difference in Squad Size (DSS)	0.96	0.63	0.127
TEAMGENDER	351.19	54.79	<0.001*
School Level Residual	99.84	12.19	<0.001*

Additional Information	
-2 log likelihood	121561.14
Pseudo R^2 Team	0.08
Pseudo R^2 School	-0.12
Pseudo R^2 Total	0.07

* = significant at the .05 level

Final Model

The prediction equation generated by Difference in Academic Progress Rate List-wise Deletion data used team variable Difference in squad size (γ_{20} = -1.77, t = -12.46, p < 0.001). Team variables SPORTPROFILE ($u_{1j,}$ = 752.50, Wald Z = 6.89, p < 0.001) and TEAMGENDER ($u3j$ = 347.03, Wald Z = 6.38, p < 0.001) were also included because of significant random effects. The variable representing the cross-level effect between SELECT and squad size was also significant and included. All insignificant team and school variables were excluded. Removal of the nonsignificant components changed regression coefficients slightly as shown in Table 15.

Table 15.

Difference in APR HLM Results Final Model (List-wise Deletion)

Fixed Effect	Coefficient	Standard Error	p
Grand Mean	2.66	0.56	<0.001*
SPORTPROFILE	0.78	1.70	0.649
Difference in Squad Size (DSS)	-1.77	0.14	<0.001*
TEAMGENDER	-0.76	1.20	0.524
Difference in Squad Size (DSS) *SELECT(DAPR-LD)	-0.41	0.14	0.004*
Random Effect	**Variance Component**	**Standard Error**	**p**
Team Level Residual	1950.28	28.92	<0.001*
SPORTPROFILE	752.5	109.16	<0.001*
Difference in Squad Size (DSS)	0.97	0.63	0.126
TEAMGENDER	347.03	54.42	<0.001*
School Level Residual	99.16	12.13	<0.001*
Additional Information			
-2 log likelihood	121577.34		
Pseudo R^2 Team	0.08		
Pseudo R^2 School	-0.12		
Pseudo R^2 Total	0.07		

* = significant at the .05 level

The prediction equation follows:

DAPR = Grand Mean + Fixed SPORTPROFILE Coefficient * (SPORTPROFILE – School Mean for SPORTPROFILE) + Fixed Difference in squad size (DSS) Coefficient * (Difference in squad size (DSS) – School Mean for Difference in squad size (DSS) + Fixed TEAMGENDER Coefficient * (TEAMGENDER – School Mean for TEAMGENDER) + Cross-level Regression Coefficient * Interaction between SELECT(DAPR-LD) and Difference in squad size (DSS)) + Team Variance + Random SPORTPROFILE Coefficient

* (SPORTPROFILE – School Mean for SPORTPROFILE) + Random Difference in squad size (DSS) Coefficient * (Difference in squad size (DSS) – School Mean for Difference in squad size (DSS)) + Random TEAMGENDER Coefficient * (TEAMGENDER – School Mean for TEAMGENDER) + School Variance

or

DAPR = 2.66 + 0.78* SPORTPROFILE – School Mean for SPORTPROFILE - 1.77* Difference in squad size (DSS) – School Mean for Difference in squad size (DSS) -0.76* TEAMGENDER – School Mean for TEAMGENDER – 0.41*SELECT(DAPR-LD) * Difference in squad size (DSS) + 1950.28 + 752.5* SPORTPROFILE – School Mean for SPORTPROFILE 0.97* Difference in squad size (DSS) – School Mean for Difference in squad size (DSS) + 347.03* TEAMGENDER – School Mean for TEAMGENDER + 99.16.

Using the Pseudo R^2 statistic, the random effects model explained an additional 8% in regard to team variance, -12% in additional school level variance, and 7% in additional total variance.

Deviance decreased from 121922.54 in the null model to 121577.34, a difference of 345.2, which was greater than 14.07, the difference allowed in a chi-square distribution with 7 degrees of freedom as advised by Newsom (2013). This difference was significant at the .05 level and indicated the model fit was different and better than the fit of the null model.

Mean Substitution Models for Difference in APR

Since preliminary t-tests indicated significant differences between cases with and without missing values, a second analysis was conducted with data altered with mean substitution of missing variables in lieu of list-wise deletion.

Exploratory Factor Analysis

Exploratory factor analysis again produced three factors labeled: SELECT (DAPR-MS), FINANCE(DAPR-MS), and SOCIAL(DAPR-MS). The three factors explained 47% of the variance among the institutional variables included in the study as shown in Table 16. FINANCE(DAPR-MS) included five variables that represented both in-state and out-of-state tuition, institutional control, NCAA subdivision, and institutional locale. Loadings ranged from .794 to .400. SELECT (DAPR-MS) was composed of variables indicating institutional admissions policy with regard to student GPA and class rank. Loadings ranged from -.783 to -.521. SOCIAL(DAPR-MS) included institutional locale and NCAA subdivision. Loadings ranged from -.757 to -.540. Complete factor loadings are shown in Table 17.

Table 16.

Total Variance Explained for Difference in APR (Mean Substitution) Factors

Factor	Initial Eigenvalues			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.490	19.151	19.151	2.347	18.051	18.051
2	2.024	15.571	34.723	1.992	15.319	33.370
3	1.646	12.658	47.380	1.821	14.010	47.380
4	1.347	10.358	57.739			
5	1.269	9.764	67.503			
6	1.127	8.668	76.171			
7	1.041	8.008	84.178			
8	.694	5.340	89.518			
9	.557	4.281	93.800			
10	.272	2.090	95.890			
11	.258	1.987	97.877			
12	.153	1.176	99.054			
13	.123	.946	100.000			

Table 17.

Factor Loadings for Difference in APR Data (Mean Substitution)

Variable	Component		
	FINANCE (DAPR-MS)	SELECT (DAPR-MS)	SOCIAL (DAPR-MS)
Control of Institution (CON(PRIVATENP))	.794	.146	.149
Difference in in-state tuition (IN_STATE)	.778	.122	.156
	-.554	.116	.165
Difference in out-of-state tuition (OUT_STATE)	.532	.024	.130
	.400	.042	-.110
Admission Policy as to GPA (AD_GPA(REQUIRED))	.152	-.783	-.015
Admission Policy as to GPA (AD_GPA(RECOMMENDED))	-.041	.773	.045
Admission Policy as to Class Rank (AD_RANK(RECOMMENDED))	.326	.550	-.017
Admission Policy as to Class Rank (AD_RANK(NEITHER))	-.124	-.521	.069
NCAA Subdivision (DIV(FCS))	.045	.203	-.757
Locale of Institution (LOC(CITY))	-.242	.096	.703
NCAA Subdivision (DIV(NOFB))	.360	-.269	.595
Locale of Institution (LOC(TOWN))	-.160	-.177	-.540

DAPR-LD is Difference in Academic Progress Rate Mean Substitution. Shaded values include loadings used in analyses.

Collinearity was examined and the highest condition index in this sample was substantially less than the 30 identified by Belsley, Kuh, and Welch (1980) at 3.27. Collinearity was not a problem in this model. Table 18 shows collinearity diagnostics.

Table 18.
Collinearity Diagnostics for Difference in APR Mean Substitution Model Variables

Dim.	Eigen -value	Condition Index	Variance Prop.						
			(Constant)	SPORT PROFILE	SQUAD SIZE	TEAM GENDER	FINANCE (DAPR-MS)	SELECT (DAPR-MS)	SOCIAL (DAPR-MS)
1	1.836	1.000	.08	.04	.00	.08	.00	.00	.00
2	1.046	1.325	.00	.26	.12	.03	.20	.00	.18
3	1.016	1.344	.00	.01	.28	.00	.15	.11	.40
4	1.000	1.355	.00	.00	.00	.00	.12	.81	.07
5	.977	1.371	.00	.03	.39	.00	.50	.06	.01
6	.954	1.388	.00	.24	.20	.04	.02	.01	.34
7	.172	3.270	.91	.42	.00	.84	.00	.00	.00

DAPR-MS is Difference in Academic Progress Rate Mean Substitution

Model Analysis

Hierarchical linear modeling produced models as summarized in the paragraphs that follow.

Null Model

Thirty five thousand, nine hundred, eleven annual differences in Academic Progress Rate (DAPR) were examined. The differences were grouped by institution and year into 2,255 groups. The grand mean of 2.34 indicated an average increase of 2.34 points at each institution each year. The team level residual was 1934.55 and the school-level residual was 84.71. From the null model an intra-class correlation of 0.04 was computed indicating that

4% of the amount of the variance in annual APR differences was attributable to differences in schools and 96 % of the variance resulted from differences in teams. Table 19 shows analysis results.

Table 19.
Difference in APR HLM Results Null Model (Mean Substitution)

Fixed Effect	Coefficient	Standard Error	p
Grand Mean	2.34	0.31	<0.001*

Random Effect	Variance Component	Standard Error	p
Team Level Residual	1934.55	14.9	<0.001*
School Level Residual	84.71	6.43	<0.001*

Additional Information			
ICC	0.04		
-2 log likelihood	374829.21		

* = significant at the .05 level

Random Coefficient Model

Of the three team level variables entered into the random coefficient model, only difference in squad size offered a statistically significant fixed relationship with difference in Academic Progress Rate (DAPR) scores (γ_{20} = -1.62, t = -20.33, p < 0.001). When controlling for institutional level variables, a one unit increase in difference in squad size was associated with a 1.62 point decrease in Academic Progress Rate for all teams. The decrease was in the opposite direction of that which was hypothesized. SPORTPROFILE ($u_{1j,}$ = 384.93, Wald Z = 8.99, $p < 0.001$), Difference in squad size (DSS) (u_{2j} = 1.66, Wald Z = 5.04, $p < 0.001$), and TEAMGENDER (u_{3j} = 175.77, Wald Z = 8.36, $p < 0.001$) were significant as random effects. Difference in squad size was significant in predicting difference in APR averages for schools while all three team variables were significant predictors of APR among teams.

Using the Pseudo R^2 statistic, the random effects model explained an additional 7% in regard to team variance, -2% in additional school level variance, and 6% in additional total variance.

Deviance decreased from 374829.21 to 374108.22, a difference of 720.99, which was greater than 12.59, the difference allowed in a chi-square distribution with 6 degrees of freedom as advised by Newsom (2013). This difference was significant at the .05 level and indicated the model fit was different and better than the fit of the null model. Results are summarized in Table 20.

Table 20.

Difference in APR HLM Results Random Coefficient Model (Mean Substitution)

Fixed Effect	Coefficient	Standard Error	p
Grand Mean	2.32	0.31	<0.001*
SPORTPROFILE	1.43	0.86	0.095
Difference in Squad Size (DSS)	-1.62	0.08	<0.001*
TEAMGENDER	-0.29	0.59	0.625

Random Effect	Variance Component	Standard Error	p
Team Level Residual	1802.97	15.19	<0.001*
SPORTPROFILE	384.93	42.83	<0.001*
Difference in Squad Size (DSS)	1.66	0.33	<0.001*
TEAMGENDER	175.77	21.03	<0.001*
School Level Residual	87.15	6.34	<0.001*

Additional Information	
-2 log likelihood	374108.22
Pseudo R^2 Team	0.07
Pseudo R^2 School	-0.02
Pseudo R^2 Total	0.06

* = significant at the .05 level

Intercepts and Slopes as Outcomes Model

The addition of institutional variables to the previous random coefficients model resulted in explanation of an additional 8% of team variance, -12% of additional school level variance, and 7% of additional total variance. Difference in squad size remained a significant fixed effect contributor (γ_{02} = -1.63, t = -20.26, p < 0.001). No school level variable was a significant contributor. SPORTPROFILE ($u_{1j,}$ = 755.30, Wald Z = 12.61, p

< 0.001), Difference in squad size (DSS) (u_{2j} = 1.68, Wald Z = 5.12, $p < 0.001$), and TEAMGENDER (u_{3j} = 359.05, Wald Z = 12.04, $p < 0.001$) were significant as random effects. No cross-level variables were significant predictors.

Deviance decreased from 374829.21 in the null model to 373725.01, a difference of 1104.2 which was greater than 27.59, the difference allowed in a chi-square distribution with 17 degrees of freedom as advised by Newsom (2013). This difference was significant at the .05 level and indicated the model fit was different and better than the fit of the null model. Results are summarized in Table 21.

Table 21.
Difference in APR HLM Results Intercepts and Slopes as Outcomes Model (Mean Substitution)

Fixed Effect	Coefficient	Standard Error	p
Grand Mean	2.30	0.31	<0.001*
SPORTPROFILE	1.36	0.96	0.156
Difference in Squad Size (DSS)	-1.63	0.08	<0.001*
TEAMGENDER	-0.31	0.66	0.721
SELECT(DAPR-MS)	-0.51	0.31	0.640
FINANCE(DAPR-MS)	-0.82	0.31	0.103
SOCIAL(DAPR-MS)	0.19	0.30	0.568
Difference in Squad Size (DSS) *SELECT(DAPR-MS)	0.12	0.08	0.139
Difference in Squad Size (DSS) *FINANCE(DAPR-MS)	0.09	0.08	0.278
Difference in Squad Size (DSS) *SOCIAL(DAPR-MS)	-0.03	0.08	0.738
SPORTPROFILE*SELECT(DAPR-MS)	-0.47	0.97	0.631
SPORTPROFILE*FINANCE(DAPR-MS)	-0.25	0.96	0.797
SPORTPROFILE*SOCIAL(DAPR-MS)	-0.73	0.94	0.440
TEAMGENDER*SELECT(DAPR-MS)	-0.11	0.67	0.868
TEAMGENDER*FINANCE(DAPR-MS)	0.54	0.66	0.413
TEAMGENDER*SOCIAL(DAPR-MS)	-0.62	0.66	0.346

Random Effect	Variance Component	Standard Error	p
Team Level Residual	1773.74	14.87	<0.001*
SPORTPROFILE	755.3	59.91	<0.001*
Difference in Squad Size (DSS)	1.68	0.33	<0.001*
TEAMGENDER	359.05	29.83	<0.001*
School Level Residual	88.22	6.32	<0.001*

Additional Information	
-2 log likelihood	373725.01
Pseudo R^2 Team	0.08
Pseudo R^2 School	-0.04
Pseudo R^2 Total	0.08

* = significant at the .05 level

Final Model

The prediction equation generated by Difference in Academic Progress Rate (DAPR) List-wise Deletion data used team variable Difference in squad size (γ_{02} = -1.63, t = -20.55, p < 0.001). Team variables SPORTPROFILE ($u_{1j,}$ = 750.23, Wald Z = 12.57, p < 0.001), and TEAMGENDER (u_{3j} = 358.14, Wald Z = 12.03, p < 0.001) were also included because of significant random effects. All insignificant team and school variables were excluded. Removal of the nonsignificant components changed regression coefficients slightly as shown in Table 22.

Table 22.

Difference in APR HLM Results Final Model (Mean Substitution)

Fixed Effect	Coefficient	Standard Error	p
Grand Mean	2.32	0.31	<0.001*
SPORTPROFILE	1.38	0.95	0.146
Difference in Squad Size (DSS)	-1.63	0.08	<0.001*
TEAMGENDER	-0.34	0.66	0.957

Random Effect	Variance Component	Standard Error	p
Team Level Residual	1773.96	14.87	<0.001*
SPORTPROFILE	750.23	59.68	<0.001*
Difference in Squad Size (DSS)	1.70	0.33	<0.001*
TEAMGENDER	358.14	29.77	<0.001*
School Level Residual	88.90	6.34	<0.001*

Additional Information	
-2 log likelihood	373746.87
Pseudo R^2 Team	0.08
Pseudo R^2 School	-0.04
Pseudo R^2 Total	0.08

* = significant at the .05 level

The prediction equation follows:

DAPR = Grand Mean + Fixed SPORTPROFILE Coefficient * (SPORTPROFILE – School Mean for SPORTPROFILE) + Fixed Difference in squad size (DSS) Coefficient * (Difference in squad size (DSS) – School Mean for Difference in squad size (DSS)) + Fixed TEAMGENDER Coefficient * (TEAMGENDER – School Mean for TEAMGENDER) + Team Variance + Random SPORTPROFILE Coefficient * (SPORTPROFILE – School Mean for SPORTPROFILE) + Random Difference in squad size (DSS) Coefficient * (Difference in squad size (DSS) – School Mean for Difference in squad size (DSS)) + Random TEAMGENDER Coefficient * (TEAMGENDER – School Mean for TEAMGENDER) + School Variance

or

DAPR = 2.32 + 1.38* SPORTPROFILE – School Mean for SPORTPROFILE -1.63* Difference in squad size (DSS) – School Mean for Difference in squad size (DSS) -0.34* TEAMGENDER – School Mean for TEAMGENDER + 1773.96 + 750.23* SPORTPROFILE – School Mean for SPORTPROFILE + 1.70* Difference in squad size (DSS) – School Mean for Difference in squad size (DSS) + 358.14* TEAMGENDER – School Mean for TEAMGENDER + 88.90.

Using the Pseudo R^2 statistic, the final model explained an additional 8% in regard to team variance, -4% in additional school level variance, and 8% in additional total variance. Deviance decreased from 374829.21 in the null model to 373746.87, a difference of 1082.34, which was greater than 12.59, the difference allowed in a chi-square distribution with 6 degrees of freedom as advised by Newsom (2013). This difference was significant at the .05 level and indicated the model fit was different and better than the fit of the null model.

Academic Progress Rate Models

Pre-analysis Screening

The Academic Progress Rate (APR) data set contained cases relating to 44,891 NCAA teams competing from 2003-2004 until 2011-2012. Three hundred eighty-seven institutions were represented. One hundred fifty-four co-ed rifle teams were deleted along with 2,292 teams with no APR reported. Forty-two thousand, four hundred, forty-five cases remained.

Excessive skewness and kurtosis found in the distribution of seven independent institutional variables were addressed with logarithmic transformations. Table 23 outlines the results of those transformations.

Table 23.

Descriptive Statistics for APR Study Variables after Transformation

	Before			After	
	Skewness	Kurtosis	Transformation	Skewness	Kurtosis
Percent male students (GEN)	2.08	9.74*	logarithmic	0.61	4.39
Academic support expenditures (ASE)	8.18	102.13*	logarithmic	0.81	2.2
Faculty/Acre (FAC_A)	14.13	205.55*	logarithmic	2.26*	9.78*
Instructional expenditures (IE)	4.08	25.26*	logarithmic	1	1.66
Student/Faculty ratio (SF)	1.98	16.92*	logarithmic	-0.07	1.33
Students/Acre (STU_A)	12.53	168.32*	logarithmic	0.5	1.82
Student service expenditures (SSE)	6.96	63.27*	logarithmic	-1.14	20.68*

* = outside guidelines by Curran, West, and Finch (1996).

Missing Data

Of the 42,445 Academic Progress Rate (APR) cases, 27,326 cases (64%) contained at least one missing variable and were excluded by list-wise deletion in the first analysis. Fifteen thousand, one hundred, nineteen cases remained. Missing data statistics are found in Table 24.

Table 24.
Frequencies of APR Study Variables

	Valid	Missing	% Missing
Level 1 Variables			
Sport Profile	42445	0	0
Squad Size	42445	0	0
Team Gender	42445	0	0
Level 2 Continuous Variables			
Percent age 24 or less(AGE)	38235	4210	9.9
Percent of minority students (ETH)	42433	12	0.0
Percent male students (GEN)	42433	12	0.0
High School GPA (GPA)	26645	15800	37.2
High School SAT (SAT)	40799	1646	3.9
Percent receiving federal aid (FED)	42270	175	0.4
Percent receiving state grants (SG)	42270	175	0.4
Percent receiving institutional grants (IG)	42270	175	0.4
Percent receiving student loans (LOAN)	42270	175	0.4
In-state tuition (IN_STATE)	42392	53	0.1
Out-of-state tuition (OUT_STATE)	42392	53	0.1
Academic support expenditures (ASE)	30917	11528	27.2
Number of majors (CUR)	42445	0	0.0
Faculty/Acre (FAC_A)	41328	1117	2.6
Instructional expenditures (IE)	30917	11528	27.2
Percent full-time faculty (FAC)	34763	7682	18.1
Percent graduate students (REA)	41041	1404	3.3
Student/Faculty ratio (SF)	42410	35	0.1
Percent dormitory capacity (DC)	42197	248	0.6
Students/Acre (STU_A)	41335	1110	2.6
Student service expenditures (SSE)	30917	11528	27.2

The analysis of Academic Progress Rate (APR) mirrored the procedures applied to difference in APR data with t-tests, factor analysis, and the development of a hierarchical linear model. T-tests again, revealed significant differences in complete data and data with missing values, leading to the classification of missing data as

MAR. Two data sets were established, one using list-wise deletion for cases with missing data entries and one using mean substitution. T-test results are shown in Table 25.

Table 25.

T-Test Results for Valid and Missing APR Data

		Mean	St. Dev.	t	p
Percent age 24 or less(AGE)	Valid	90.55	6.99	-27.23	.000*
	Missing	92.61	7.59		
Percent of minority students (ETH)	Valid	32.49	23.36	-10.53	000*
	Missing	34.95	22.66		
Percent male students (GEN)	Valid	1.66	0.06	-13.23	000*
	Missing	1.67	0.07		
High School GPA (GPA)	Valid	340.57	30.36	-2.89	004*
	Missing	341.69	32.3		
High School SAT (SAT)	Valid	972.83	136.25	-41.44	000*
	Missing	1035.27	163.57		
Percent receiving federal aid (FED)	Valid	26.32	14.42	10.6	000*
	Missing	24.72	15.68		
Percent receiving state grants (SG)	Valid	37.34	25.44	35.7	000*
	Missing	28.66	21.04		
Percent receiving institutional grants (IG)	Valid	41.36	21.03	-50.25	000*
	Missing	53.02	25.84		
Percent receiving student loans (LOAN)	Valid	45.28	15.61	-26.05	000*
	Missing	49.65	18.08		
In-state tuition (IN_STATE)	Valid	7624.42	6185.86	-97.38	000*
	Missing	16202.97	11943.23		
Out-of-state tuition (OUT_STATE)	Valid	16299.42	5438.73	-68.44	000*
	Missing	21077.61	8921.26		
Academic support expenditures (ASE)	Valid	3.26	0.24	-22.43	000*
	Missing	3.33	0.3		
Number of majors (CUR)	Valid	34.51	8.96	7.47	000*
	Missing	33.8	10		

Table 25 Continued

Faculty/Acre (FAC_A)	Valid	69.72	9.23	-22.56	000*
	Missing	71.59	10.72		
Instructional expenditures (IE)	Valid	3.88	0.19	-14.05	000*
	Missing	3.92	0.23		
Percent full-time faculty (FAC)	Valid	69.72	9.23	-17.47	000*
	Missing	71.59	10.72		
Percent graduate students (REA)	Valid	21.35	9.42	-35.4	000*
	Missing	25.3	13.05		
Student/Faculty ratio (SF)	Valid	1.31	0.09	43.7	000*
	Missing	1.27	0.11		
Table 25 Continued					
Percent dormitory capacity (DC)	Valid	4442.03	3020.06	9.91	000*
	Missing	4143.01	2883.19		
Students/Acre (STU_A)	Valid	1.5	0.44	-6.67	000*
	Missing	1.54	0.53		
Student service expenditures (SSE)	Valid	3.06	0.3	-24.42	000*
	Missing	3.14	0.29		

*= significant difference in means at the .05 level
Equal variances not assumed

List-wise Deletion Models for Academic Progress Rate

Exploratory Factor Analysis

Exploratory factor analysis produced three aggregated institutional factors. Twenty-four variables were chosen from thirty-seven variables entered into the analysis to form three factors. The three factors combined to explain over 50.6% of the variance among institutional variables included in the data set as shown in Table 26. The three factors were named: SELECT(APR-LD), FINANCE(APR-LD), and SOCIAL(APR-LD). SELECT(APR-LD) contained ten variables: high school GPA and SAT scores, age, gender, and ethnicity percentages, percentage of students receiving federal aid and student loans, dormitory capacity, NCAA subdivision, and number of majors offered at the institution. Loadings for variables comprising SELECT(APR-LD) ranged from -.421 to .765. FINANCE(APR-LD) contained nine variables representing both in-state and out-of-state tuition, instructional, academic support and student services expenditures, institutional control, student/faculty ratio, research orientation of the institution, and percentage of students receiving institutional grants. Loadings for FINANCE(APR-LD) ranged from .455 to .911. The final factor was SOCIAL(APR-LD) which included five variables relating to student and faculty per acre, locale, and NCAA subdivision. Loadings ranged from .411 to .882. Composition of factors and loadings are listed in Table 27.

Table 26.

Total Variance Explained for APR (List-wise Deletion) Factors

Factor	Initial Eigenvalues			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	6.215	25.897	25.897	4.886	20.357	20.357
2	3.465	14.439	40.336	4.650	19.376	39.733
3	2.468	10.284	50.621	2.613	10.887	50.621
4	1.810	7.544	58.164			
5	1.455	6.064	64.228			
6	1.249	5.203	69.431			
7	.973	4.055	73.486			
8	.914	3.808	77.294			
9	.785	3.270	80.564			
10	.726	3.024	83.588			
11	.615	2.565	86.152			
12	.534	2.223	88.376			
13	.443	1.844	90.220			
14	.424	1.767	91.987			
15	.380	1.582	93.569			
16	.347	1.447	95.016			
17	.318	1.324	96.340			
18	.225	.937	97.276			
19	.182	.760	98.036			
20	.149	.619	98.655			
21	.130	.543	99.199			
22	.119	.495	99.694			
23	.044	.183	99.877			
24	.029	.123	100.000			

Table 27.

Factor Loadings for APR Data (List-wise Deletion)

Variable	Component		
	SELECT (APR-LD)	FINANCE (APR-LD)	SOCIAL (APR-LD)
High School GPA (GPA)	0.765	0.293	0.074
Percent receiving federal aid (FED)	-0.717	-0.206	-0.142
High School SAT (SAT)	0.71	0.508	0.113
Percent dormitory capacity (DC)	0.694	0.122	-0.188
NCAA Subdivision (DIV1)	0.657	-0.211	0.04
Percent male students (GEN)	0.641	0.04	-0.156
Percent receiving student loans (LOAN)	-0.576	0.264	-0.198
Percent age 24 or less(AGE)	0.556	0.429	-0.165
Number of majors (CUR)	0.473	-0.025	0.174
Percent of minority students (ETH)	-0.421	0.041	-0.002
In-state tuition (IN_STATE)	-0.063	0.911	0.13
Institutional control (CON2)	-0.222	0.812	0.167
Out-of-state tuition (OUT_STATE)	0.383	0.736	0.11
Instructional expenditures (IE)	0.494	0.629	0.111
Percent receiving institutional grants (IG)	-0.043	0.585	0.019
Percent graduate students (REA)	0.285	0.565	0.31
Academic support expenditures (ASE)	0.432	0.554	0.092
Student/Faculty ratio (SFII)	-0.025	-0.535	0.128
Student service expenditures (SSE)	-0.255	0.455	-0.279
Students/Acre (STU_A)	-0.075	-0.038	0.882
Faculty/Acre (FAC_A)	-0.047	0.141	0.857
Locale of Institution (LOC1)	0.087	-0.013	0.498
NCAA Subdivision (DIV2)	-0.219	-0.025	-0.468
NCAA Subdivision (DIV3)	-0.268	0.193	0.411

APR-LD is Academic Progress Rate Mean Substitution Shaded values include loadings used in analyses.

Team variables and institutional factors were examined for intercollinearity. Table 28 shows the condition index in this sample at 4.232 is well below the moderate to strong threshold of 30 set by Belsey, Kuh, & Welch (1980).

Table 28.

Collinearity Diagnostics for APR List-wise Deletion Model Variables

Dim.	Eigen-value	Condition Index	Variance Prop.						
			(Constant)	SPORT TYPE	SQUAD SIZE	TEAM GENDER	PERSONAL	MONEY	SOCIAL
1	2.560	1.000	.03	.03	.04	.03	.00	.00	.00
2	1.080	1.539	.01	.21	.01	.10	.00	.09	.09
3	1.006	1.595	.00	.00	.00	.00	.95	.00	.01
4	1.000	1.600	.00	.00	.00	.00	.00	.49	.50
5	.980	1.616	.00	.06	.00	.03	.01	.41	.40
6	.231	3.329	.00	.67	.61	.34	.03	.00	.00
7	.143	4.232	.96	.02	.34	.51	.01	.00	.00

Model Analysis

Hierarchical linear models were consequently developed. The results are shown in the following paragraphs.

Null Model

Fifteen thousand, one hundred nineteen team Academic Progress Rate (APR) scores were examined. The differences were grouped by institution into 290 groups. The grand mean of 959.85 was the average APR score at each institution over the eight year period.

The team level residual was 1472.53 and the school-level residual was 261.35. From the null model an intra-class correlation of 0.15 was computed indicating that 15% of the amount of the variance in annual Academic Progress Rate (APR) scores was attributable to differences in schools and 85 % of the variance resulted from differences in teams. Table 29 summarizes the analysis.

Table 29.
APR HLM Results Null Model (List-wise Deletion)

Fixed Effect	Coefficient	Standard Error	p
Grand Mean	959.85	1.05	<0.001*
Random Effect	Variance Component	Standard Error	p
Team Level Residual	1472.53	17.10	<0.001*
School Level Residual	261.35	26.71	<0.001*
Additional Information			
ICC	0.15		
-2 log likelihood	153792.63		

* = significant at the .05 level

Random Coefficient Model

The random coefficient model produced a Pseudo R^2 of .11 for team variance, meaning that team characteristics entering the model accounted for an additional 11% of the explainable variance at the team level. Pseudo R^2 statistics for school variance and total variance were -.02 and 0.09, respectively. From the team variables, SPORTPROFILE (γ_{02} = -18.35, t = --14.36, p < 0.001), squad size (SQSZ) (γ_{03} = -

0.10, $t = -4.34$, $p < 0.001$), and TEAMGENDER ($\gamma_{04} = 13.21$, $t = 16.31$, $p < 0.001$) were significant fixed effects contributors. Squad size affected APR scores in the opposite direction of that hypothesized. Though squad size (SQSZ) was statistically significant as a fixed effect, the covariance parameter was less than .000001 and classified as redundant in SPSS. Squad size was deleted as a random effect to allow the model to converge. Both SPORTPROFILE ($u_{1j,} = 101.10$, Wald Z = 3.45, p =.001) and TEAMGENDER ($u_{3j} = 41.91$, Wald Z = 3.03, p =0.002) were significant as random effects.

Deviance decreased from 153792.63 to 152214.77, a difference of 1577.86, which was greater than 11.07, the difference allowed in a chi-square distribution with 5 degrees of freedom. The random coefficients model was, therefore, considered different from, and a better fit for the data than the null model at a significance level of .05. Table 30 outlines the model.

Table 30.

APR HLM Results Random Coefficient Model (List-wise Deletion)

Fixed Effect	Coefficient	Standard Error	p
Grand Mean	959.84	1.05	<0.001*
SPORTPROFILE	-18.35	1.28	<0.001*
Squad Size (SQSZ)	-0.10	0.02	<0.001*
TEAMGENDER	13.21	0.81	<0.001*

Random Effect	Variance Component	Standard Error	p
Team Level Residual	1306.52	15.47	<0.001*
SPORTPROFILE	101.10	29.34	0.001*
TEAMGENDER	41.91	13.85	0.002*
School Level Residual	268.59	26.92	<0.001*

Additional Information	
-2 log likelihood	152214.77
Pseudo R^2 Team	0.11
Pseudo R^2 School	-0.02
Pseudo R^2 Total	0.09

* = significant at the .05 level

Intercepts and Slopes as Outcomes Model

Significant fixed effect predictors included team variables: SPORTPROFILE (γ_{02} = -18.03, t = -12.83, $p < 0.001$), squad size (SQSZ) (γ_{03} = -0.11, t = -4.81, $p < 0.001$), and TEAMGENDER (γ_{04} = 13.92, t = 15.56, $p < 0.001$), school variables SELECT(APR-LD) (γ_{04} = 9.04, t = 12.15, $p < 0.001$), and FINANCE(APR-LD) (γ_{05} = 10.02, t = 17.10, $p <$ 0.001), cross-level variables Squad Size (SQSZ) *SELECT(APR-LD) (γ_{21} = -0.05, t =

2.17, $p = 0.030$) and TEAMGENDER*FINANCE(APR-LD) ($\gamma_{32} = -3.04$, $t = -3.91$, $p < 0.001$).

SPORTPROFILE ($u_{1j,} = 169.51$, Wald $Z = 4.15$, $p < 0.001$) and TEAMGENDER ($u_{3j} = 73.57$, Wald $Z = 3.83$, $p < 0.001$) were both significant random effects predictors.

The addition of institutional variables resulted in a Pseudo R^2 of $^{0.18}$ for total variance, explaining an additional 18% of the total in Academic Progress Rate (APR). Pseudo R^2 for team variance and school variance were .13 and .51 explaining 13% of team variance and 51% of school variance in APR scores. Deviance decreased from 153792.63 in the null model to 151815.02, a difference of 1977.61, which was greater than 27.59, the difference allowed in a chi-square distribution with 17 degrees of freedom. The random coefficients model was, therefore, considered different from, and a better fit for the data than the null model at a significance level of .05. Results are shown in Table 31.

Table 31.

APR HLM Results Intercepts and Slopes as Outcomes Model (List-wise Deletion)

Fixed Effect	Coefficient	Standard Error	p
Grand Mean	959.31	0.80	<0.001*
SPORTPROFILE	-18.03	1.41	<0.001*
Difference in Squad Size (DSS)	-0.11	0.02	<0.001*
TEAMGENDER	13.92	0.89	<0.001*
SELECT(APR-LD)	9.04	0.74	<0.001*
FINANCE(APR-LD)	10.02	0.59	<0.001*
SOCIAL(APR-LD)	0.14	0.68	0.835
Squad Size (SQSZ) *SELECT(APR-LD)	0.05	0.02	0.03*
Squad Size (SQSZ) *FINANCE(APR-LD)	-0.02	0.02	0.515
Squad Size (SQSZ) *SOCIAL(APR-LD)	-0.02	0.02	0.297
SPORTPROFILE*SELECT(APR-LD)	0.41	1.38	0.768
SPORTPROFILE*FINANCE(APR-LD)	1.91	1.26	0.131
SPORTPROFILE*SOCIAL(APR-LD)	-0.09	1.32	0.945
TEAMGENDER*SELECT(APR-LD)	-1.31	-1.31	0.131
TEAMGENDER*FINANCE(APR-LD)	-3.04	-3.04	<0.001*
TEAMGENDER*SOCIAL(APR-LD)	-0.64	-0.64	0.441

Random Effect	Variance Component	Standard Error	p
Team Level Residual	1287.46	15.26	<0.001*
SPORTPROFILE	169.51	40.84	<0.001*
TEAMGENDER	73.57	19.21	<0.001*
School Level Residual	127.22	15.19	<0.001*

Additional Information	
-2 log likelihood	151815.02
Pseudo R^2 Team	0.13
Pseudo R^2 School	0.51
Pseudo R^2 Total	0.18

* = significant at the .05 level

Final Model

The prediction equation generated by Academic Progress Rate List-wise Deletion data used the team variables representing SPORTPROFILE (γ_{02} = -17.88, t = -12.98, p < 0.001), squad size (SQSZ) (γ_{03} = -0.11, t = -4.8, p < 0.001) and TEAMGENDER (γ_{04} = 14.12, t = 15.86, p < 0.001), school variables SELECT(APR-LD) (γ_{04} = 8.48, t = 12.43, p < 0.001), and FINANCE(APR-LD) (γ_{05} = 9.97, t = 17.07, p < 0.001), cross-level variables Squad Size (SQSZ) *SELECT(APR-LD) (γ_{21} = 0.06, t = 2.76, p = 0.006) and TEAMGENDER*FINANCE(APR-LD) (γ_{32} = -3.52, t = -5.17, p < 0.001).

SPORTPROFILE ($u_{1j,}$ = 160.59, Wald Z = 4.065, p < 0.001) and TEAMGENDER (u_{3j} = 74.72, Wald Z = 3.87, p < 0.001) were both significant random effects predictors.

Removal of the nonsignificant components changed regression coefficients slightly as shown in Table 32.

Table 32.
APR HLM Results Final Model (List-wise Deletion)

Fixed Effect	Coefficient	Standard Error	p
Grand Mean	959.17	0.80	<0.001*
SPORTPROFILE	-17.88	1.38	<0.001*
Squad Size (SQSZ)	-0.11	0.02	<0.001*
TEAMGENDER	14.12	0.89	<0.001*
SELECT(APR-LD)	8.48	0.68	<0.001*
FINANCE(APR-LD)	9.97	0.58	<0.001*
Squad Size (SQSZ) *SELECT(APR-LD)	0.06	0.02	0.006*
TEAMGENDER*FINANCE(APR-LD)	-3.52	0.68	<0.001*

Random Effect	Variance Component	Standard Error	p
Team Level Residual	1287.92	15.26	<0.001*
SPORTPROFILE	160.59	39.58	<0.001*
TEAMGENDER	74.72	19.33	<0.001*
School Level Residual	126.87	15.10	<0.001*

Additional Information			
-2 log likelihood	151821.43		
Pseudo R^2 Team	0.13		
Pseudo R^2 School	0.51		
Pseudo R^2 Total	0.18		

* = significant at the .05 level

. The prediction equation follows:

APR = Grand Mean + Fixed SPORTPROFILE Coefficient * (SPORTPROFILE – School Mean for SPORTPROFILE) + Fixed Squad Size (SQSZ) Coefficient * (Squad Size (SQSZ) – School Mean for Squad Size (SQSZ)) + Fixed TEAMGENDER Coefficient * (TEAMGENDER – School Mean for TEAMGENDER) + Fixed SELECT(APR-LD)

Coefficient * SELECT(APR-LD) + Fixed FINANCE(APR-LD) Coefficient * FINANCE(APR-LD) + Cross-level Regression Coefficient * Interaction between SELECT(DAPR-LD) and Squad Size (SQSZ) + Cross-level Regression Coefficient * Interaction between FINANCE(DAPR-LD) and TEAMGENDER + Team Variance + Random SPORTPROFILE Coefficient * (SPORTPROFILE – School Mean for SPORTPROFILE) + Random TEAMGENDER Coefficient * (TEAMGENDER – School Mean for TEAMGENDER) + School Variance

or

APR = 959.17 - 17.88* SPORTPROFILE – School Mean for SPORTPROFILE - 0.11* (Squad Size (SQSZ) – School Mean for Squad Size (SQSZ)) + 14.12 * (TEAMGENDER – School Mean for TEAMGENDER) + 8.48 * SELECT(APR-LD) + 9.97 * FINANCE(APR-LD) + 0.06 * SELECT(DAPR-LD)*Squad Size (SQSZ) - 3.52 *FINANCE(DAPR-LD)*TEAMGENDER + 1287.92 + 160.59 * (SPORTPROFILE – School Mean for SPORTPROFILE) + 74.72* (TEAMGENDER – School Mean for TEAMGENDER) + 126.87

Pseudo R^2 computations indicated, the final model explained an additional 13% in regard to team variance, 51% in additional school level variance, and 18% in additional total variance.

Deviance decreased from 153792.63 in the null model to 151821.43, a difference of 1971.20, which was greater than 16.92, the difference allowed in a chi-square distribution with 9 degrees of freedom as advised by Newsom (2013). This difference was significant at the .05 level and indicated the model fit was different and better than the fit of the null model.

Mean Substitution Models for APR

Since preliminary t-tests indicated significant differences between cases with and without missing values, a second analysis was conducted with data altered with mean substitution of missing variables in lieu of list-wise deletion.

Exploratory Factor Analysis

Exploratory factor analysis produced three factors, labeled SELECT(APR-MS), FINANCE(APR-MS), and SOCIAL(APR-MS). The three factors explained 49.2% of the variance among the institutional variables included in the study as shown in Table 33. FINANCE(APR-MS) included ten variables representing both in-state and out-of-state tuition, instructional, academic support and student services expenditures, institutional control, student/faculty ratio, research orientation of the institution, percentage of students receiving institutional grants, and percentage of students age 24 or less. Loadings ranged from .928 to .507. SELECT(APR-MS) contained nine variables and was composed of high school GPA and SAT scores, gender and ethnicity percentages, percentage of students receiving federal aid and student loans, dormitory capacity, NCAA subdivision, and number of majors offered at the institution.. Loadings ranged from .702 to - .421. SOCIAL(APR-MS) included student and faculty per acre, locale, and NCAA subdivision. Loadings ranged from -.841 to -.462. Complete factor loadings are shown in Table 34.

Table 33.

Total Variance Explained for APR (Mean Substitution) Factors

Factor	Initial Eigenvalues			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.991	23.964	23.964	5.298	21.193	21.193
2	3.631	14.525	38.489	4.188	16.752	37.945
3	2.680	10.720	49.210	2.816	11.264	49.210
4	1.770	7.079	56.288			
5	1.419	5.677	61.966			
6	1.213	4.852	66.818			
7	1.021	4.083	70.901			
8	.902	3.609	74.510			
9	.748	2.991	77.501			
10	.736	2.945	80.447			
11	.723	2.894	83.340			
12	.660	2.640	85.981			
13	.555	2.219	88.199			
14	.511	2.046	90.245			
15	.461	1.845	92.090			
16	.414	1.656	93.746			
17	.356	1.426	95.171			
18	.303	1.210	96.382			
19	.200	.801	97.182			
20	.192	.766	97.949			
21	.170	.678	98.627			
22	.150	.598	99.225			
23	.131	.522	99.747			
24	.041	.163	99.910			
25	.022	.090	100.000			

Table 34.

Factor Loadings for APR Data (Mean Substitution)

Variable	Component		
	FINANCE (APR-MS)	SELECT (APR-MS)	SOCIAL (APR-MS)
In-state tuition (IN_STATE)	0.928	-0.039	0.091
Institutional control (CON(PRIVATENP))	0.882	-0.19	0.088
Out-of-state tuition (OUT_STATE)	0.827	0.184	0.146
Student/Faculty ratio (SF)	-0.643	-0.068	0.246
Percent receiving institutional grants (IG)	0.603	-0.168	0.144
Percent graduate students (REA)	0.566	0.273	0.356
Instructional expenditures (IE)	0.531	0.487	0.011
Percent age 24 or less(AGE)	0.519	0.465	-0.162
Academic support expenditures (ASE)	0.519	0.41	-0.012
Student service expenditures (SSE)	0.507	-0.064	-0.221
Percent dormitory capacity (DC)	-0.017	0.702	0.008
Percent receiving federal aid (FED)	-0.356	-0.689	-0.034
NCAA Subdivision (DIV(FBS))	-0.309	0.674	0.075
High School SAT (SAT)	0.614	0.626	0.029
Percent male students (GEN)	0.033	0.617	-0.212
Percent receiving student loans (LOAN)	0.103	-0.581	-0.054
High School GPA (GPA)	0.236	0.518	0.072
Percent of minority students (ETH)	-0.033	-0.435	0.071
Number of majors (CUR)	-0.01	0.421	0.261
Students/Acre (STU_A)	0.041	-0.174	0.841
Faculty/Acre (FAC_A)	0.239	-0.11	0.777
NCAA Subdivision (DIV(FCS))	0.041	-0.103	-0.563
Locale of Institution (LOC(CITY))	-0.026	0.049	0.527
NCAA Subdivision (DIV(NOFB))	0.175	-0.35	0.493
Percent full-time faculty (FAC)	0.2	-0.194	-0.462

APR-MS is Academic Progress Rate, Mean Substitution. Shaded values include loadings used in analyses.

Collinearity was examined and the highest condition index in this sample was substantially less than 30at 4.195. Collinearity was not a problem in this model. Table 35 shows the condition index in this sample at 4.195 is well below the moderate to strong threshold of 30 set by Belsey, Kuh, & Welch (1980).

Table 35.

Collinearity Diagnostics for APR Mean Substitution Model Variables

Dim.	Eigen -value	Condition Index	Variance Prop.						
			(Constant)	SPORT PROFILE	SQUAD SIZE	TEAM GNDR	FINANCE (APR-MS)	SELECT (APR-MS)	SOCIAL (APR-MS)
1	2.545	1.000	.03	.03	.04	.03	.00	.00	.00
2	1.084	1.532	.01	.21	.01	.09	.12	.01	.10
3	1.007	1.590	.00	.01	.00	.00	.00	.91	.04
4	1.000	1.595	.00	.00	.00	.00	.47	.02	.50
5	.972	1.618	.00	.09	.00	.03	.40	.01	.35
6	.246	3.214	.00	.65	.57	.35	.00	.04	.00
7	.145	4.195	.96	.02	.38	.49	.01	.01	.00

APR-MS is Academic Progress Rate, Mean Substitution

Model Analysis

Hierarchical linear modeling produced three models as summarized in the paragraphs that follow.

Null Model

Forty-two thousand, four hundred forty-five team Academic Progress Rate (APR) scores were examined. The differences were grouped by institution into 388 groups. The grand mean of 964.26 was the average APR score at each institution over the eight year period.

The team level variance (σ2) was 1315.37 and the school-level variance (τ) was 256.04 resulting in an intra-class correlation of approximately 0.16 for the null model meaning that 16% of the variation between APR scores is explained by differences in those institutions. Table 36 summarizes the analysis.

Table 36.

APR HLM Results Null Model (Mean Substitution)

Fixed Effect	Coefficient	Standard Error	p
Grand Mean	964.26	0.85	<0.001*
Random Effect	**Variance Component**	**Standard Error**	**p**
Team Level Residual	1315.37	9.07	<0.001*
School Level Residual	256.04	19.91	<0.001*
Additional Information			
ICC	0.16		
-2 log likelihood	426422.31		

* = significant at the .05 level

Random Coefficient Model

All three team level variables, SPORTPROFILE (γ_{01} = -16.13, t = -19.53, p < 0.001), Squad Size (SQSZ) (γ_{20} = -0.10, t = -7.56, p < 0.001), and TEAMGENDER (γ_{03} = 11.71, t = 23.39, p < 0.001), entered into the random coefficient model offered a statistically significant fixed relationship with APR scores. Slope for squad size was in the opposite direction of that which was hypothesized. SPORTPROFILE ($u_{1j,}$ = 104.58, Wald Z = 6.87, p < 0.001) and TEAMGENDER (u_{3j} = 35.56, Wald Z = 5.67, p < 0.001) were significant as random effects.

Pseudo R^2 statistics indicated the random effects model explained an additional 9% in regard to team variance, -1% of school level variance, and 8% in additional total variance.

Deviance decreased from 426422.31 to 422626.34, a difference of 3795.97, which was greater than 12.59, the difference allowed in a chi-square distribution with 6 degrees of freedom as advised by Newsom (2013). This difference was significant at the .05 level and indicated the model fit was different and better than the fit of the null model. Results are summarized in Table 37.

Table 37.

APR HLM Results Random Coefficient Model (Mean Substitution)

Fixed Effect	Coefficient	Standard Error	p
Grand Mean	964.25	0.85	<0.001*
SPORTPROFILE	-16.13	0.83	<0.001*
Squad Size (SQSZ)	-0.10	0.01	<0.001*
TEAMGENDER	11.71	0.50	<0.001*

Random Effect	Variance Component	Standard Error	p
Team Level Residual	1187.95	8.29	<0.001*
SPORTPROFILE	104.58	15.22	0.001*
Squad Size (SQSZ)	0.001	0.003	0.860
TEAMGENDER	35.56	6.27	<0.001*
School Level Residual	257.85	19.94	<0.001*

Additional Information	
-2 log likelihood	422626.34
Pseudo R^2 Team	0.09
Pseudo R^2 School	-0.01
Pseudo R^2 Total	0.08

* = significant at the .05 level

Intercepts and Slopes as Outcomes Model

Significant fixed effect predictors included team variables: SPORTPROFILE (γ_{02} = -15.38, t = -19.88, p < 0.001), squad size (SQSZ) (γ_{03} = -0.11, t = -8.04, p < 0.001), and TEAMGENDER (γ_{04} = 11.61, t = 25.38, p < 0.001), school variables SELECT(APR-MS) (γ_{04} = 9.47, t = 19.58, p < 0.001), and FINANCE(APR-MS) (γ_{05} = 12.50, t = 24.69, p < 0.001), cross-level variables SPORTPROFILE*SELECT(APR-MS) (γ_{11} = 2.84, t =

3.71, $p < 0.001$), SPORTPROFILE* FINANCE(APR-MS) ($\gamma_{12} = 2.57$, $t = 3.34$, $p = 0.001$), (Squad Size (SQSZ) *SELECT(APR-MS) ($\gamma_{21} = 0.03$, $t = 2.72$, $p = 0.007$), TEAMGENDER* SELECT(APR-MS) ($\gamma_{31} = -1.46$, $t = 3.20$, $p = 0.001$), and TEAMGENDER*FINANCE(APR-MS) ($\gamma_{32} = -2.96$, $t = -6.50$, $p < 0.001$).

SPORTPROFILE ($u_{1j,} = 76.12$, Wald $Z = 5.88$, $p < 0.001$) and TEAMGENDER ($u_{3j} = 21.93$, Wald $Z = 4.14$, $p < 0.001$) were both significant random effects predictors.

The addition of institutional variables resulted in a Pseudo R^2 of $^{0.19}$ for total variance, explaining an additional 19% of the total in APR. Pseudo R^2 for team variance and school variance were .11 and .62 explaining 11% of team variance and 62% of school variance in Academic Progress Rate scores. Deviance decreased from 426422.31 in the null model to 421715.56, a difference of 4706.75, which was greater than 27.59, the difference allowed in a chi-square distribution with 17 degrees of freedom. The random coefficients model was, therefore, considered different from, and a better fit for the data than the null model at a significance level of .05. Results are shown in Table 38.

Table 38.

APR HLM Results Intercepts and Slopes as Outcomes Model (Mean Substitution)

Fixed Effect	Coefficient	Standard Error	p
Grand Mean	965.83	0.55	<0.001*
SPORTPROFILE	-15.38	0.77	<0.001*
Squad Size (SQSZ)	-0.11	0.01	<0.001*
TEAMGENDER	11.61	0.46	<0.001*
SELECT(APR-MS)	9.47	0.48	<0.001*
FINANCE(APR-MS)	12.50	0.51	<0.001*
SOCIAL(APR-MS)	0.57	0.48	0.239
Squad Size (SQSZ) *SELECT(APR-MS)	0.03	0.01	0.007*
Squad Size (SQSZ) *FINANCE(APR-MS)	0.02	0.01	0.096
Squad Size (SQSZ) *SOCIAL(APR-MS)	-0.02	0.01	0.132
SPORTPROFILE*SELECT(APR-MS)	2.84	0.77	<0.001*
SPORTPROFILE*FINANCE(APR-MS)	2.57	0.77	0.001*
SPORTPROFILE*SOCIAL(APR-MS)	-0.60	0.76	0.435
TEAMGENDER*SELECT(APR-MS)	-1.46	0.46	0.001*
TEAMGENDER*FINANCE(APR-MS)	-2.96	0.46	<0.001*
TEAMGENDER*SOCIAL(APR-MS)	0.19	0.45	0.673

Random Effect	Variance Component	Standard Error	p
Team Level Residual	1174.94	8.19	<0.001*
SPORTPROFILE	76.12	12.95	<0.001*
TEAMGENDER	21.93	5.29	<0.001*
School Level Residual	98.52	8.96	<0.001*

Additional Information	
-2 log likelihood	421715.56
Pseudo R^2 Team	0.11
Pseudo R^2 School	0.62
Pseudo R^2 Total	0.19

* = significant at the .05 level

Final Model

The prediction equation generated by APR Mean Substitution data used the team variables representing SPORTPROFILE (γ_{02} = -15.37, t = -19.83, $p < 0.001$), squad size (SQSZ) (γ_{03} = -0.11, t = -8.25, $p < 0.001$) and TEAMGENDER (γ_{04} = 11.61, t = 25.38, $p < 0.001$), school variables SELECT(APR-MS) (γ_{04} = 9.50, t = 19.72, $p < 0.001$), and FINANCE(APR-MS) (γ_{05} = 12.47, t = 24.71, $p < 0.001$), cross-level variables SPORTPROFILE*SELECT(APR-MS) (γ_{11} = 2.81, t = 3.67, $p < 0.001$), SPORTPROFILE* FINANCE(APR-MS) (γ_{12} = 3.07, t = 4.20, $p < 0.011$), (Squad Size (SQSZ) *SELECT(APR-MS) (γ_{21} = 0.03, t = 2.53, $p = 0.007$), TEAMGENDER* SELECT(APR-MS) (γ_{31} = -1.45, t = -3.18, $p = 0.002$), and TEAMGENDER*FINANCE(APR-MS) (γ_{32} = -2.93, t = -6.45, $p < 0.001$).

SPORTPROFILE ($u_{1j,}$ = 76.75, Wald Z = 5.91, $p < 0.001$) and TEAMGENDER ($u3j$ = 21.92, Wald Z = 4.15, $p < 0.001$) were both significant random effects predictors.

Removal of the nonsignificant components changed regression coefficients slightly as shown in Table 39.

Table 39.

APR HLM Results Final Model (Mean Substitution)

Fixed Effect	Coefficient	Standard Error	p
Grand Mean	965.83	0.55	<0.001*
SPORTPROFILE	-15.37	0.77	<0.001*
Squad Size (SQSZ)	-0.11	0.01	<0.001*
TEAMGENDER	11.61	0.46	<0.001*
SELECT(APR-MS)	9.50	0.48	<0.001*
FINANCE(APR-MS)	12.47	0.50	<0.001*
Squad Size (SQSZ) *SELECT(APR-MS)	0.03	0.01	0.011*
SPORTPROFILE*SELECT(APR-MS)	2.81	0.77	<0.001*
SPORTPROFILE*FINANCE(APR-MS)	3.07	0.73	<0.001*
TEAMGENDER*SELECT(APR-MS)	-1.45	0.46	0.002*
TEAMGENDER*FINANCE(APR-MS)	-2.93	0.45	<0.001*

Random Effect	Variance Component	Standard Error	p
Team Level Residual	1175.11	8.19	<0.001*
SPORTPROFILE	76.75	5.28	<0.001*
TEAMGENDER	21.92	12.98	<0.001*
School Level Residual	97.73	8.84	<0.001*

Additional Information			
-2 log likelihood	421713.28		
Pseudo R^2 Team	0.11		
Pseudo R^2 School	0.62		
Pseudo R^2 Total	0.19		

* = significant at the .05 level

The prediction equation follows:

APR = Grand Mean + Fixed SPORTPROFILE Coefficient * (SPORTPROFILE – School Mean for SPORTPROFILE) + Fixed Squad Size (SQSZ) Coefficient * (Squad Size (SQSZ) – School Mean for Squad Size (SQSZ)) + Fixed TEAMGENDER Coefficient * (TEAMGENDER – School Mean for TEAMGENDER) + Fixed SELECT(APR-MS)

Coefficient * SELECT(APR-MS) + Fixed FINANCE(APR-MS) Coefficient * FINANCE(APR-MS) + Cross-level Regression Coefficient * Interaction between SELECT(DAPR-MS) and Squad Size (SQSZ) + Cross-level Regression Coefficient * Interaction between SELECT(DAPR-MS) and SPORTPROFILE + Cross-level Regression Coefficient * Interaction between FINANCE(DAPR-MS) and SPORTPROFILE + Cross-level Regression Coefficient * Interaction between SELECT(DAPR-MS) and TEAMGENDER + Cross-level Regression Coefficient * Interaction between FINANCE(DAPR-MS) and TEAMGENDER + Team Variance + Random SPORTPROFILE Coefficient * (SPORTPROFILE – School Mean for SPORTPROFILE) + Random TEAMGENDER Coefficient * (TEAMGENDER – School Mean for TEAMGENDER) + School Variance

or

APR = 965.83 – 15.37* SPORTPROFILE – School Mean for SPORTPROFILE - 0.11* (Squad Size (SQSZ) – School Mean for Squad Size (SQSZ)) + 11.61 * (TEAMGENDER – School Mean for TEAMGENDER) + 9.50 * SELECT(APR-MS) + 12.47 * FINANCE(APR-MS) + 0.03 * SELECT(DAPR-MS)*Squad Size (SQSZ) + 2.81*SELECT(DAPR-MS)*SPORTPROFILE + 3.07*FINANCE(DAPR-MS)*SPORTPROFILE – 1.45*SELECT(DAPR-MS)*TEAMGENDER – 2.93*FINANCE(DAPR-MS)*TEAMGENDER + 1175.11 + 76.75*(SPORTPROFILE – School Mean for SPORTPROFILE) +21.92*(TEAMGENDER – School Mean for TEAMGENDER) +97.73

Pseudo R^2 computations indicated, the final model explained an additional 11% in regard to team variance, 62% in additional school level variance, and 19% in additional total variance.

Deviance decreased from 426422.31 in the null model to 421713.28, a difference of 4709.03, which was greater than 22.36, the difference allowed in a chi-square distribution with 13 degrees of freedom as advised by Newsom (2013). This difference was significant at the .05 level and indicated the model fit was different and better than the fit of the null model.

Hypotheses Findings

Table 40 reports the study hypotheses and findings. The following section details the hypothesis and finding for each predictor. Partially supported means the variable or factor was significant as a random or fixed effect but not both, or was significant in the opposite direction that was hypothesized.

Table 40.

Hypotheses Findings

Predictor	Hypothesis		Finding
Difference in APR Models			
Team Variables for List-wise Deletion Model			
Sport Profile	H1a	(-)	Partially Supported. Random effect.
Squad Size	H1b	(+)	Partially Supported. Fixed effect (-1.77).
Team Gender	H1c	(+)	Partially Supported. Random effect.
Institutional Factors for List-wise Deletion Model			
SELECT	H2		Partially Supported. Cross-level effect.
FINANCE	H2		Not Supported.
SOCIAL	H2		Not Supported.
Team Variables for Means Replacement Model			
Sport Profile	H1a	(-)	Partially Supported. Random effect.
Squad Size	H1b	(+)	Partially Supported. Fixed effect (-1.61). Random effect.
Team Gender	H1c	(+)	Partially Supported. Random effect.
Institutional Factors for Means Replacement Model			
SELECT	H2		Not Supported.
FINANCE	H2		Not Supported.
SOCIAL	H2		Not Supported.
APR Models			
Team Variables for List-wise Deletion Model			
Sport Profile	H3a	(-)	Supported. Fixed effect (-17.88). Random effect.
Squad Size	H3b	(+)	Partially Supported. Fixed effect (0.11).
Team Gender	H3c	(+)	Supported. Fixed effect (14.12). Random effect.
Institutional Factors for List-wise Deletion Model			
SELECT	H4		Supported. Fixed effect (8.48). Cross-level effect
FINANCE	H4		Supported. Fixed effect (9.97). Cross-level effect
SOCIAL	H4		Not Supported.
Team Variables for Means Replacement Model			
Sport Profile	H3a	(-)	Supported. Fixed effect (-15.37). Cross-level effect. Random effect.

Table 40 Continued

Squad Size	H3b	(+)	Partially Supported. Fixed effect (-0.11).Cross-level effect
Team Gender	H3c	(+)	Supported. Fixed effect (11.61). Cross-level effect. Random effect.

Table 40 Continued

Institutional Factors for Means Replacement Model		
SELECT	H4	Supported. Fixed effect (9.50). Cross-level effect
FINANCE	H4	Supported. Fixed effect (12.47).Cross-level effect
SOCIAL	H4	Not Supported.

Sport Profile

H_{1a}: Participation in high profile sports negatively impacted changes in difference in Academic Progress Rate.

H_{3a}: Participation in high profile sports negatively impacted changes in Academic Progress Rate.

At the institutional level, no significant relationship was discovered between difference in Academic Progress Rate (DAPR) and high profile sports teams. High profile sports included football, men's basketball, and baseball. A significant negative relationship was produced by the Academic Progress Rate (APR) models. This finding supports previous research that shows negative student outcomes are associated with sport profile. At the team level, a significant relationship was found for both difference in APR and APR models.

Squad Size

H_{1b}: Increases in squad size positively impacted changes in difference in Academic Progress Rate.

H_{3b}: Increases in squad size positively impacted changes in Academic Progress Rate.

At the institutional level, squad size was significantly related to difference in Academic Progress Rate (DAPR), but in a negative direction from that which was hypothesized. Squad size as a fixed effect was significant in the Academic Progress Rate (APR) models but also opposite of the expected direction. At the team level, squad size was a significant predictor in the difference in APR- mean substation model. Squad size as a random effect was very small and removed from the APR models to allow convergence.

Team Gender

H_{1c}: Female team gender positively impacted changes in difference in Academic Progress Rate

H_{3c}: Female team gender positively impacted changes in Academic Progress Rate.

At the institutional level, team gender was not significantly related to difference in Academic Progress Rate (DAPR). Team gender was significantly related to difference in Academic Progress Rate (APR) at the team level. Female team gender was found to support APR in a significantly positive fashion at both levels.

Institutional Impact

H_2: Institutional variables organized into factors which impacted changes in difference in Academic Progress Rate.

H_4: Institutional variables organized into factors which impacted Academic Progress Rate.

None of the institutional factors impacted difference in Academic Progress Rate (DAPR). Academic Progress Rate (APR) was significantly affected by SELECT and FINANCE. SELECT(APR-LD) was composed of : students precollege SAT scores and high school GPA, dormitory capacity, percent of students receiving federal aid and student loans, percent of students of age 24 or less, percent of male students, diversity of the curriculum, and the percentage of minority students on campus. SELECT(APR-MS) included the same variables except for the percent of students of age 24 or less. FINANCE(APR-LD) included: in-state and out-of-state tuition levels, the percentage of students receiving institutional grants, whether the institution was public or private and its research orientation, student service, instructional, and academic support expenditure levels, and student/ faculty ratio. FINANCE(APR-MS) included the same variables with the addition of the percent of students of age 24 or less.

Model Fit

Statistics indicating model fit are summarized in Table 41. ICC statistics, indicating the percent of variance in difference in APR and APR scores attributable to school differences, were consistent at 4% for difference in APR and 15% for APR. Deviance consistently fell by significant amounts as variables were introduced into the models. Pseudo R^2 indicated 8% of additional team and total variances, were explained in difference in APR models. School variance increased 4 to 12 percent as variables were introduced. In APR models an additional 11 to 13 percent of team variance was explained, a notable, additional 51 to 62 percent of school variance was explained, and 18% of total variance was explained by the predictive models

Table 41.

Deviance and Covariance Values for Hierarchical Linear Models

Difference in APR List-wise Deletion Model				
	Null	Random Coefficients	Intercepts and Slopes-as-Outcomes	Final
Deviance	121922	121595	121561	121577
Difference		327*	361*	345
Covariance Parameters				
Team Level Variance (σ2)	2115	1953	1950	1950
Pseudo R^2		8%	8%	8%
School Level Variance (τ)	89	99	100	99
Pseudo R^2		-12%	-12%	-12%
Total Variance	2204	2052	2050	2049
Pseudo R^2		7%	7%	7%
ICC	4%			

Difference in APR Mean Substitution Model				
	Null	Random Coefficients	Intercepts and Slopes-as-Outcomes	Final
Deviance	374829	374108	373725	373747
Difference		721*	1104*	1082*
Covariance Parameters				
Team Level Variance (σ2)	1935	1802	1774	1774
Pseudo R^2		7%	8%	8%
School Level Variance (τ)	85	87	88	89
Pseudo R^2		-2%	-4%	-4%
Total Variance	2020	1889	1862	1863
Pseudo R^2		6%	8%	8%
ICC	4%			

Table 41 Continued

APR List-wise Deletion Model	Null	Random Coefficients	Intercepts and Slopes-as-Outcomes	Final
Deviance	153793	152215	151815	151821
Difference		1578*	1978*	1972*
Covariance Parameters				
Team Level Variance (σ2)	1473	1307	1287	1288
Pseudo R^2		11%	13%	13%
School Level Variance (τ)	261	269	127	127
Pseudo R^2		-2%	51%	51%
Total Variance	1734	1576	1414	1415
Pseudo R^2		9%	18%	18%
ICC	15%			

APR Mean Substitution Model	Null	Random Coefficients	Intercepts and Slopes-as-Outcomes	Final
Deviance	426422	422626	421716	421713
Difference		3796*	4706*	4709*
Covariance Parameters				
Team Level Variance (σ2)	1315	1187	1175	1175
Pseudo R^2		9%	11%	11%
School Level Variance (τ)	256	258	99	98
Pseudo R^2		-1%	62%	62%
Total Variance	1571	1445	1274	1273
Pseudo R^2		8%	19%	19%
ICC	16%			

* = Significant at 0.05 level.

Chapter Summary

Two models were developed for both difference in Academic Progress Rate (DAPR) and Academic Progress Rate (APR). Since missing data for both dependent variables was found to be MAR, list-wise deletion and a mean substitution models were generated and found to be very similar. Factor analysis produced three aggregated constructs for each model. Comparison of those constructs is discussed in the next chapter.

Intra-class correlation statistics, indicating the percent of variance in difference in Academic Progress Rate (DAPR) and Academic Progress Rate (APR) scores attributable to school differences, were consistent at 4% for difference in APR and 15% for APR. Difference in APR (DAPR) models showed the introduction of school level factors to the model resulted in an increase in school variance. Addition of team variables resulted in an additional 8% of team variance, as well as 7% of total variance, explained. Difference in APR models identified differences in squad size to be significant fixed effect predictors at the school level and sport profile and team gender to be significant random effect contributors at the team level.

Academic Progress Rate (APR) models explained more variance with the introduction of school factors lowering school variance by as much as 62%. Introduction of team variables resulted in lowering team level variance by 11%. Total variance was reduced by 18%. APR models found team level variables, sport profile, squad size, and team gender and school factors associated with students' pre-college characteristics and financial position to be significant fixed effect contributors at the school level. Sport profile and team gender were, again, significant random effect predictors at the team level. Hypotheses were reviewed and partially supported. Chapter V provides an in depth discussion of these findings.

CHAPTER V

DISCUSSION AND CONCLUSIONS

This study explained both Academic Progress Rate levels and annual differences in Academic Progress Rate as functions of team variables and aggregated institutional variables. Hierarchical linear modeling was required because of the multi-level nature of the data with teams nested within institutions. The data for each dependent variable was segregated into two groups: cases with all variable entries present and cases with missing entries. T-tests revealed differences in variable means for cases identified as complete and cases missing variable entries. These differences led to the development of two models for each dependent variable with similar results. While some findings supported previous research, others created the need for questioning and re-examination. This research illuminated the processes that result in both the success and retention of student-athletes.

Chapter V begins with implications for research and theory which include a review of factor analyses, a review of research questions, a review of hypotheses, and a summary of the findings. Future directions and limitations are then followed by implications for practitioners and a conclusion.

Implications for Research and Theory

Review of Factor Analyses

Factor analyses of the four data sets produced similar results. Figure 5 illustrates the factors resulting from exploratory factor analysis for each data set. Three threads emerged: institutional policy concerning selection and characteristics of students, the cost of attendance, and the social and academic environments on campus. Of thirty-five variables considered, twenty- nine were used to form aggregate factors and sixteen were used in two or more factors within the same thread.

SELECT was composed of variables describing institutional policy on admission of students for difference in Academic Progress Rate. For Academic Progress Rate, student body demographics such as percent of students aged 24 years or less, percent of males, and percent of minority students were added. SELECT did not describe the student-athletes but the makeup of the student body of which they were a part. FINANCE, likewise, described the socio-economic status of the entire student body. Variables such as tuition level, control (public or private), and expenditure levels for the institution were included. SOCIAL was composed largely of variables describing locale of the institution, NCAA subdivision in which athletes would compete, and density of both faculty and students on campus.

The nature of all three factors is that they were institutional in nature, describing the university as a whole. They did not describe teams or individual student-athletes. They were not easily or quickly changed and, in some cases, not subject to change. These threads are consistent with the previously mentioned conceptual framework that listed student characteristics, financial considerations, and academic and social environments as contributors to student success and retention.

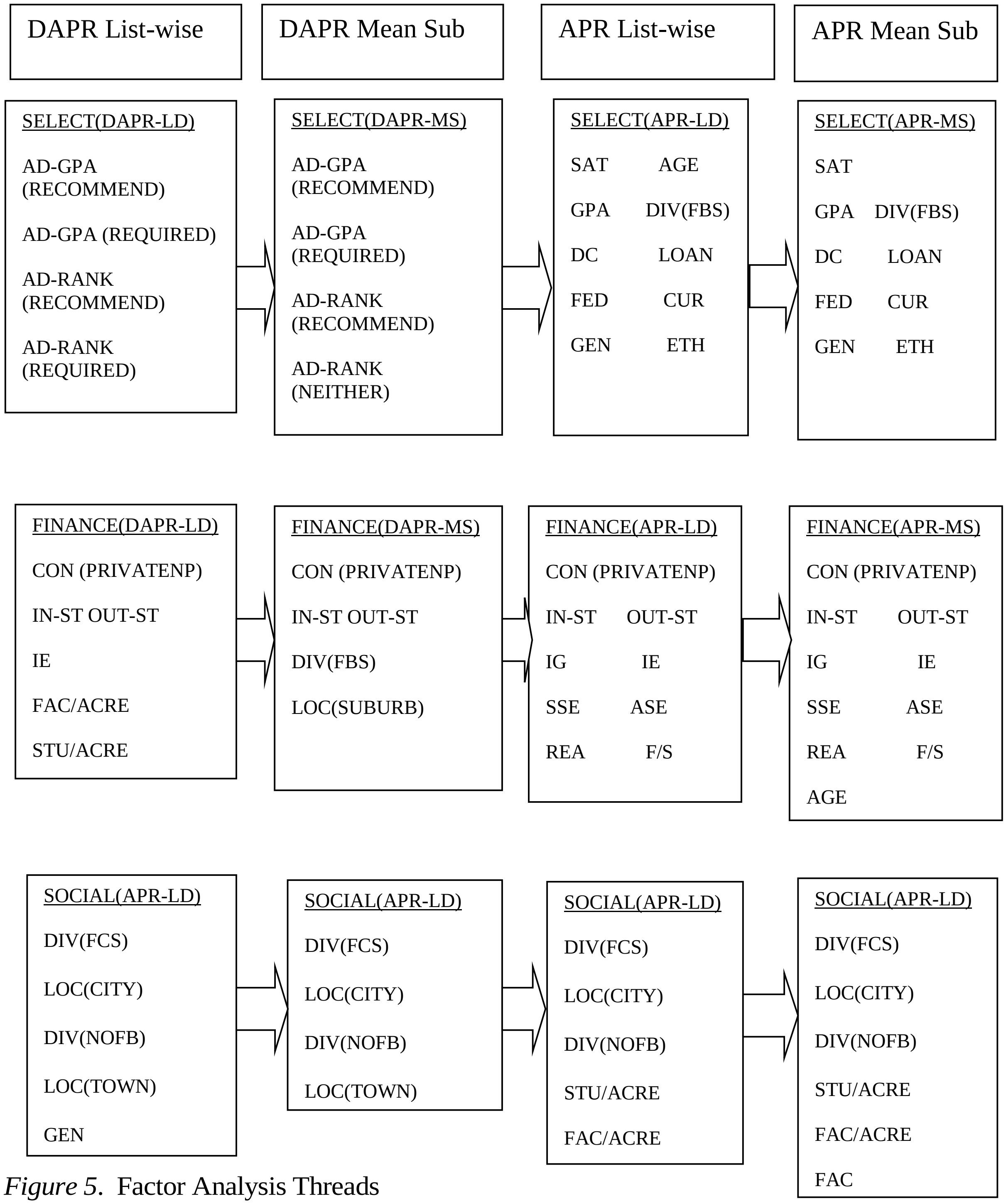

Figure 5. Factor Analysis Threads

Review of Research Questions

Four research questions guided this study. The first research question was: *Which annual changes in team variables explain the variance in annual differences in Academic Progress Rate scores?* Squad size was found to be a significant contributor in both difference in Academic Progress Rate models at the school level. Even though squad size contributions were statistically significant, variance at the school level increased with the introduction of predictors. A low intraclass correlation coefficient of 4% indicated a small amount of school variance available for explanation. Difference in APR scores decreased as squad size increased which was opposite of the direction hypothesized.

Both sport profile and team gender were significant predictors of difference in Academic Progress Rate at the team level. Difference in squad size was also included as a significant team variance predictor in the mean substitution model. The introduction of team variables as predictors into both models resulted in a reduction of unexplained team variance and total unexplained variance in difference in APR of 8%

The second research question was: *Which annual changes in institutional variables explain the variance in annual difference in Academic Progress Rate scores?* None of the institutional factors contributed significantly in either model with the exception of a cross-level effect between the factor representing personal characteristics of students (SELECTION(DAPR-LD)) and difference in squad size in the list-wise deletion model. As squad size decreased, SELECTION(DAPR-LD) increased and together they negatively impacted difference in APR. Only 4% of the total variance in difference in APR scores was attributable to differences in schools.

It stands to reason from these findings that APR may be a function more responsive to long-term variable levels and less sensitive to small changes, making it hard to change in a short period of time. This study used a larger data base, covering a larger time interval, than previous studies researched by the author. Umbach, Kuh, Palmer, and Hannah (2006) found student athletes do not differ very much from other students at their respective institutions. Differences do exist, however among institutions and often those differences are related to variables that are not readily changed. McLaughlin (2012) alluded to the wide range in characteristics found among Division I institutions. Institutions within this study varied in percent of minority students from 99% to 4%, in percentage of male students from 72% to 21%, in GPA of incoming freshmen from 4.20 to 2.45, in out of state tuition from $40,970 to $3,150, and from curriculum size from 65 majors to 9 majors.

The third research question was: *Which team variables explain the variance in team Academic Progress Rate levels?* Both sport profile and team gender were significant contributors at both levels. Squad size contributed opposite of the expected direction. LeCrom et al. (2009) found student-athletes who were female and members of individual sport teams to be retained at a higher rate. Squad size was a significant contributor at the school level. The introduction of team variables resulted in an additional 11% of total variance in APR explained.

The fourth research question was: *Which institutional variables explain the variance in team Academic Progress Rate levels?* The addition of factors reflecting personal and financial characteristics resulted in an additional explanation of 51% to 62% of school level variance. These findings are consistent with Tinto's (1982) ideas about the importance of pre-college characteristics of students and Bean's (2005) ideas about financial considerations. These findings also confirm research by McLaughlin (2012) who found team gender, squad size, institutional control, institutional expenditures, dormitory capacity, percentage of students receiving federal aid, and ethnicity to be significant predictors. McLaughlin used hierarchical linear models to explain 43% of total variance in Academic Progress Rate (APR) scores. McLaughlin did not find conference affiliation, institutional gender or selectivity of prospective students as significant predictors. McLaughlin called these findings counterintuitive and in contrast to prior research and urged further study.

Porter (2006), using a hierarchical linear model, found pre-college characteristics to have a limited impact on student engagement and ultimately, achievement and retention. On the other hand, because of peer effects, selectivity policies of institutions do impact student engagement. Porter found research orientation, student and faculty density, curriculum differentiation, and institutional control to be significant predictors. All were confirmed by this study except density and selection policy.

Johnson, Wessel, and Pierce (2012) found Academic Progress Rate (APR) significantly related to gender, race, high school GPA, standardized tests, coaching change, playing time, and winning percentage. All were confirmed by this study except coaching change, playing time, and winning percentage. Those three variables were not included in the study. Johnson, Wessel, and Pierce were able to explain 38.7% of total variance in APR scores using least squares linear regression.

Review of Hypotheses

For difference in Academic Progress Rate (DAPR), all hypotheses except H_2 were at least partially supported. H_2 was concerned with impact aggregations of school level variables on difference in APR (DAPR). Only a significant cross-level effect between the factor reflecting personal characteristics of students, SELECT(DAPR-LD), and difference in squad size contributed to the differences in APR. In the Academic Progress Rate (APR) models all hypothesis were at least partially supported except H_4 which was concerned with the relationship between the aggregate of institutional, social variables and APR.

Summary of Findings

Many of the relationships outlined in the literature are confirmed by the results of this study. The lack of significant contributions by school level variables to annual differences, the lack of significant predictive effect by school level social constructs on Academic Progress Rate (APR) scores, and the direction of the impact created by increases in squad size were not consistent with the results expected.

It was surprising that student and faculty density, percentage of full-time faculty, university selection policies in regard to GPA and standardized test scores, and locale were not included in the factors that contributed to difference in Academic Progress Rate (DAPR) or Academic Progress Rate (APR). These findings were in contrast to Porter (2006) who used hierarchical linear regression to relate student engagement to both student and faculty density. Goenner and Snaith (2003) found university selection policies as well as percentage of full time faculty to affect retention. Tinto (1987) and Scott, Bailey and Kienzl (2006) also found locale as a factor in retention. The omission of the social environment related factor in the models for APR was consistent with the work of Couch (2009) who found that student-athletes often substitute team related activity for social interaction and team rules for social norms.

Seven percent of the total variance in annual differences in Academic Progress Rate (DAPR) was explained as compared to 18% of the total variance explained in Academic Progress Rate (APR). Eight percent of team level variance was explained in annual differences in APR (DAPR), compared to 11% of team level variance in Academic Progress Rate (APR) scores. School level variance actually increased when annual differences in APR (DAPR) were modeled compared to a large 51% decrease in school variance in Academic Progress Rate (APR) models. These comparisons suggest a dramatic difference in the effect of school level variables on annual differences in APR (DAPR) as opposed to the actual Academic Progress Rate (APR) scores.

The models were able to explain less variance in annual differences in Academic Progress Rate (DAPR) than in actual Academic Progress Rate (APR) scores at every level and two school level factors had a negative impact on explaining difference in APR

(DAPR) as opposed to a large impact on explaining Academic Progress Rate (APR) itself. The two points are somewhat related in the fact that differences in the contributions of institutional factors to the models constituted the biggest difference in predicting Academic Progress Rate (APR) as opposed to predicting annual difference in APR (DAPR). School level variables, included in the factors used in the intercepts and slopes as outcomes models were affiliated with institutional admission policy, institutional control and tuition levels. Although these variables vary among schools, they are not subject to change quickly, even with administrative support. Considering the difficulty in changing school level factors, it is not surprising that they remained relatively constant and did not predict annual differences in APR (DAPR). As a result, 4% of the variance in the annual differences in APR (DAPR) scores was attributable to school level variables as opposed to 15% of the variance in Academic Progress Rate (APR).

The aggregated institutional factor, SOCIAL, was not a significant predictor. This lack of significance seems counterintuitive to the literature, especially expressed by Tinto (1975) who found social and academic integration to be of primary importance in the success and retention of students. Though the lack of significance in environmental variables is surprising, it must be remembered that student-athletes are a subset of the entire student body which is often closed in regard to academic and social integration (Mangold, Bean, & Adams, 2003). Student-athletes are provided with a social environment, through relationships with teammates, that is both strong and separate from the institution as a whole (Adler and Adler, 1985; Bowen and Levin, 2003; Bean, 2005). Miller and Kerr

(2002) found conflict between athletic and social spheres for student athletes. Engstrom, Sedlacek, and McEwen (1995) found resentment toward student athletes from both faculty and peers to be a factor in the lack of integration of student-athletes. While academic and social integration impacts all students, student-athletes may be insulated from the effects of institutional, environmental conditions.

The direction of the impact of squad size was opposite of that expected. LaForge & Hodge (2011) found Academic Progress Rate (APR) could be affected by squad size management in two ways: by encouraging at risk student athletes to transfer to another university or by offering partial scholarships to academically proficient students who have little chance of competing. Either strategy would be more easily implemented on a team with a large number of scholarships available, such as football. Difference in Academic Progress Rate (DAPR) could be either positive or negative, depending on the strategy used most often.

Future Directions

There is no doubt that the objective for institutions and for society is for student-athletes to do well at all their endeavors, both athletically and academically. Identifying variables that correlate with academic success gives efforts to provide a conductive environment direction. It is understood that correlation alone is insufficient for the assumption of causality. This study found a correlation between annual differences in squad size and school level financial variables with annual differences in APR. The study found very little of the total variance in differences in Academic Progress Rate (DAPR) explained. Other team and institutional variables, identified as significant in related studies, were not found as significant here. These findings cause questions to be raised concerning the longitudinal period, variable selection, and the effectiveness of Academic Progress Rate (APR) in defining student-athletes' academic success.

Three questions emerge. First, which variables impact Academic Progress Rate? Although the APR has been criticized in some quarters (Cusack, 2007), it remains the measure used by governing bodies to judge the effectiveness at educating student -athletes. If APR is not the entire solution to academic underachievement by college athletes, it is a measuring device used to judge the academic success of teams at colleges and universities. Like any measurement, APR has limitations. When human behavior is involved, the number of variables involved can be staggering. Though the formula is documented, it is the struggle to understand which variables contribute most that motivates this study and the studies to follow. With large portions of variance unexplained for differences in APR and for APR, there is much room for exploration.

Second, does Academic Progress Rate measure academic success? APR can certainly reflect the completion rate for athletes in obtaining degrees, but it cannot insure that those degrees obtained are relevant for each individual. It is incumbent on the institution to go beyond the numbers and do more than what is required to ensure the complete development of student athletes. Just as coaches are obligated to teach more than fundamentals, universities must go beyond eligibility and retention in counseling student-athletes. The guidelines, provided by scholars like Tinto, Bean, and Astin, point to areas like selection, academic and social environment, and financial obligation, as places where institutions may begin to provide help, if not complete answers to the student-athlete.

Third, if student-athletes are a sub-set of the student population that deserves study, are there sub-sets within the student-athlete population that should be studied? LeCrom et al. (2009) found that certain populations of student-athletes leave institutions at a higher rate. These findings may suggest a need to target retention efforts toward particular subsets of student-athletes. Circumstances may differ at the Division II and Division III levels as well. The findings within this study relating to the lack of significant effect of academic and social environmental factors on both annual differences and on APR levels may provide a start.

Limitations

The first, and foremost, limitation of this study is the lack of availability of individual data. Tinto (1975, 1987, 1993) outlined the interaction of internal characteristics with collegiate experiences that result in integration of students into academic and social communities. Acquisition of individual data proved problematic because of privacy considerations of the student athletes. Furthermore, assignment of institutional and team characteristics to individuals introduces an aggregation bias resulting from the loss of within-group variability and the change in meanings of variables when aggregated (Ethington, 1997).

The NCAA, in accordance with the right to privacy of student-athletes, declined to provide even partial datasets. This has been an on-going problem in the study of student-athletes. While this model is built on robust data, it could be improved by the inclusion of data describing the individual student-athlete. Further the choice of variables was limited by the IPEDS data-set. Though IPEDS is the world's largest archive of computer-based research and instructional data for higher education, it may not contain the best information for evaluating academic achievement and persistence in the sub-set of student athletes.

To the author’s knowledge, no model of longitudinal differences in APR has been previously developed. Therefore, no milepost exists by which to judge the model developed here in terms of either predictive power on difference in APR or choice of predictive variables. The differences in Academic Progress Rate models in particular, are exploratory and the results are unrefined. Much like the APR models in this study serve previous work, more research and replicative models are needed to confirm or correct findings in the difference in APR models.

Implications for Practitioners

While there are many stakeholders in the academic success of student-athletes, three groups emerge; the student-athletes, coaches, who now have an Academic Progress Rate score attached to their resume, and the universities. At the front are the student-athletes. It has been well documented and publicized that most student-athletes will not enjoy the opportunity to compete professionally. Establishing conditions that contribute to the probability that they graduate is paramount. A secondary benefit is that research which identifies favorable conditions for success educates prospective recruits in choosing a university. The results of this study indicate that institutions are different in their effectiveness in promoting achievement and retention of student athletes. Knowing the effect of institutional variables, such as control, tuition levels, and density, that do not readily change may help with the choice of institution. The primary goal remains the success and retention of student athletes and this study continues the discussion. LaForge & Hodge (2011) found the impact of APR to be mostly positive, bringing academic issues of student-athletes into the forefront of public attention.

Coaches may benefit in Academic Progress Rate research by making informed decisions concerning where to work, whom to recruit, and how to enhance the development of student-athletes in their care. Christy, Seifried, and Pastore (2008) found that 64% of administrators and head coaches felt the APR would have a positive impact on college athletics. Selection of recruits and increased emphasis on academic progress toward graduation were identified as areas of potential progress. Identification of environments conducive to success may extend beyond the academic realm and into athletic instruction and persistence. Some institutional traits may fall outside of the coach's sphere of influence. Recognizing factors such as locale, control, and tuition levels are not controlled by coaches, allows them to choose employment wisely and to defend the numbers attached to their tenure.

Affecting even more lives is the role of the university. As the university accepts payment for tuition, either in dollars or in athletic participation, it accepts the mission to provide the most conductive environment possible for success. It must also define and measure success in its own context. LaForge & Hodge (2011) warned that the responsibility for the accountability for the academic progress of students-athletes lies with the university and not with the NCAA. Universities must do more to accept that responsibility than to simply defer to NCAA policy.

While findings of this study confirm that team and institutional variables explain 18% of the variance in Academic Progress Rate, they also suggest that changes to APR are not sensitive to relatively small changes in those variables. Part of the problem may lie with the convenient but arbitrary time interval of one year used when measuring changes. Longer intervals may be necessary. Furthermore, improvement in APR scores may require more than quick fix solutions. Changes in APR may require long term solutions and the patience and time required for their implementation. There may be other institutional variables that are inherent and not subject to change. This realization may be important to coaches and institutions, in that either group may have grounds to request a level field of competition or ample time to improve. It may also be a consideration to the NCAA itself. The rolling average function used by the NCAA to compile APR falls in line with these findings. These findings also suggest that some institutions may have an advantage over others, such as locale and control that make compliance less difficult.

Conclusion

From this study it is clear that annual differences in Academic Progress Rates do vary. Explaining that variance has proved difficult. Perhaps the explanation lies with differences in individual precollege traits. If so, only the inclusion of individual level data will result in confirmation. It is also clear that schools are different and those differences explain a substantial portion of the variance in Academic Progress Rate levels. These findings resonate with three distinct groups: administration and those who influence administrative decisions, coaches, and student-athletes.

The findings contained within this study benefit student-athletes by identifying differences in institutions that correlate with academic success. While understanding that the institutional environment will affect the student-athlete, it is important for each to examine their own values and goals and then wisely choose a university that aligns. Tinto (1975) wrote that the degree to which a student's attitudes and values align with a particular subgroup determines integration levels within the university community and ultimately academic success. Coaches also benefit by clearly understanding expectations, opportunities, and limitations inherent in their chosen institution. Understanding differences in institutions that fall beyond their control also allows coaches to defend their record when compared to others in more advantageous settings. Finally, universities benefit by being able to see themselves clearly, strengths and weaknesses, in order to determine who they wish to serve and how they wish to serve. It is often problematic for administrators and influential friends to agree on the identity and mission of an institution. Knowledge of quantitative levels of significant variables allows justification or compromise when differences arise.

It is clear that continued research is needed to identify differences in the individual characteristics of student-athletes that correlate with academic success. While understanding that the environment is affected by input, universities would benefit by hiring and recruiting individuals who share their values and goals. Coaches would benefit by knowing which recruits most likely align with the institution. Understanding which individual characteristics correlate with academic success would help student-athletes evaluate themselves and then choose an institution that aligns with them. It is often problematic for student-athletes to evaluate themselves because of unfounded and unbounded ambition, supplied by parents, unscrupulous coaches looking for an edge in recruiting, and the student-athletes, themselves. Knowledge of quantitative levels of significant variables allows more reasonable comparisons and expectations and ultimately, better decisions.

This study represents a small step in the process of understanding the best ways to improve academic success and retention of student-athletes. Often in the course of improving human conditions, we must immerse ourselves in the environment in order to understand it. Questions lead us to answers which foster new questions. There is little doubt that we are in the early stages of this process and the hope remains that some of the information presented here is useful and that it leads to recognition of a need to continue searching for factors that may influence improvement.

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