Copyright

by

Cheryl A. Grefenstette-Moon

May 2011

HIGH SCHOOL COURSE PATTERNS AS RELATED TO UNIVERSITY ACADEMIC ACHIEVEMENT AND PERSISTENCE

A Dissertation Presented to the
Faculty of the College of Education
University of Houston

In Partial Fulfillment
of the Requirements for the Degree

Doctor of Education

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Dr. Catherine H. Horn, Chairperson

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May, 2011

Acknowledgement

This journey has a happy ending. I could not have succeeded without the invaluable support of many people who shared knowledge, commitment, moral support and patience beyond what I could have ever expected.

First, I would like to give special thanks to my mentor, boss and dearest friend, Dr. Donna Lang, who always took time to help me understand and express my ideas. Her calm and organized approach kept me sane as no one else could. Never once did she lose faith in me and for that I will always be grateful.

I'd also like to give special thanks to Dr. Catherine Horn who stepped in as my chair late in the process. Her commitment to my success through gentle criticism and encouragement were amazing. She was always available to me, even with a very condensed timetable, and there will never be enough words to express my gratitude for her relentless help in this process.

My heartfelt gratitude is also extended to Dr. Alexander Schilt, who once again came to my rescue. Every time I talk to this man I walk away with greater confidence in myself. He is truly amazing, and I appreciate the knowledge he brought to my committee and my life.

The thanks to my committee would not be complete without thanking Dr. Doris Prater. She agreed to be on the "fast track" committee and managed to read several versions of my paper giving valuable feedback that was necessary for my success.

Other stanch supporters include my co-workers. I feel very lucky to be a member of a team that worked harder so that I could finish this major accomplishment in my life. I was especially touched by the picture of support the team sent the morning of my defense and their offer to come to yet another graduation. In addition, I would like to thank my technical expert, Brian Borski who practiced extreme patience as we built my data tables. Second, I sincerely appreciated Christina Goertz for her dedication to assist me in reconstructing my references from paper copies due to the electronic version being lost to Ike. Others, such as Amber Beasley, Truman Glenn, John Merritt and Susan Stakes, I thank for their diligent readings and word processing expertise as we wrestled this paper into the correct format.

These acknowledgements would not be complete if I did not mention my dad, Donald Grefenstette. He has given me a great foundation with which to meet life and continues everyday as one of my closest friends. He has shown me resilience, hard work, strength and character and has been a wonderful role model. The fact that he has paid the tuition many semesters does not hurt either.

Last, but certainly not least, I must acknowledge the kind and giving spirit of my daughter, Sydney Moon. Of course she helped by making committee packets, etc. but more importantly she unconditionally loved me through the entire process. She hugged me through the bad days and celebrated at Starbucks through the good ones. She understood this was important for both our futures and graciously afforded me the time to finish this dream.

In closing, I am grateful to finish this journey and move on to new adventures. One thing is for sure … Ike destroyed all of my possessions, but it did not take my opportunity to finish this dissertation. Thank you University of Houston!

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Grefenstette-Moon, Cheryl A. "High School Course Patterns as related to University Academic Achievement and Persistence." Unpublished Doctor of Education Dissertation, University of Houston, May 2011.

Abstract

Texas is committed to better prepared students for educational endeavors after high school. Specifically, Texas seeks to increase participation in higher education by 630,000 students as well as to increase certificate and graduation rates. The Texas legislature mandated a new high school core curriculum and Universal Admissions policy that becomes effective in May 2011. With this change, it is important to understand the effects of course taking and course achievement on college success and persistence. The purpose of this study was to identify the extent to which various high school course patterns, individually and as a block, predicted student academic success and persistence. The sample included student-level postsecondary data for 1,707 first-time, full-time college freshmen entering a small, special purpose four-year institution in the summer and fall of 2004, 2005, 2006, 2007 and 2008. Two regression analyses were applied to the data in order to identify the relative contributions of predictor variables (rank in high school class; scholastic aptitude test scores; various blocks of high school courses in mathematics, science, foreign language, and English; and college level courses, including advanced placement and/or dual credit successfully completed during high school) that were relevant to one or both of the outcome measures of the study (academic achievement measured by the end of the first year grade point average and persistence measured by enrollment in the fall term of the sophomore year).

The findings confirmed that high school rank and standardized tests have moderate predictive value (15.4%) for measuring academic success during the first year of enrollment. The high school course patterns, however, added very little additional predictive value to academic achievement (3.8%). Furthermore, this study showed very little predictive validity of either the traditional criteria or the high school course patterns for persistence to the second year of college. While the findings are limited, they suggest further study is needed to explore if individual grades in high school courses or other critical high school contributions might yield more significant results.

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Chapter I. INTRODUCTION TO THE STUDY

University admissions officers struggle to determine the appropriate balance between access and selectivity. Foremost, there continues to be a need to understand the combination of application credentials that best predict the likelihood of a student's ability to persist and succeed in the first year (Texas Higher Education Coordinating Board, 2000b). In May 2011, the first students required to complete the Texas Four by Four will graduate from Texas public high schools. Both policy makers and higher education officials are eager to determine if these students will be more prepared and ready to both persist and succeed in college. This bold policy move was a response to increase the percentage of the high school graduates prepared for college level coursework. Using retrospective data, this study has built upon a previous study that explored the relationship of traditional admissions criteria and has more fully explored the predictive ability of high school courses individually and in combination as outlined by the state's revised graduation standards to determine if they have a positive relationship with success and persistence as these students move from high school into higher education.

Background

Texas leaders want to assure their students are competitive nationally so that they can be tomorrow's leaders and workforce. With ninety percent of future jobs requiring individuals with either advanced technical or higher education degrees, it has been found necessary for high school students to graduate with skills and knowledge to carry them through these programs and ultimately be competitive in the global workforce (Paredes, 2010).

The state's secondary education leaders have recognized that college preparatory courses are important for students' future success by implementing a three-tier high school diploma type model (Appendix A, B & C) with minimum, recommended and distinguished achievement (otherwise known as the advanced high school program) levels (Texas Higher Education Coordinating Board, 2000b). Since its inception, however, data suggest that the general diploma type was not preparing students for either higher education or the workforce. For example, in 1997 the Texas Higher Education Coordinating Board reported 58% of Texas high school graduates earned only enough credits to be awarded the regular/general diploma type (2000b). This was alarming as the results of their study indicated high school curriculum is linked to college academic success (Texas Higher Education Coordinating Board, 2000b). For seniors graduating prior to fall 2011, they could select the minimum curriculum if the student, a parent or guardian and high school counselor deemed it was the most appropriate program for their educational circumstances. However, for the seniors graduating on or after May 2011, there are many more restrictions with fewer exceptions to that policy in an attempt to encourage all high school students to graduate with at least the recommended program (Texas Education Code, 2009, §28.002). Both recommended and advanced tracks require students to complete 26 credits with the increased emphasis in the core four areas of English, mathematics, science and social studies. Both tracks also increased the 2008 mandated credit hours required from 3 to 4 credits in the mathematics and science areas (see Appendices A and B). The major difference between the recommended and advanced curriculums has been course level and course sequence for the mathematics requirements. The sequences in the distinguished curriculum are more rigorous when selections are made for the fourth credit as students may select math models if they take it before the completion of algebra II. For the advanced program, students are geared toward calculus or statistic sequences. In science, the recommended and advanced programs both require the biology, chemistry and physics sequence, which as shown on Appendix B are more rigorous than the 2008 requirements when students could choose biology, chemistry or physics and a third credit off an approved list. These requirements, coupled with the English and social studies, increase the strength of the Texas high school graduation core curricula. Additional graduation requirements are listed on Appendix C and in conjunction with the courses listed on Appendices A and B require the most rigorous requirements the state of Texas has ever mandated.

Conceptual Underpinnings for the Study

The State has implemented these mandates to clarify to high schools and students what level of academic preparation will be required to be successful in higher education undergraduate programs (Texas Higher Education Coordinating Board, 2009; Texas Education Agency, 2010). In addition to these laws, the State has developed a plan for institutions to increase enrollment by 6% as well as a goal to reflect the demographics of the state (Texas Higher Education Coordinating Board, 2000a).

The Closing the Gap program challenges Texas institutions to increase overall enrollments adding 630,000 students by 2015 (Texas Higher Education Coordinating Board, 2006) in their 143 public and independent institutions of higher education (Texas Higher Education Coordinating Board, 2008c). This attempt to address the expected increase of college age citizens and their need to obtain higher skill sets will require institutions to define, predict and address achieving readiness in order to meet institutional goals, state mandates to include high school graduates in higher education, and student higher education attainment. Balancing limited resources and public priorities with creating affordable access while maintaining quality education will need to be a part of the Closing the Gaps equation (Ruppert, 2003).

The *Closing the Gaps* initiative boasts four goals including participation, success, research and excellence. By mandating that high schools require all students to study minimum college-preparatory courses and requiring a 50% increase of degree and certificate awards from the higher education institutions, both of these strategies have the potential of positive influence on attendance and retention (Texas Higher Education Coordinating Board, 2006). Enrollment in Texas has risen by 23% since the fall of 2000, but the State will still not meet its *Closing the Gaps* goals for 2015 at the current rate of matriculation (Texas Higher Education Coordinating Board, 2008c).

This initiative of enrolling 630,000 more students can only be successful if the students graduate once enrolled and become productive citizens and leaders of Texas. The current calculations for Texas shows they have awarded 124,843 degrees and 21,279 certificates in 2004 (Texas Higher Education Coordinating Board, 2006) but with a graduation rate of just over 57% (Texas Higher Education Coordinating Board, 2008c), success and retention in higher education leaves much to be desired. Only 25.2 percent of citizens of Texas age 25 or greater have obtained a bachelors (or higher) degree (Texas Higher Education Coordinating Board, 2008c). Within the 15-year time frame of the Closing the Gaps program (2000 – 2015), the initiative was approximately 60 percent complete in 2009. Many goals have already been accomplished, such as being well above target projections for the measures of participation (statewide, African American, Hispanic and white), research, and excellence national rankings and program recognition, but is falling below target in the success measure with African American and Hispanic students receiving bachelors degrees (Texas Higher Education Coordinating Board, 2010).

Texas has a persistence problem both at the secondary level and in higher education. Although the State has made strides in a year's time, readiness concerns are still on the rise as Texas educational institutions are demonstrating 80.6% graduation rates at the high school level (Texas Education Agency, 2010) and 52.6% six-year graduation rates at the higher education level (Texas Higher Education Coordinating Board, 2006). In comparison to other states, Texas placed 50th in the percent of students graduating from high school in 2004 (78.3%) and 35th in the percent of students graduating from college (24.5%) (Murdock, 2007). Institutions must find the indicators that will assist them in determining success and persistence factors as the consequences for not solving this puzzle continue to become more grave (Carey, 2004). In order for Texas to stay competitive among other states when comparing educated and technological competent citizens, graduation rates must improve.

Statement of the Problem

Given the State's new Four-by-Four requirements to address the issues of enrollment growth, diversity, and persistence, it was necessary to study the impacts of the policy changes at both the State and institutional levels. While there has been significant research that establishes academic background (Tinto, 1975; Nora, 1990, 2003) as an indicator of student persistence, a policy change of this magnitude requires further study and documentation. In addition, previous research has multiple definitions, constructs, and measurements of academic background such as test scores (Adebayo, 1993; Kobrin & Michel, 2006; Noble & Sawyer, 2002a, 2002b; Pascarella, Duby, Miller & Rasher, 1981), high school grade point average and rank (Astin, 1972; Hood, 1992; Perkhounkova, McLaughlin & Noble, 2006; Noble & Sawyer, 1987). This study has explicitly focused on the courses and combinations of courses that increase the likelihood to succeed. This critical information can be used by university administrators to establish admissions criteria for their particular institutions that will foster both enrollment growth and academic success. Furthermore, this information can support further K-12 reform. The research questions included:

1. What was the contribution or impact of different high school course patterns on the academic achievement in the first year of college?
2. What was the contribution or impact of different high school course patterns on persistence to the second year of college?

Limitations of the Study

While this study may be useful for both further research and practitioners, there are significant limitations. The first limitation of the study to determine the impact of achievement and persistence was the risk of other factors including a wide variety of reasons for academic difficulties such as illness, injury, alcohol and/or drug abuse, family and financial concerns.

The second limitation of this study pertained to high school curricula, grade scales, and teacher quality that often vary from school to school. From a theoretical perspective, there are some validity concerns with grade point average and high school rank comparisons between high schools and even programs within specific high schools.

The possibility existed that the variation of academic rigor from course to course could produce students from the same school that have different academic and social characteristics. The data could be skewed due to the size of the high school class and the method of calculating and or weighting the high school grade point average.

The third limitation of the study pertained to the sample and the fact that it was drawn from a single special purpose institution. The population may not be representative of the other institutions of the general college going population.

The fourth limitation of this study pertained to the use of units versus grades for the evidence of high school course and course combination success. The data maintained by the Texas Common Application was measured by course in units completed successfully or being taken concurrently. The only grade recorded in the high school course data file was senior level English. For the purposes of this study, the courses, course patterns and rigor levels were reviewed rather than the level of success as normally determined by grades.

Definitions of Terms

Inasmuch as the purpose of the proposed research study was to describe the relationship between admissions selection criteria such as high school grade point average, standardized scholastic aptitude, high school class rank, high school courses and course combinations and the persistence and academic achievement of first-time full-time college freshmen at the subject institution, the following terms require an operational definition for the purposes of the proposed research:

Academic Achievement. Academic achievement has been measured by the grade point ratio (GPR) at the completion of the participants first postsecondary academic year (includes prior summer if applicable, fall and spring term). The grade point ratio has been defined as the number of quality points divided by the number of semester credit hours. Quality points were awarded on a four point scale; A equaled 4, B equaled 3, C equaled 2, D equaled 1, and F equaled 0. All credit courses for which the student was enrolled on the census day (12^{th} official class day of each fall and spring term) and received a grade of A through F were included. All courses on a pass/fail grading scheme were included only if the grade of F (fail) was assigned, as the grade of P (pass) has no bearing on the grade point ratio calculation. Grades of Q (Q-drop or student initiated drop with no penalty), W (Withdrawal), NG (No Grade), I (Incomplete) or X (Not reported) and their associated credit hours were not utilized in the individual calculation of the grade point ratios. Students who officially withdrew from the University were treated as missing data.

College Level Course Units Concurrently Achieved in High School. High school students who have mastered curriculum enough to be eligible to take college level courses in high school were either completing these courses through advanced placement courses (US Code, 2010, Title 20, Chapter 70, Subchapter 1, Part G, §6532) offered through their home institutions or taking concurrent courses from local colleges or universities (Texas Education Code, 2009, §28.009).

First-Time, Full-Time College Freshmen. FTFT freshmen shall be defined for the purposes of this study as a student who has not previously enrolled for college credit since graduating from high school with the exception of dual and/or advanced placement credit. Students must have enrolled for 12 or more semester credit hours to be considered a full-time student (Texas A&M University at Galveston Catalog 132, 2010)**.**

High School Class Rank. Rank shall be calculated as the ratio of a student's graduation standing divided by the number of graduates in their class. This ranking has been provided by most high schools on their official transcripts and this study did not take into consideration the size of the institution or individual high school course weighting schemes. All rankings were taken at face value. For example, a student ranked as 190th out of 200 was considered in the top quarter of their graduating class, whereas another student ranked 4th out of 24 was considered in the fourth quarter of their graduating class.

Persistence. Persistence was defined as dichotomous in nature (persist and non-persist) for the purposes of this study. Postsecondary enrollment records of all participants were checked early in the fall semester of their second year. Students who re-enrolled for the fall term by the 12th class day of record (either full or part time) were coded as persisters.

Summary

The fact that Texas was attempting to strengthen higher education success for an increase of 630,000 students shows commitment. While Texas now mandates universities to require a minimum of four units each of English, math, science and social studies for general admission and the State expects institutions to grow by 630,000 students, there are a significant number of students that do not meet the new criteria. It was important for ethical and monetary reasons to continue to understand predictors of success or groups of indicators that administrators can use as tools to select freshmen classes that are diverse, successful graduates in four years. As the diversity of incoming students continues to rise, the issues surrounding admissions criteria are likely to increase

(Clarke & Shore, 2001). The history of persistence and success indicators along with the current theories that are presented in Chapter 2 of this study should assist in the understanding of why it continues to be critical for institutions to find criteria that will more accurately predict success and graduation.

This study served to provide further explanation of the use of high school coursework to determine admissions and hence the likelihood to persist and succeed in college. Moreover, this study served as a baseline study prior to the entry of students who have completed the Texas four by four curriculum. Future studies should be planned to study the policy implementations over time, as well as, replication across different institutions.

Furthermore, if particular patterns of courses are found to yield significant effects, every effort should be made to align admissions decisions accordingly. Long-term, efforts should also be made to increase awareness and encourage students to enroll in optional curricula.

Chapter II. REVIEW OF THE LITERATURE

Introduction

This study intends to describe the relationship between university admissions selection criteria, including high school level course (and combinations of courses), and the academic achievement of first-time full-time college freshmen at a southern university. Further, this study looked at the relationship between the same admissions criteria and persistence to the second year at the same university.

When looking at these factors, it was important to have some background on Texas' plan for increased access to higher education and persistence theory. By examining the State's Closing the Gaps and Uniform Admissions policy, one can begin to see the struggle between access and success in Texas higher education. This coupled with the desire of admissions officers to create diverse freshmen classes makes further discovery of success predictors an important part of policy that cannot be ignored. With the ultimate goal of persistence to graduation once enrolled in college, it was prudent to look at the various persistence models dating from the early 1970's to present and to acknowledge that academic criteria, such as past academic performance and experiences, continue to play an important role in persistence theories. This chapter will proceed to present studies regarding both traditional admissions criteria (i.e., test scores, grade point average and high school rank) and high school courses and course patterns where relationships to success and persistence have been indicated. Analysis of admissions criteria, literature concerning academic coursework, and the added value of college credit earned during high school through dual credit or advanced placement aids in the discussion of why further research will help the State of Texas determine if the new high school curriculum will present better prepared high school graduates with increased potential to succeed and graduate from university level programs.

Texas Plans to Increase Access to Higher Education

Steve Murdock, Chief Demographer of the Texas State Data Center, has concluded that there will be tremendous growth in the Texas Hispanic and black student populations (Murdock, 2007; Texas Higher Education Coordinating Board, 2000c). As the fastest growing segment of the Texas population currently at 37% of state residents (Texas Higher Education Coordinating Board, 2010), Hispanics are expected to comprise 59% of the population by 2040 (Arnone, 2003).

In light of this growth, the Texas Legislature and the Texas Higher Education Coordinating Board developed the Closing the Gaps Plan and required institutions to submit initial written Strategic Enrollment Management Plans in October 2001 in support of this initiative (Texas Higher Education Coordinating Board, 2000a). They require that institutions file evaluation results and updated plans on a regular yearly basis (Texas Higher Education Coordinating Board, 2006). The Closing the Gaps plan is intended to address four stated goals: 1) participation; 2) success; 3) excellence; and 4) research. Some important strategies related to enrollment of the program include making the Recommended High School Program the standard high school curriculum, increasing higher education participation across Texas to include 630,000 more students by the year 2015, and conducting a statewide public awareness campaign about the benefits of higher education. Other strategies include recruiting, preparing and retaining well qualified teachers, rewarding retention and graduation rates, increasing collaboration between business and higher education, requiring institutions to move one of their programs or services to a level of nationally recognized excellence and encouraging grants, contracts and expanded research.

The Closing the Gaps initiative has contributed to the debate over what students should be achieving in high school. With the anticipated influx of 630,000 students and the known issues with Texas retention and graduation rates, it was becoming more apparent for administrators, lawmakers, parents and communities to discuss and come to a consensus as to what the goals and expectations of the knowledge needed to graduate from high school. When Peter D. Hart Research Associates and The Winston Group questioned views on the purpose of high schools, they found parents and teachers had differing views of what students needed to achieve upon graduation (2006). Parents are looking for continuous progress toward the sensible goals of graduation with enough knowledge to carry their student forward toward their personal education or occupational goals. On the other hand, teachers believe high school graduates should be educated citizens that can demonstrate they have mastered the academic material (Peter D. Hart Research Associates, Inc. & The Winston Group, 2006). Many parents are not even aware of or do not understand the different curricular programs. This confusion has been seen at the individual high school level where the differentiation of students appears to be growing between high and low achievers (Sanoff, 2006). This oxymoron of increased students and less preparedness and more selective admissions criteria and less high school opportunity or counseling to take higher level curricula seems like a knot that cannot be untangled without more of a commitment to bring the educational sequence into alignment (Sanoff, 2006).

In an effort to bring more consistency across high schools in Texas for the new 630,000 students, and in an attempt to align the curriculums for higher education preparation, legislatures and other educational governing agencies are implementing required curricula (Texas Education Code, 2009, §28.002) and minimum admissions criteria for Texas high school graduates applying to state public colleges and universities in Texas (Texas Education Code, 2010). These mandates are being accomplished through the new Four by Four Curriculum and Uniform Admissions policies.

Uniform admissions policy. The Texas Education Agency, Texas Higher Education Coordinating Board and lawmakers are hopeful about the graduation curriculum requirements enacted through the Four by Four mandate and the Uniform Admissions Policy (Texas Education Code, 1997; 2010). House Bill 3826 provides policy as to which students Texas public higher education institutions may admit to freshmen classes (Texas Education Code, 1997; 2010).

The policy states that students who graduated in the top ten percent of their graduating class (or from the top twenty five percent if the institutional governing board has approved this policy) from either a private or public Texas high school must complete either the recommended or advanced high school graduation curriculum, satisfy the ACT (originally American College Testing hereafter referred to as ACT) college readiness benchmarks, earn at least 1500 out of 2400 on the SAT Reasoning Test (formerly Scholastic Aptitude Test and Scholastic Assessment Test; hereafter referred to as SAT), or submit written proof in the format required that the requirements were not available to the top ten percent student. If admission slots are still available and the institutions chooses, they may admit students into an "other admissions" category by considering the eighteen other admissions criteria (Appendix D) as outlined in the Texas Education Code (2009), Section 51.805(b) for students who do not meet the top ten percent criteria but have fulfilled either the recommended/advanced curriculum or ACT/SAT test score requirements.

These new policies have the potential to assure that student's course requirements are similar when applying to college but the admission decision was not enough, as students need to have the skills to be successful. The various school districts have differing amounts of resources and oftentimes the learning outcomes of similar courses across districts are very different (Kobrin, Milewski, Everson, The College Board, Zhou & Fordham University, 2003). If students are granted access without a true chance of success, then we will continue with dismal graduation rates that have not increased at near the rate of increase in college attendance (Venezia, 2003; Venezia & Kirst, 2005). This aspect could jeopardize the success of the State's policies in that access to higher education should not only include opportunity and enrollment but also persistence to graduation (Arbona & Nora, 2007).

Creating diverse learning environments. Administrators have been struggling for years with legal mandates that have complicated their ability to implement institutionally driven admissions decision policies based on quality, mission and applicable research. They realize understanding admissions, success and persistence criteria and developing strategies to utilize those criteria can foster a more diverse learning environment.

In an effort to support access to underrepresented students, Texas enacted House Bill 588 (1997) [now codified through Texas Education Code (1997), Section 51.802], which grants students who graduate in the top 10% of their graduating high school class automatic admission to any state public college or university. Texas State Representative Garnet Coleman (2004) declared that the new top 10% rule would assist underrepresented students gain access even though he acknowledges the rule will not solve all of the diversity issues (Texas Education Code, 1997; House Bill 588, 1997). However, Hebel (2004) feels these policies are not enough in that African American and Hispanic student populations on Texas university campuses do not reflect the growth of these populations in the states public high schools. Both institutional administrators and lawmakers (including the authors of the Ten Percent Plan) are concerned that it will take both a commitment of mission and resources to make even moderate strides toward implementation (Hebel, 2004). Many university administrators feel there is merit in the Top Ten Percent policy (Texas Education Code, 1997; House Bill 588, 1997), but argue that it limits their ability to utilize other criteria and initiatives to increase diversity at their institutions. Factors such as gender, culture, state and country of residence, academic and personal interests, age, travel and work experiences, household income, etc. can affect life experiences which can enhance learning in the classroom. The concerns that higher or mandated admissions requirements will only allow students with access to certain resources (advanced coursework, high quality teachers, counselor mentorship, parental encouragement, etc.) the ability to be admitted to higher education are important as Texas institutions need to find success indicators for the anticipated influx of underrepresented students who may not all have access to adequate resources.

Success and Persistence Theory

All of these initiatives related to access and success should provide indications that students will graduate at higher rates. Academic success in college has immediate and lasting effects on the student's academic self-esteem and persistence in selected majors and higher education (Benford & Gess-Newsome, 2006). It also has the potential to affect much more including career choice, future income, and community participation that can ultimately play a role in the adult life of the student (Benford & Gess-Newsome, 2006). These implications make it imperative for admissions administrators to continue searching for ways to predict freshmen academic success, as well as, it's equally important outcome, increased likelihood to persist. In order to have a clearer understanding of current persistence theory and how it was being applied, it was helpful to look at a few early models and how they have been developed since the early 1970's.

Theoretical models seeking to understand college student persistence. For some time, higher education researchers used Tinto's (1975, 1987, 1993) *student integration model* and Bean's (1982, 1983, 1985) *student attrition model* to begin their quest for persistence guidance. Although the results have varied, both Tinto's and Bean's models have included past academic performance (Pascarella & Terenzini, 1983). With the majority of the drop out problem being attributed to the first two years of higher education where 75% of students make their departure (Tinto, 1993), researchers have studied a myriad of factors from pre-college attributes to individual success and institutional commitment. Tinto's initial retention theory (1975) suggested that students come to institutions with a variety of individual characteristics, including pre-college schooling experiences, which affect their initial institutional commitment, goals of eventual graduation and potentially their ultimate decision to leave the institution. He found through academic and social integration that institutional commitments and goals for graduation were shaped (1975).

Tinto proceeded to look at primary and secondary preparation for college and the effects across several ethnicities (1987). He found the differences in the retention rates of African Americans compared to white students were due to the academic preparedness that students obtained in K-12 academic experiences that he feels favored non-minorities. In a study to look at several persistence contentions, one of which was Tinto's 1987 study claiming academic preparedness was a factor for African American persistence; it was found that the level of preparedness did not play any larger role than it did for whites in their decision to persist in higher education (Cabrera, et al., 1999). Braxton and Lien (2000) discovered Tinto's (1975) theory that students' academic achievements indicate an ability to fulfill institutional academic expectations does not take into consideration intellectual isolation or collective affiliation which should be taken into account to examine academic commitment and integration. In addition, the empirical support for Tinto's (1975) well-known and respected theory as studied by Braxton, Sullivan, and Johnson (1997) needed revision. They felt that the academic integration component of the theory varied between multi and single institutional tests suggesting that the academic integration construct be measured differently or dropped completely from future persistence research (1997). While it was certain that persistence decisions were shaped by a myriad of experiences, it was clear that academic preparation directly impacts the likelihood to graduate across all groups.

Other constructs were looked at in an effort to see if they could add to the persistence search. One such factor, self-efficacy, was modeled by Bandura (1986, 1997). He found that confidence gained from the recognition of past experiences or particular situational competencies gave the individual students the ability to aspire for persistence, achievement and graduation (Bandura, 1997; Bandura & Cervone, 1986). This was confirmed, especially for under prepared students, in a study by Lent, Brown, and Larkin (1987) who found that self-efficacy for academic performance was indeed an indicator for academic achievement and persistence. By looking deeper into the past beliefs and experiences, Tinto (1975, 1993) felt Durkheim's (1951) "egotistical suicide" theory provided a conceptual framework to understand academic integration. Durkheim felt that individuals who did not integrate normatively (similar beliefs and values) or collectively (affiliation with others) were in danger of "egotistical suicide" (1951). Tinto theorized that students with different beliefs and values or felt isolated from the campus community put students at risk for departure (1975, 1993). If students feel isolated due to either real or perceived failure in preparation for success in higher education, this could lead to insecurity regarding their choice of major, their ability, or institutional fit which might lead to dropout altogether. This inability of some to make a smooth and short term successful transition from secondary schools to higher education facilities continuously pushes researchers to look for additional factors that could be grouped with known persistence predictors. Many of the subsequent studies paired the pre-college preparation variables with other factors to see if they could find a better fit. For example, Nora's earlier 1990 model found that pre-college academic ability, financial need and the various forms of campus-based financial aid, and the first year academic achievement during the freshmen year accounted for 75% of the variance in the persistence process (1990). Nora continued in his quest in a 1992 study with Cabrera and Castaneda to test an integrated model of student retention. By examining Tinto's *Student Integration Model* (1975) and Bean's *Student Attrition Model* (1983, 1985) they were able to appreciate the strengths of each and begin to make efforts at looking at them integrated together (Cabrera, Nora & Castaneda, 1993). They found freshmen year grade point average accounted for 46 percent of the persistence variance and was second only to intent to persist that explained 49 percent of the variance. Other factors included institutional commitment (.273), encouragement from friends and family (.217), goal commitment (.133), academic integration (.083), finance attitudes (.054) and social integration (.046).

From these studies new models were envisioned to include multiple indicators of persistence. Hossler (1984) found several commonalities between Tinto's (1975, 1988) *Student Integration Model* and Bean's (1983, 1985) *Student Attrition Model*s. They both demonstrated that pre-college factors affect a student's adjustment to college, as well as, concluding that persistence is "the result of a complex set of interactions over time" and "is affected by the successful match between the student and the institution" (Cabrera, Castaneda, Nora, & Hengstler, 1992, p. 145). However, Braxton, Sullivan and Johnson (1997) found critics of Tinto's (1975, 1988) models such as Attinasi (1989, 1992, 1994) and Tierney (1992). They found that although strong points were offered in the critiques, they too were unable to offer a fully integrated persistence model (Braxton, Sullivan & Johnson, 1997).

Nora and Cabrera's Student Adjustment Model. Cabrera, Castaneda, Nora, and Hengstler (1992, p. 146) utilized a three-stage strategy "to test the convergent validity between the two theories." Tinto (1975, 1987) and Bean's (1982, 1983, 1985) independent development of like factors, such as institutional commitment (*Student Integration Model*) and institutional fit and quality (*Student Attrition Model*) and courses in the *Student Attrition Model* and the academic integration component of the *Student Integration Model*, manifested areas of overlap between the models (Cabrera, Castaneda, Nora, & Hengstler, 1992). Since Cabrera, Castaneda, Nora and Hengstler (1992) and Cabrera, Nora and Castaneda (1993), the converged adjustment model has been refined in a new synthesized model (Nora & Cabrera, 1996). In the synthesized model, pre-college academic abilities, parental and community encouragement were still found to be important (Nora & Cabrera, 1996). In an effort to further explain adjustment to college of African Americans and non-minorities, it was found that preparation for college, positive academic experiences, strong parental encouragement and academic performance in college were the four factors that both groups shared as positive indicators of persistence (Cabrera, et al., 1999). Nora continued in 2003 to propose the *Student/Institution Engagement Model* that demonstrates the importance of the unique relationship between the student and the institution. This model took pre-college academic factors and coupled them with college experiences and environmental pulls to demonstrate what contributes to student retention and graduation (Nora, 2003).

Continual efforts have been made to bring new factors into the search for persistence. Tinto discussed the absence of including the actual classroom in persistence literature and feels the social and academic aspects of persistence should be considered as two "nested spheres" rather than two distinct paths or segments (Bean, 1983, 1985, 1990; Braxton, 2000; Cabrera, Castaneda, Nora & Hengstler, 1992; Tinto, 1987, 1997). He stated that although both factors could potentially counterbalance or at least influence the absence of the other, it was important to note that without academic involvement, academic failure was sure to ensue and without success, departure would be eminent (Tinto, 1997; Braxton, 2000). All of these attempts to find criteria for persistence prediction proves that the process was very complex and needs to be evaluated from various angles including institutional fit, family characteristics, precollege academic curriculum and success and the academic confidence to stay the course through the first year and then to eventual graduation. Many found that combining models or adding to existing models created a better fit with persistence (Cabrera, Castaneda, Nora, & Hengstler, 1992; Nora & Cabrera, 1996).

Persistence through second term into sophomore year. Although many of the persistence studies incorporate various secondary preparations for college variables, they are still failing to clearly state the content and value of the education that the students actually received (Ishitani & Snider, 2004). Value received is difficult to define due to the varying resources available across school districts. Many opportunities are just not available to individual schools or families, which leads to inequalities and differing levels of success. For example, many families who can afford it are deciding to take SAT/ACT review and preparation classes in addition to their high school curricula. This participation was found to decrease dropout rates by 33% of test review participants in comparison to those students who did not take the classes (Ishitani & Snider, 2004). Although this was an example of family mentorship and resources that are not available to all students, this bolster of academic preparation has some clear benefits. Many students, without the resources to go above and beyond high school curriculum, have decided to delay college enrollment in order to work or take care of family responsibilities. It was found that students who waited to enroll straight from high school into higher education due to personal or academic reasons were at greater odds of departure by 89%. When looking across ethnicities, “Hispanic, black, and Native American students were 32%, 32% and 42% more likely to leave their institutions than their counterparts” (Ishitani & Snider, 2004, p. 5). If students do not have the funds to enhance their academics and go straight to college with a low academic ability, such as placing in the fourth quartile, then the likelihood of the student departing increases by 2.5 times (2004).

The National Longitudinal Study of the High School Class of 1972 (NLS:72/86), High School & Beyond Longitudinal Study 1980 Sophomores (HS&B-So:80/92) and the National Education Longitudinal Study of 1988 (NELS:88/2000) indicated through the three cohorts that students who successfully completed greater that ten credits at any postsecondary institution had between 45 and 49 percent chance of obtaining a bachelor’s degree. Going a step further, they found that students that obtained the same credit from a university (bachelor’s degree granting institution) had a much higher graduation rate ranging between 66 and 67 percent (Adelman, Daniel & Berkovits, 2003; Adelman, 2004, 2006). As he analyzed each cohort individually, he found that “88% of the students from the class of 1992 who entered any postsecondary education persisted from their first to second year” (Adelman, 2004, p. v). If the notion that students increase likelihood to graduate by successfully completing university credits during the first semester, there was also plausibility that students gain efficacy and likelihood to graduate by completing college level credits during high school.

The question continues of what factors can a student bring to the University admissions process that will give them the best chance of success and staying enrolled until graduation? Institutions continue to look at the quality and rigor of a student's high school program, which continues to be one of the best predictors of first year success and undergraduate degree attainment (Astin & Oseguera, 2005; Caison, 2005; Glynn, Sauer & Miller, 2006; Tinto, 2003; Warburton, Bugarin & Nunez, 2001). In addition, Nora and Cabrera not only found that college academic experiences were as important as pre-college experiences to persistence, they demonstrated that first year grade point average was much more critical, three times more important in fact, for Hispanic and African American students as it was for white students (1996). Although the national first to second year higher education persistence rate is around 88% (Adelman, 2004), that falls to between 50 and 60 percent graduation rates within six years of initial enrollment (Carey, 2004) and declines dramatically for Hispanic and African American students who only complete college degrees at half the rate of their white counterparts (Adelman, 2004).

In the past, studies have shown that gender and race, coupled with traditional factors such as grade point average (Glynn, Sauer & Miller, 2006) and test scores (Nora & Cabrera, 1996), were responsible for the greatest retention variance (Astin, 1997). The policies which prohibit use of race as a factor, the low prediction value of test scores due to biases (The Journal of Blacks in Higher Education, 2005/2006) and the varying quality of high school coursework leaves much work to be done in the admissions area as far as predicting graduation potential. The huge demographic shift in Texas will have the continuing affect of merging many cultures and ethnicities (Reason, 2003). These changes will influence administrators to look at other applicant attributes during these changing times (Pascarella & Terenzini, 1998). The history of persistence theory discussed above shows promise when the existing models are combined or synthesized to increase the prediction value (Cabrera, Castaneda, Nora, and Hengstler, 1992; Nora & Cabrera, 1996).

Pre-college academic preparation efforts toward persistence and success. There were many factors to consider in the transition from secondary school to higher education, such as the shift to high order thinking and learning which occurs during the freshmen year (Upcraft & Gardner, 1989; Tinto, 1993). This may be supported by the fact that first year freshmen tend to have lower cumulative grade point averages than their sophomore through senior counterparts (Erekson, 1992).

First semester freshmen schedules, especially in technical or scientific majors, tend to have core classes that are generally referred to as gateway courses that serve as prerequisites to higher level major courses. Many gateway courses are proving problematic for new freshmen and resulting in low performance and dissatisfaction (Horn, et al., 2002). A study at Northern Arizona University was conducted to determine trends in demographic groups that receive non-passing grades (D, F, and W). This study was developed to identify students at risk and develop actions that could intervene to assist these students (Benford & Gess-Newsome, 2006). Because these courses usually are taken at the beginning of students' academic careers, low performance could have negative effects on personal, academic and career choices (2006). This is troubling as approximately 16% of freshmen at bachelor degree granting institutions did not return for their sophomore year (Horn & Carroll, 1998).

Although first year grade point average is commonly used to measure academic success (Noble & Sawyer, 2004), predictors of retention are a bit more complicated. This study did not only attempt to identify pre-collegiate course success indicators, it also sought to see if those same indicators have any predictive value for retention to the sophomore year (U.S. General Accounting Office, 2003). In this regard, Horn and Kojaku studied high school curriculum choices in regards to first year retention and found that students should choose more rigorous courses and course patterns to be more successful during their first year in higher education (2001). Therefore, the following review of admissions predictor criteria will often affect persistence as well as academic success (Tam & Sukhatme, 2003).

Admissions criteria. Much of the literature regarding freshman academic success illustrates in its evolution that it is critical to look at many factors (Perkhounkova, McLaughlin & Noble, 2006; Tracey & Sedlacek, 1989). Payne (1973) stated that the searches for success predictors were endless and true relevance of the predictor should be weighted heavily. The belief that past performance was the best predictor for future performance (Payne, Rapley & Wells, 1973) was utilized to describe a potential way to develop factors to determine their fit with success and persistence.

High school quality and rigor. Quality of past high school performance was often discussed in terms of rigor of coursework (Pike & Saupe, 2002). As global primary and secondary educational comparisons continue to show the United States falling behind, there are concerns over rigor with the hope of increased focus and depth within topics especially in math and science (Schmidt, McKnight & Raizen, 1997).

Curriculum requirements at the state level rarely require students to take upper level coursework that assists in their preparation for higher education (Williams, Blank, Potts, & Toye, 2004; Manise, Blank, Pewett, Potts & Williams, 2002). The same requirements when looking at graduation vary considerably from state to state as well. Texas has had some movement from its' policy makers to increase their students' readiness for higher education by mandating the new Four by Four graduation standards and the Universal Admission policies (Texas Education Code, 1997, 2008).

Rigor is often hard to standardize and measure across high schools, let alone individual courses. Feelings that students are prepared for the rigors of higher education as long as they graduate from high school are confusing for parents (Conger & Tell, 2007). They are not always aware of the various options or what was really needed to be prepared to succeed in college (Venezia, 2003). Current college and university policies are often not understood or even known to high school students or their counselors, making preparation for such institutions difficult at best (Venezia, 2003). In addition, difficulty exists for families to know if their students' are having rigorous experiences (Conger & Tell, 2007) if they read reports that students who partake in rigorous high school coursework patterns in math, science and English are preparing themselves for not only higher education, but also for the resulting workforce (ACT Inc., 2005a).

Using a longitudinal study of 8,100 high school students that participated in a national study, Anderson and Keith (1997) looked at the learning equivalencies of "at risk" students and determined that ability, quality, motivation and coursework are important factors in the prediction of academic success. Pre-college academic ability has been known to influence college academic success and ultimately persistence as has been shown in persistence models (Nora & Cabrera, 1996; Nora, Castaneda, & Cabrera, 1992; Pascarella & Terenzini, 1980).

Traditional criteria. Looking at pre-college predictive success criteria, traditional factors have been used by administrators for years to make admissions decisions for their standardization, ease, past reliance and some value to predict academic achievement.

Prior high school academic performance and rank. In 1971, Astin stated that high school performance measures such as high school rank or grade point average are predictors of success in college. "Grade point average is neither a cognitive nor affective variable; it is neither a measure of aptitude nor state of mind. Instead, it is a holistic measure of performance" (Benford & Gess-Newsome, 2006, p. 25). In a paper presented at the 2009 AIR Forum by Micceri, Brigman and Spatig, it was found that high school grade point average was clearly the strongest of the reviewed multivariate predictor variables. In a more recent white paper, Zwick (2007) found many studies (Camara & Echternacht, 2000; Hawkins & Clinedinst, 2006; Noble & Sawyer, 2002a, 2002b), including his own in 2007, that found high school grade point average were better than test scores in predicting achievement all the way from the first fall term to graduation.

As the reliance on grade point average climbed, administrators tried to find ways to utilize the predictor as a more comprehensive tool (Hosler & Anderson, 2005). Universities such as the University of Rochester have developed predicted grade point average formulas that assist them in estimating the future grade point averages of applicants to their institutions. They are utilizing similar factors such as high school rank, grade point average, level of coursework and test scores to determine who is most likely to stay the course (Henson & Sanders, 2000).

As institutions experimented with formulas and weighting, they discovered multiple uses for traditional criteria. Ruban and Nora (2002) reported that the higher the high school rank in a students' graduating class indicated better chances that they would be an achiever in college. The evidence went as far as indicating for every increase a student achieved in high school rank, there was a 1.2 increase in the likelihood of the student being considered a high achiever in college (2002). They were not only trying for success indicators, but as the need for more selective measures became apparent, they wanted to predict level of success to obtain the highest level of academic strength possible. Searches that sought academic strength went a step further to individual course predictions, where they found high school grade point ratio and high school rank have also shown to be predictive in gateway courses in college level biology courses (Carmichael, 1986).

For many years institutions used mainly traditional criteria to choose freshmen classes. The debate between past performance (grade point average and rank) and test scores ensued and brought about new studies to determine their validity (Trusty & Niles, 2004). Astin (1972) felt that past performance as reflected by high school grades were a more appropriate predictor than standardized test scores for higher education success as they fit more closely with a student's ability to perform in an academic setting. Mattson's (2007, p. 9) study "confirmed research (Astin, 1997; Hoffman & Lowitzki, 2005; Schwartz & Washington, 2002; Ting, 1998; Wolfe & Johnson, 1995) regarding high school GPA as a successful significant positive predictor." Many researchers have also found that high school grades, as an indicator of precollege academic experiences, have an indirect effect to the likelihood to persist (Blanchfield, 1971; Chase, 1970;

Lawhorn, 1971; Smith, 1971; Taylor and Hanson, 1970). Miller and Herreid (2008; 2009) discussed these claims of grade point average predictive value and found through their own study that the relationship existed. They looked at grade point average with several other nonacademic factors and feltl that caution should be used in these interpretations due to the potential causal relationship with persistence (Miller & Herreid, 2008; 2009).

Debates continue as to if the traditional factor, test scores or high school grade point average that has the best predictive value. There have been studies that have shown some predictive value in test scores as a predictor. Kobrin and Michel (2006) hypothesized in a recent study that SAT scores were a better predictor of first year college grade point averages overall than high school grades. However, high school grade point average over test scores was found to be a better predictor where admissions decisions were not based on the top academic performers for highly selective institutions (Kobrin & Michel, 2006). The controversy reaches even further as in a recent study the SAT composite score was found to have a 'negative relationship to persistence' where "students who scored in the lowest combined quartile (Quartile 1) were 7.7 percent more likely to be enrolled in their third fall term than students who scored in highest quartile (Quartile 4)" (Miller & Herreid, 2009, p. 7-8). In the debate over grade point average versus test scores, studies have gone further to look at individual course success predictors. It was demonstrated that grades have shown strength in studies that have looked at high school grade point average and its predictive value towards a single college course, such as psychology, have found that the grade point average was the most significant predictor over SAT scores and 32 personality variables (Wolfe & Johnson, 1995).

Administrators continue to struggle with looking at these predictors for many reasons. With literature stating past performance is a good predictor (Coyner, 1993), efforts are still being made to standardize high school transcripts and institutions at both the secondary and higher education level continue to debate the value of individual courses, grades, test scores and rankings. In addition, high schools use a variety of course titles, levels, grade weightings and ranking formats that make comparisons of content and level next to impossible (Cizek, 2000; Ziomek & Svec, 1995). Many institutions attempt to recalculate high school grade point averages in efforts to standardize their admissions processes. As more and more institutions use holistic approaches, they are opting to evaluate each transcript and grade point average on the individual merits of what is listed on the transcript (Rigol, 2004). All of these concerns have been addressed through governing boards and school administrators, but results will take time. Universities need to find current ways to predict success and retention to keep their institutions thriving. Especially as Texas implements the new Four-by-Four curriculum and Uniform Admissions policy, as well as, strives toward Closing the Gaps goals, the issue of finding predictive criteria for increased underrepresented students needs to be addressed.

The National Task Force on Minority High Achievement in 1999 purported that minorities such as African American and Hispanic are very underrepresented when grades and class rank are utilized to determine top academic achievers. Camara and Schmidt (1999, p. 5) have gone on to show that the "mean ethnic and racial subgroup differences in freshman college course grades are even larger than differences in high school grades." As apparent as it may seem that all constituents are interested in finding predictive criteria for college preparedness, it has also come to light that this is a very complex problem and not all of the parties (administrators, lawmakers, students, counselors, etc.) have the same opinion or facts that prove what is really important.

Standardized test scores. There have been many studies that have attempted to determine if the SAT exam is a valid predictor of first year grade point average (Burton and Ramist, 2001; Kirkup, Wheater, Morrison & Dubin, 2010). In 2001, a meta-analysis of 3,000 studies was conducted and resulted in finding that it was a valid predictor as evidenced by correlations from .44 to .62 (Hezlett, Kuncel, Vey, Ahart, Ones, Campbell & Camara, 2001; Speyer, 2004). Obviously, with the amount of debate as to the worth of standardized test scores in the admissions arena, validity is critical to establish.

When Mouw and Khanna (1993) looked at available literature in aggregate, they found that the variables being tested, including test scores and rank, were not a good fit to predict college success (average r^2 < or = .25). This study found that 50% of the students who were predicted to fail were actually successful (graduated or in good standing), and 30% of the students predicted to succeed had failed indicating a prediction error that has the potential of negatively affecting students' futures (Mouw & Khanna, 1993).

The testing agencies have increased their presence in the discussion as to how their products perform in the prediction of success process. The SAT (owned by the College Board and first developed in 1901) and ACT (owned by ACT, Inc. and first developed in 1959) agencies have conducted studies where they have shown that their respective scores have a higher predictive value when predicting higher grade point ratios. In an effort to examine SAT score levels and how they relate to success in college, the College Board examined academic intensity, high school grade point average and SAT scores. The study showed students with SAT scores of 1000 or lower (scores range from 800 to 1600 with both math and reading being both 800 point sections) had less than a 14% chance of having a college grade point average of 3.5 or higher. This is compared to over half of the students who had SAT scores over 1200 and 77% of the students with scores over 1400 who accomplished grade point averages at or above 3.5. In this study, the authors attempted to show that even though there were studies that show the SAT did not increase the prediction value of high school grade point average in overall college success predictions, looking at the level of the score can assist administrators to predict level of success (Bridgeman, Pollack & Burton, 2004). In a similar effort, ACT conducted studies to determine the predictive value of traditional admission factors such as high school grade point average and achievement test scores for college success. Noble and Sawyer (2004), both associated with ACT, Inc., found that although the prediction value for success was better while utilizing both high school grade point average and ACT composite scores (success at the grade point average of greater than or equal to 2.0), the ACT composite scores were more accurate than high school grade point average in predicting higher levels of academic success [greater than or equal to 3.0] (also see Geiser & Santelices, 2007).

Test score bias. Although some studies have shown factors such as high school class ranks, coursework, grade point averages, and standardized examinations to be measures of pre-college academic abilities (e.g., Bean, 1982, 1983, 1990; Nora & Cabrera, 1996; Nora, Castaneda, & Cabrera, 1992; Pascarella & Terenzini, 1980; Tinto, 1975, 1987, 1988) they continue to weather strong criticism. The major criticism of test scores found in literature was the possibility of biases against ethnicity and social stratifications in the use of standardized test scores as a major criterion in admissions decisions.

High-stakes testing may have begun in a noble effort to open up opportunity, but excessive dependence on aptitude tests has instead reproduced the very hierarchy that they were originally intended to topple. Reliance on test scores tends to favor the children of the rich over those of working class families. At the University of California at Berkley, for instance, nearly 42% of the white students entering in 1997 came from families earning more than $100,000 a year. (Guinier, 2001, p. 13-14)

In a 1997 study, it was found that African American SAT composite scores were approximately 80 points lower than their white student counterparts, which further indicate the potential of ethnic bias (Lawlor, et al., 1997; The Journal of Blacks in Higher Education, 2005/2006). In a more recent study conducted at the University of South Florida, Micceri found that utilizing standardized test scores to predict success for both "females (from any racial/ethnic group) or underrepresented minorities (from any racial/ethnic group), negatively discriminates in favor of whites and males when viewed from the perspective of academic progress at USF" (2010, p. 2). With these claims, come reservations of many administrators as they were looking for indicators of both success and persistence as evidenced by Sewell and Shah (1967) when they discovered that the social status of the family was not near as important as the measured ability of the student as criteria.

A major player in the admissions arena are the testing agencies, such as The College Board and ACT, that develop, administer and grade the scholastic aptitude exams, namely the SAT and ACT. In a College Board Report, Camara and Schmidt (1999) acknowledge that there are clear differences in score achievement across ethnic and economic groupings, but defend the standardized exam with the charge that severe opportunity inequities exist for minorities including academic preparation, economic class, access and family/community background. This perspective was reiterated by Stewart (1999) in his presentation to the Macalester College Forum on Higher Education, where he assessed minority inequities to include not only schools, teachers and academic programs and courses, but also factors such as poverty, poor family support and low expectations. This assessment leads to the findings of Adelman (1999; 2006) and Schmidt (1999) where they found that when open opportunities to participate in more rigorous courses were offered and accessible, test score gaps diminished and outcomes such as graduation rates significantly increased. These findings have identified the issue of inequity in available resources across school districts. Students in lower economic settings do not have the same opportunities for advanced coursework, top of the line technology and highly qualified educators (Zwick, 2001). This problem has compounded as the initiatives developed to make progress toward a solution for this problem have resulted in mixed results. The pressure to make progress affects all of the players in the education arena including the students.

With so much attention being given to admissions criteria and the message high school students hear about the need to excel at college entrance exams, the pressures are oftentimes overwhelming (Atkinson, 2001). The pressure of required performance on scholastic achievement tests, potential biases and predictive value has been debated in many venues and their value has been questioned (Atkinson, 2001). Many students are turning to college exam reviews and tutoring services in order to compete for the available admissions offers at their first choice institutions (McDonough, 1994). These pressures have built up over decades from the increasing use of test scores by admissions officers as the main criteria to ensure that they seat the most academically suited freshmen class. Administrators have oftentimes moved toward utilizing test scores in combination with other factors in an attempt to increase their chances of finding students with the most potential for success and persistence at their individual institutions.

It has been stated that the prediction value of the SAT exam on college performance has been small and should be used with caution (National Center for Fair and Open Testing, 2003). Even though the shadow of doubt has been cast upon the utility of test score preparedness and success prediction, institutions in Texas are still being mandated to use them as one of the indicators of college readiness through their Uniform Admission Policy that goes into effect for the Fall 2011 term (Texas Education Code, 2009, §58,801-§58,809). Regardless of the debates and mandates, test scores do not have enough predictive value to stand alone and additional research needs to be conducted to determine what criteria should or should not be coupled with standardized test scores to increase predictive value.

In a study to look at an existing admissions index, it was found that although high school grade point average was the best predictor of first year college success, both high school grade point average and SAT scores produced a weight ratio of 1.65 (Hu, 2002). In addition, it proved that additional weight was required to be added to high school grade point ratio to achieve quality, success and selectivity (Hu, 2002). Further studies suggest that using both grade point average and standardized test scores demonstrates a better prediction than either construct used alone (Camara, 2005).

Predicting success, or even just readiness, of college applicants has proved to be a complex problem. Companies such as ACT claim that their exam predicts college readiness. ACT’s researchers found this readiness has been measured more on the individual courses taken rather than the number of years in major subject areas (ACT Inc., 2005b). This claim was interesting because although there has been a 30% increase in the number of test takers, the score results have basically stayed the same in all areas (reading, science, mathematics, English and composite) even with additional ethnic representation (ACT Inc., 2010). With only 24% of ACT Benchmark exam participants passing all four-readiness areas in 2010, 66% passed the English exam and 71% met at least one of the benchmarks (ACT Inc., 2010). In 2005, only 41% of the graduating high school students achieved an ACT predictive score of 22 on the mathematics portion indicating potential success in college algebra (Duranczyk & Higbee, 2006). These low passing rates may have been affected by many causes such as population growth and the larger percentage of students testing. Conflicting data such as these, especially when presented from the testing agencies themselves, make reliance on them exclusively or in combination hard for admissions professionals. These professionals are striving to admit classes that will graduate and contribute to communities in their selected fields when in fact less than 50% of the high school graduates who indicated interest in the fastest-growing career fields predicted for the year 2018 did not successfully complete the mathematics or science ACT benchmark (ACT Inc., 2010). Morrison and Schmidt found “students with an average 2.5 HSGPA [high school grade point average] with an ACTM [ACT mathematics exam score] score of 20 could expect a .47 success probability while students with ACTM score of 26 could expect a .66 success probability” (2010, p. 18). Whether or not these readiness exams are measuring the right knowledge and aptitude bases, the fact still remains that more students than we expect are not prepared for college level curriculum. When this realization occurs, administrators tend to slide back to the only known indicators they have traditionally used, such as test scores and high school grade point average.

In an effort to explore the reliance on test scores alone for success prediction, a baseline study was conducted of the relationship between high school grade point average, standardized scholastic aptitude, high school class rank and the academic achievement of first-time, full-time college freshmen. It was found that high school grade point average might be predictive of first term academic achievement. But as measured by their first term grade point average, it was an extremely weak relationship that only explains 23% of the variance (Grefenstette-Moon, 2002). In addition, admission formulas, which include both high school grade point average and high school class rank, may actually be weighing this factor too heavily. These variables both suggest positive relationships to success, but, more than likely, they are highly interrelated. This positive correlation was also found in a later study done by Adebayo where he found high school GPA and rank had a positive correlation coefficient of $r = .40$ (2008). In addition to GPA and rank, the baseline study found when scholastic aptitude as measured by the SAT or ACT test was added to the model, no additional prediction value was realized (Grefenstette-Moon, 2002).

Further research may be needed in an attempt to find other success predictors, either coupled with or independently, which will give administrators and faculty a better than 77% chance of prediction error. It appears that these traditional criteria have some, but not enough, predictive value and other factors will need to be coupled with them in order to provide decision makers with enough information to admit successful students (Linn, 1990). As discussed, many of the persistence and success research has included precollege academic factors in their studies. This precollege academic history not only contains traditional criteria such as test scores and grade point average, but also looks at high school curriculum to determine its fit with persistence and success predictions (Williford, 2009).

High school courses and course patterns. Institutions have had a difficult time in obtaining and tracking data that would be relevant to success and academic persistence indicators but with the advent of the Texas Common Application, consistent data collection has improved dramatically. Since the Common Application has transitioned to be completely electronic (including some transcripts and most other required documentation), all of the data elements that are required from the applicant are stored and tracked in the institutions student information system. With increased data sets, looking at high school courses has become easier. The course titles, credits and levels are all available based on the answers students provided on the Common Application.

The increased data accessibility has opened the door for longitudinal studies to begin to incorporate high school coursework and associated patterns into persistence and success studies. Several studies indicate that high school performance was predictive of college success (ACT, Inc., 2005a; National Science Foundation, 1994; Nora & Rendon, 1990; Ruban & Nora, 2002; Updegraff, Eccles, Barber & O'Brien, 1996) and this may assist in the attempt to combine traditional criteria with high school course data (Hosler & Anderson, 2005) to see if the new Texas policies toward more rigorous curriculum are going to create a better predictor model.

Texas has realized, with the anticipated influx of highly diverse students by 2015, that high school students will be struggling with higher education and are taking steps to help facilitate a change. With their new Four-by-Four mandate, all students entering high school for the first time in Texas are assumed to pursue a college preparatory track (Texas Higher Education Coordinating Board, 2000c) and the rigor of curriculums were mandated to increase for students graduating in May 2011 (Texas Education Code, 2008; 2009, §28.002). In addition to the mandates at the high school level, Texas higher education institutions have been mandated by the Coordinating Board to follow a core curriculum for the first few years of a student's college curriculum. All students who first started college in fall 2009 or after must take a General Education Core Curriculum consisting of 42 to 48 hours of courses including math, English, science, etc. Williford feels, "detailed outcomes of high school core curricula have not been assessed for their appropriateness as predictors of student success (2009, p. 24). By looking at high school courses and course patterns it may be possible to predict if students can be successful in the college core curriculum and make it past the most vulnerable first year when the most drop outs occur in higher education.

As lawmakers watch to see the result of their mandates, constituents continue to seek answers in the classroom. Daempfle discusses studies that look at instructional methods and pedagogy as reasons for low retention but feels the discrepancy between incoming freshmen skills and course expectations also leads to student failure (2004). This study looked at biology majors and found that the difference in preparation expectations creates a real roadblock in the student's transition experience from high school to college level expectations (Chaskes, 1996). Expectations when moving from the high school environment to higher education are varied and oftentimes reflect just a piece of the puzzle. The problem goes further than the students themselves as university faculty have expectations of newly admitted freshmen classes (ACT Inc., 2009). For example, as reported by the ACT National Curriculum Survey, college faculty ranked grammar and usage skills first as a needed writing skill as opposed to it being ranked 6th by high school teachers (ACT Inc., 2003). Again, four years of English are required by the new curriculum and college faculty require their students to be able to write in order to complete their courses successfully. Focusing on coursework as a main admissions criterion often puts extra pressure on teachers to award grades not earned (Bishop, 2003). Peter D. Hart Research Associates (1995) found that 30% of teachers felt the need to raise grades above performance levels and reduce the workload of their students. Obviously there are issues with high school grading uniformity, standards, scales, etc. (Camara, 1998; Miller, 2006; Sedlacek, 2007) but the actual courses and course patterns successfully completed seem logical to affect success as student transition to college (Trusty & Niles, 2004). With varying views on the definition of the critical skills for success, it was becoming more important to identify, through research, what pre-college courses indicate college preparedness and lead to persistence and success.

Even students have been struggling to make the best choices regarding which high school courses to take to accomplish readiness. In 2004, less than a third of all ACT test participants scored a 22 or higher on the ACT Science test that indicates students have a 75% chance of achieving a grade of C or better in college level biology and algebra classes (ACT Activity, 2004). The required curriculums for high school graduation are not supporting success at the college level. In fact, "less than half of all students take the courses they need to be prepared in mathematics and science" (ACT Inc., 2005b, p. vi). Some studies have gone as far to say students can increase their chances of completing a bachelor's degree with each higher level mathematics course they complete in high school (Adelman, 1999). The State of Texas has also come to this realization by increasing both the math and science requirements to include four required credits rather the old requirement of three credits. Other studies completed outside of the testing agency realm may point to the importance of looking at high school courses to further the understanding of how they affect success in college level courses.

With the complex problem of looking at individual courses and course patterns to see if they affect success and persistence, some studies have focused on the math and science areas. Mathematic aptitude was measured by the Scholastic Aptitude Test (Helseth, et al., 1981) and math achievement (Biermann & Sarinsky, 1989) was also show to be strong predictors of achievement in freshmen college level biology. An interesting predictor for college level biology that evolved from the Benford and Gess-Newsome study was verbal skills (2006). Hagedorn found that students who were ready for college and university level mathematics courses and were in fact enrolled in the same had a much better chance of success than the students who needed remediation prior to being ready for college level math (1999). Many feel that advanced mathematics participation begins in the eighth grade when approximately 22% of eighth graders actually take high school level math (Horn & Nunez, 2000). Choy found that 78% of these students had enrolled in advanced mathematics in high school as compared to 39% of overall students (2002). The evidence that high school calculus was important to college success was substantiated when Ruban and Nora found, "compared to those that did not enroll in that course [calculus], those students that were enrolled in calculus were 28 times more likely to be a high-achiever in college" (2002, p. 20). These results do follow previous studies who state that high school academic preparation in mathematics and science do correspond to their achievement outcomes in college (Ruban and Nora, 2002; Nora & Rendon, 1990). This finding has been shown for all students but was especially true for first generation students (Choy, 2002).

It was important to look at other high school courses such as science to find predictors as a piece in the mathematics achievement puzzle. Tai and Sadler (2001) found that high school achievement, parent's education and high school calculus assisted in college level physics achievement. The study showed that males and females did better in algebra or calculus based physics if they successfully completed a high school calculus class (Tai & Sadler, 2001). In addition, the study showed that students performed better in university physics courses if they partook in high school physics courses that covered fewer topics in greater depth rather than broad scans of multiple topics (Tai & Sadler, 2001). The disparaging fact that females lose interest and dropout of science majors for the most part between high school and the freshmen year of college (Oakes, 1990) was something that institutions need to address. Nora and Rendon (1990) found similar results such that females with low academic preparation obtained low grades, took less science courses in high school and had little family support to attend college. Their study showed how mathematics and science participation and achievement could be drawn from their academic preparation (1990). This same preparation allowed students to study more academic subjects such as engineering and biological sciences rather than taking a vocational track or just general education courses (Nora & Rendon, 1990). Other sciences, such as chemistry, have success indicators that also include mathematics. Some studies indicate standardized test scores stand alone as predictive of college chemistry success (Craney & Armstrong, 1985) yet others indicate math and the associated reasoning skills as success indicators for first year chemistry (BouJaoude & Giuliano, 1994).

Coursework can be one of the admissions criteria that send the right signals to students. Students will realize they can increase their college readiness and chances of admissions to the school of their choice if they take upper level courses such as advanced English, math and science. They will benefit from taking courses that stretch them academically instead of playing admissions games, such as easy courses taken for good grades and top ten percent inclusion. The level of coursework and the achievements accomplished within those courses in comparison to aptitude, rank and grade point average places undo pressure on both teachers and peers (Bishop, 2003). The positive impact that intentional higher level course taking may show, with additional research that these efforts pay off in higher success and graduation levels in higher education.

All of the discussions regarding encouraging students to take as many upper level courses in high school as possible do create other issues that would need to be addressed. As communities strive to implement additional rigor to their high school curriculums to realize the positive impact, they must also acknowledge the claim that unequal opportunities exist at low-income high schools either through offerings or advisement. The good news was that progress has been shown in the NLS:72/86, HS&B-So:80/92, and NELS:88/2000 by demonstrating 12.6% of the 1992 African American cohort earned engineering baccalaureate degrees as compared to half of that for the 1982 cohort and six times for the 1972 cohort (Adelman, 2004). This information hints that measurable progress toward opportunities for underrepresented students began to occur. In order to create admissions policies utilizing criteria that have been shown by research to have predictable value towards success and persistence, school districts need to find a way to create similar opportunities for all students.

High school course patterns. The current indications in literature, reported mostly by the standardized testing agencies, are beginning to indicate that individual course and combinations are important factors that point to higher education success. For example, Domer and Johnson (1982) found that the number of semesters of high school foreign language courses was indicative of success in architecture students. ACT has tackled course combinations in some of its recent policy reports. A recent ACT Policy Report (ACT Inc., 2005a) found that English 9-12, algebra 1, geometry, algebra 2, one (or more) upper-level mathematics course, biology, chemistry, physics and foreign language are the best course sequences to prepare students for college. It was apparent that many students were still not making these choices. Even though 93% of students planned on taking English 12 and 89% planned on one or more foreign language, only 23% planned on taking math beyond algebra 2 and only 44% planned to take biology, chemistry and physics [13% planned to take biology only] (ACT Activity, 2004; ACT Inc., 2005a). In addition to traditional college preparatory courses, cross-disciplinary indications were also evident with examples such as high school foreign language courses increasing success in college level English and advanced mathematics influencing college biology success (ACT Inc., 2005a). Cross-disciplinary indication shows up more drastically in the mathematics and science areas (ACT Inc., 2005a; Ruban and Nora, 2002; Nora & Rendon, 1990).

The search for this consensus will require parties coming to the table to discuss readiness indicators and then working as teams to assure the students are prepared for gateway courses. In order to understand how college level gateway course success were affected by pre-college preparedness and ultimately affects freshmen to sophomore persistence, it was important to look at individual course and course sequences to find potential predictors. Studies have been conducted to show success in college level mathematics courses through high school grades and composite ACT scores (Richards, et al., 1966), ACT composite scores and high school grade point averages (Noble & Sawyer, 1989), and high school rank and high school grades (Troutman, 1978). "Students whose highest level of mathematics in high school was at the trigonometry, pre-calculus, or calculus level had bachelor's degree completion rates above 60%; for students who completed a calculus course in high school, the bachelor's degree completion rate was 83%" (Adelman, Daniel & Berkovits, 2003, p. 7).

Math success plays an important role in success in the sciences as well. Students who took physics class in high school along with achieving high grades in high school math classes have had success in introductory college level physics courses (Hart & Cottle, 1993; Alters, 1995). Other researchers feel a more rigorous high school preparation of calculus and two years of high school physics would be indicative of success in college physics (Sadler and Tai, 2001). It has been found that students from low socioeconomic homes are not generally taking physics in high school (Neushatz & McFarling, 1999).

With students not voluntarily signing up for the most rigorous coursework patterns available or not having the option, it was becoming important for high school counselors to find ways to communicate this importance to the students. Other studies have been focusing on the alignment between secondary mathematics and science curriculums with post secondary expectations and how it was becoming critical for success during the first year college science course and poses a risk to potential persistence in the science fields if a consensus between the two levels of instruction was not obtained (Daempfle, 2004).

Once the various educational agencies come together on what was needed to succeed in college, they can then plan together how to achieve their goals. Many of the current discussions have indicated that certain courses and course sequences are proving to prepare students for higher education better than others (ACT Inc., 2005a; Smith, 2007).

College credit earned during high school. As Texas leaders and educators watch hopefully as the new curriculum mandates are implemented and enough data are collected to see if they are making readiness progress, there was some evidence that some schools and students are going to the next level. More communities show high schools and local colleges and universities working together to create opportunities for eligible students. Dual credit enrollments often are the result of collaborative agreements between these institutions allowing high school juniors and seniors who demonstrate readiness the opportunity to take college courses while concurrently enrolled in high school (Karp & Hughes, 2008). It was believed that these programs offer many outcomes including increasing the rigor of the high school curriculum, enticing students to stretch to higher academic standards, increase offerings at small or rural schools who do not have the resources available for the offerings, increasing student aspirations, increasing ultimate college adjustment and reducing the overall cost of college (Karp & Hughes, 2008; Manzo, 2007).

Some researchers such as Adelman felt students were able to grasp learning strategies that assisted them in self-directed study through courses like Advanced Placement and International Baccalaureate (1999; 2006). These skills provided for additional movement toward positive relationships with academic outcomes (Adelman, 1999; 2006). The ability to improve the transition to college from high school by raising individual high school course rigor provides students confidence as they begin their college careers (Holstead, Spradlin, McGillivray & Burroughs, 2010). The Advanced Placement program was initiated in the 1950's to assist students in preparing for higher education. It currently offers 37 college level classes for high school level students seeking additional rigor and advanced college credit prior to high school graduation (Holstead, Spradlin, McGillivray & Burroughs, 2010). In 2010, 179,320 Texas students took advantage of advanced placement courses and their associated exams. With many students taking more than one exam (325,571 exams), 153,539 (11% increase over 2009) earned a score of three or higher [scale of 1 – 5 with college credit usually being awarded at 3 or higher] (Texas Education Agency News Online, 2010). This news was promising as high schools and lawmakers strive to increase the quality, level and amount of offerings within their institutions, more and more students are graduating with dual credit and advanced placement exam scores that result in college credit earned while continuously enrolled in high school.

College level courses taken by high school students varies among the ethnicities such as in 2001 69% of Asian students, 50% of white students, 43% of Hispanic students and 33% of African American students. Also, more women took college level classes than men with 50% of women and 44% of men partaking in the increased level in 2001 (Texas Higher Education Coordinating Board, 2010).

It was interesting to note that Hispanic and African American students took more advantage of the dual enrollment opportunities even though they were underrepresented in the accelerated programs overall (Buckley & Muraskin, 2009). Although it appears that taking these concurrent courses increase rigor, preparedness and success, there are unequal opportunities for access to these programs. For example, access to advanced placement courses varies over ethnicities, such that 94% of Asian students attend high schools where advanced placements courses are offered but only 81% of African American students have the same opportunities (Handwerk, Tognatta, Coley & Gitomer, 2008).

Further, approximately 5% of high school students in participating advanced placement programs took the opportunity to take these courses and "less than 1 percent of low-income students (as measured by eligibility for free and reduced price lunch) took AP exam in schools that offered AP exams" (Handwerk, et al., 2008, p. 4). When looking at all of the opportunities to take college level courses in high school, 83% took advanced placement courses, 13% took academic dual credit, 3% took non-academic dual credit and 1% completed international baccalaureate courses (Texas Higher Education Coordinating Board, 2008).

Texas was finding that students who successfully completed dual credit and advanced placement classes during high school are experiencing positive benefits. “Students who took college-level courses in high school tend to earn more credits in their first year of college, have higher GPAs as freshmen, and earn baccalaureate degrees at higher rates than other students at Texas public higher education institutions” (Texas Higher Education Coordinating Board, 2008a, p. 1). In a study of 2000 and 2001 high school graduates it was found that there was a correlation between the number of courses taken and the time it took to graduate. Whereas 44% of the students who graduated in 2000 who took one or more college classes received a baccalaureate degree in four years, only 15% received the same degree who took no advanced placement, international baccalaureate or dual credit while continuously enrolled in high school (Texas Higher Education Coordinating Board, 2008a). The Texas Coordinating Board accepts that their data does not show causality, but it definitely shows a positive relationship between college level courses while in high school and college outcomes (Texas Higher Education Coordinating Board, 2008a). In a 2009 study of the Denver Public Schools, similar results were found in that 43% of all graduates completed accelerated courses (dual credit, advanced placement, International Baccalaureate and honors), and for the these students who pushed for advanced coursework it showed that they were more likely to enroll in college over their nonparticipant peers (Buckley & Muraskin, 2009). In addition, Keng and Dodd (2008) found that students who passed the appropriate advance placement exam with a 3 or higher could expect more academic success than their peers who did not participate in the advanced placement initiative. In another study, Dodd, along with Hargrove and Godin found students' success in advanced placement courses allowed them a better chance of graduating from a four-year college curriculum (2008). Although these studies suggest a positive relationship between advanced placement courses and academic success and persistence, Thompson and Rust (2007) found some contradictory evidence. Their findings "that AP students would earn significantly higher college grades when their grades were compared to those of other high achieving students. Likewise AP students did not rate the benefit of their high school courses higher than did their high achieving peers who did not take AP courses" (Thompson & Rust, 2007, p. 416). Although the Thompson and Rust study did find evidence that high achieving students made similar grades whether or not they partook in advanced placement classes or not, they studied only high achieving students (2007). On the other hand, Dodd, Fitzpatrick, De Ayala and Jennings studied all students, regardless of level, and found that advanced placement students had higher college grade point averages than those students who did not take advanced placement classes (2002; see also Bernholc, Baenen & Howell, 2000; Curry, MacDonald & Morgan, 1999; Hargrove, Godin & Dodd, 2008; Horn and Kojaku, 2001; Morgan and Maneckshana, 2000). This relationship indicates the potential for examining this criterion in conjunction with high school curriculum to see if it increases prediction outcomes.

Conclusions

It was clear that completing degree programs was more difficult for students who were required to participate in remediation classes (Adelman, 2004). Remediation for unpreparedness was not a new problem as evidenced by the National Center for

Education Statistics (NCES) comprehensive survey in 1995 (similar surveys conducted in 1983-1984 and 1989) where they found 29% of new freshmen in the fall of 1995 enrolled in one or more remedial course (Merisotis & Phipps, 2000). This problem did not seem to be going away and effects nearly every institution in the nation as was evidenced by 100% of community colleges and 78% of higher education institutions offering at least one course focusing on remediation in 1995 (Merisotis & Phipps, 2000).

This problem surpasses families when institutions, states and even the federal government have to budget for remediation on high school skill levels (Kirst & Venezia, 2006). With an estimated $16 billion in remediation costs each year; our nation continues to struggle with 28% of students who require remediation in one or more courses as they start academic careers in higher education (National Center for Education Statistics, 2003).

As more focus was placed on specific courses, Camara and Schmidt (1999) found that most high schools, by requiring less than three years of math and science, were graduating students who would require remediation. This fact was very concerning for local communities and state agencies as evidenced by the concern expressed by legislators that, "… tax dollars are being used in colleges to teach high school courses" (Merisotis & Phipps, 2000, p. 68).

This transition process has many students finding themselves in high school content remediation courses before they can progress to college level curriculum and studies are finding they are just not making it to graduation in high enough numbers (McCabe, 2000; U.S. Department of Education: National Center for Educational Statistics, 2001). This evidence was furthered by Adelman's (2004) claim that 70% of students who are required to take reading remedial coursework are not making it to graduation within eight years of beginning college.

Although persistence research has made progress in recent years with both academic and non-academic variables, additional research would be needed to progress to the next level of understanding what combinations and patterns of variables will most assist administrators in predicting success and retention (Mattson, 2007). Studies seem to be identifying individual high school courses that would indicate success in single college level courses, but further investigation would be needed to identify high school course patterns that would affect success patterns in the higher education curricula. As evidenced by the literature, academic success and persistence have experienced some growth in understanding how administrators can make more informed admissions decisions by using institutional and student data. The results continue to show that both variables are complex and neither previous high school nor first year college grade point average are strong enough predictors to use alone and administrators are still struggling to find additional factors to increase their decision strength. Until recently, the Texas legislature has funded higher education based on enrollment counts but the tides are changing to look at persistence, time to graduation and graduation rates. The discussions of preparedness (with the associated proof and press) has risen to the level of educational and state officials and has spurred action in the form of a new, stronger curriculum that was now mandated for every public high school student with few exceptions. Further examination of this initiative may give precollege academic background more strength in predicting college academic achievement and persistence to graduation.

Chapter III. METHODS

Introduction

Chapter Three consists of five sections: an introduction, population and sample, data collection procedures, instrumentation and data, and data analysis. The design of this study incorporated a longitudinal study of data collected at three different points in time: upon enrollment to the University, end of their first year, and fall of their second year for first-time, full-time college freshmen entering in the summer and fall of 2004, 2005, 2006, 2007 and 2008. This study utilized both multiple and logistic regression techniques that are intended to develop a greater understanding of the criteria's impact and relationship to academic achievement and current persistence theory.

Population and Sample

The initial study was conducted at a small, special purpose, public undergraduate institution in the south. The mission of the institution emphasizes undergraduate science and engineering education. While the mission continues to be special purpose, the campus provides a full four-year program including general studies and the state core curriculum. The institution has adopted a forty-three-semester credit hour core curriculum to ensure that all students have a broad application of mathematics, science, language and humanities. This core requirement promotes some stability of the freshman coursework and allows grade point ratio comparisons to be more uniform. Due to the special nature, the campus does exhibit unique characteristics. Within the state, the campus hosts one of the largest populations of non-resident students. The student body represents 41 states including Puerto Rico and the District of Columbia as well as 53 countries. The undergraduate students' average semester credit hour load is 14, making the majority of the student body full-time students. Nearly 60% of the students reside in the campus community.

The sample was drawn from the entire population of first-time full-time freshman-admitted students who enrolled for the summer and fall 2004, 2005, 2006, 2007 and 2008 semesters. Approximately 2144 students meet the population description. The entering year breakdown of the freshmen participants included 19.6% in fall 2004, 21.2% in fall 2005, 17.4% in fall 2006, 19.8% in fall 2007 and 22% in fall 2008. The participants were mostly Caucasian (80.4%), but also include 11.8% Hispanic, 2.3% African American and approximately 5.6% of other ethnicities. The admissions status of the classes consisted of 9.5% top ten percent, 67.3% ranked in the top half, 83.3% unconditionally admitted and 16.7% provisional admissions. 61% were male. Fourteen percent were minorities (either African American or Hispanic). The mean SAT score was 1080 and the mean ACT score was 23.

The sample size was expected to be at least 94% of the population. Some of the decrease in population size may be accounted for by the use of a precondition variable (earning greater than 10 semester credit hours during their first term at a university), which was utilized to control the dataset of the University. Adelman found that students who earned greater than 10 semester credit hours during their first term of enrollment achieved a greater graduation rate (between 66 and 67 percent) of earning a bachelor's degree (2004). All students who did not earn greater than 10 hours after their first fall semester (in the case of provisionally admitted students the first semester hours will include the summer hours earned) were excluded from the study.

Data Collection Procedures

After approval by the researcher's Institutional Research Board and the University of Houston Committee for Human Subjects was granted, a database was produced from archival official records maintained by the institutional Office of Admissions and Records. The student information system integrates all applicable data concerning a student's application, admission, matriculation, continued enrollment, and graduation progress. This study utilized historical data that was collected at the time of application, admission, enrollment, end of the first year enrolled, and fall of the second year.

Instrumentation and Data

Profile data.

The information was pulled from both the Student Information Management System and applicant databases that were both official university sources. The table included the student's high school grade point average, high school class rank, SAT or ACT standardized scholastic aptitude exam scores, high school mathematics courses, high school science courses, high school senior level English grade, high school foreign language units completed, college level course units concurrently achieved in high school, freshmen year grade point ratio and first term sophomore year enrollment status. In addition, the table included demographic information such as: type of admission granted to the student (top ten percent, regular admission, TAMU bound, academic review, admit special and provisional), gender (male, female or not specified), ethnicity (coded as white or nonwhite), birth date (applicant's day, month and year of birth), high school name (the name of the applicant's most recent high school) and location information (to include county and city as reflected on the high school transcript), student's Texas residency status (Texas resident or Non-Texas resident for tuition purposes), admissions term (summer or fall) and name of the academic major for which student was admitted.

Dependent variables.

Academic achievement. Academic achievement was measured by the grade point ratio at the completion of the first long semester. For this study, only first time, full-time freshmen completing their first semester in either the summer or fall of 2004, 2005, 2006, 2007 and 2008 were used. The grade point ratio was defined as the number of quality points divided by the number of semester credit hours. Quality points were awarded on a four point scale; A equals 4, B equals 3, C equals 2, D equals 1, and F equals 0. These grades were scanned into the official Student Information System database and then the grade point ratios were computed automatically and stored in the appropriate field. All credit courses for which the student was enrolled on the census day (12^{th} official class day of each fall and spring term) and received a grade of A through F were included. All courses on a pass/fail grading scheme were included only if the grade of F (fail) was assigned as the grade of P (pass) had no bearing on the grade point ratio calculation. Grades of Q (q-drop or student initiated drop with no penalty), W (Withdrawal), NG (No Grade), I (Incomplete) or X (Not reported) and their associated credit hours were not utilized in the individual calculation of the grade point ratios. Students who officially withdraw from the University were treated like missing data.

Persistence. Persistence was defined as dichotomous in nature (1 = persist and 0 = non-persist). Enrollment records of all participants were checked early in the fall semester of their second year. Students who re-enrolled for the fall term by the 12^{th} class day of record (either full or part time) were coded as persisters.

Predictor variables.

The pre-college variables that were incorporated into this study were based on admissions standards and models in the field and persistence related literature (e.g., ACT Inc., 2005a; ACT Inc., 2007; Adelman, 2004; Braxton, 2000; Camara & Schmidt, 1999; Hawkins & Clinedinst, 2006; Herzog, 2005; Horn & Carroll, 1998; Mouw & Khanna, 1993; Pascarella & Terenzini, 2005; Payne, Rapley & Wells, 1973). The variables were analyzed using three blocks consisting of demographic variables, traditional admissions criteria variables and high school coursework patterns. The demographic block included gender and ethnicity. The traditional admissions criteria block included rank in high school class and scholastic aptitude test scores. The high school coursework block included information regarding completed mathematics, science, English, foreign language and college level courses (advanced placement and/or dual credit) that the students took during their high school career. These variables were tested to derive their validity in predicting academic achievement and persistence.

Demographic block.

The demographic block analyzed the relationship between academic achievement and persistence and the demographic variables gender, ethnicity and admit type.

Gender. The gender variable was obtained from the Texas Common Application as self reported by the student. Gender was coded as “0” for male or “1” for female.

Ethnicity. The ethnicity of the students was obtained from the Common Application as well and was coded as “0” for non-white or “1” for white. The ethnicities that were included in the non-white category were American Indian/Alaskan Native, Asian or Pacific Islander, Black, Hispanic or other.

Traditional block.

These variables were used to describe the participant's academic achievement in high school as measured by traditional college readiness factors such as high school class rank and scholastic aptitude test results.

High school grade point average. High school grade point averages were provided on official high school transcripts and were carefully reviewed. However, due to varying course weighting policies, lack if usable scales or legends and little standardization that was found in the data, high school grade point average was not utilized. Theoretically, grade point average should be tightly coupled to class rank. Rank was used to suffice.

High school class rank. Class rank was defined as the ratio of the student's graduation standing divided by the number of graduates in their class and reflected where the student was ranked competitively among the other graduating seniors from that school. This ranking was provided by most high schools at the end of junior year on official transcripts. This study did not take into consideration the size of the institution or individual high school course weighting schemes. All rankings were taken at face value. For example, a student ranked as 20^{th} out of 200 was considered in the top quarter of their graduating class, whereas another student ranked 20^{th} out of 24 and was considered in the fourth quarter of their graduating class. In addition, the high school rank values were inverted to reflect class position to keep all of the criterion variable outputs with higher numbers meaning greater value.

Standardized scholastic aptitude. The test score information for each applicant provided insight into the applicant's verbal and mathematics abilities and aptitudes. Although this was a traditional admission criteria used nationally by many institutions, current literature reflects caution in use due to biases and limitations (e.g., Mattson, 2007; Sedlacek, 2004). Standardized scholastic aptitude was defined as the composite score of either the SAT or the ACT college entrance standardized tests. Although debated as to whether this variable reflects aptitude or achievement (e.g., Sedlacek, 2004), it remains one of the criteria heavily relied on by institutions in admissions decisions and needs to be included in this study. The College Board and ACT, Inc. (2006) provides institutions with a crosswalk table for equivalencies and this has been attached to this study as Appendix E. This table was used to standardize ACT scores to SAT scales.

High school coursework block.

Mathematics high school achievement level. Students who graduate from Texas public high schools have to complete a minimum of four mathematics credits (Texas Education Code, §§7.102(c)(4) (2001), 28.002 (2009), and 28.025 (2009); Texas Administrative Code, Title 19, §74, §§F). Lawmakers have outlined two diploma levels that include a recommended and advanced (also known as the distinguished) distinction (a third distinction is available in rare instances and requires a minimum amount of credits). Both the recommended and advanced levels require four mathematics credits which must consist of algebra I, algebra II, and geometry with required options, which may include the additional requirement of pre-calculus (Texas Education Code, 2001, §7.102(c)(4); 2009, §28.002, and 2009, §28.025; Texas Administrative Code, 2007, Title 19, §74.63(b)(2) and §74.64(b)(2). The diploma types are important in order to understand what options the high school students are being afforded as they prepare for higher education. The minimum high school mathematics admissions requirement for the institution being reflected in this analysis-included algebra I, algebra II, geometry and one-half unit of an advanced math leading up to this mandate of four math credits. The individual high school course completions reflected the applicant's course level in each of the listed disciplines that were taken and successfully completed. The number of years completed for each course was taken from the student's official high school transcript and supporting information was obtained from the Texas Common Application for Freshman Admission question number 18 where applicants were requested to list the exact titles of the courses they expect to complete their senior year, including the number of credits they expected to earn for each course (2007-08 Texas Common Application). The types and number of courses that each student completed in high school mathematics are reviewed and then grouped into one of three categories as general, academic or academic rigorous. Level "1" (general) [also known as the minimum program] included the minimum admissions requirement of algebra I, algebra II and geometry plus 1/2 elective credit in mathematics which may include statistics, business math, etc. but did not include pre-calculus or calculus. Level "2" (academic) [also known as the recommended program] included the three credits in algebra I, algebra II, geometry and at least one additional credit in pre-calculus. Lastly, Level "3" (academic rigorous) [also known as the advanced program] included the minimum requirements of algebra I, algebra II and geometry plus at least one unit of both pre-calculus and calculus. Students with more than four units of mathematics in their high school history that include both pre-calculus and calculus were included in Level "3". Other types of math that a student could have credit for include math concepts, statistics, pre-algebra, business math, etc. Many of the curricula at the particular institution of the researcher rely heavily on calculus that makes pre-calculus and calculus the preferred math courses.

Science high school achievement level. As with mathematics, there are minimum state science requirements that need to be acquired in order to graduate from public Texas high school. Students are required to complete four credits where at least one credit each must be from biology, chemistry, and physics. Science requirements also span three diploma types and include additional requirements for both the recommended and advanced distinctions. Both the recommended and advanced levels require students to earn four credits that may be chosen from four defined areas. Students planning on attending this institution are encouraged to take biology, chemistry and physics to satisfy the science requirement, with an additional component option.

Science credits may be selected from a wide variety of basic sciences, advanced placement (AP) or International Baccalaureate (IB) level course work, and even some specific advanced courses in medicine and research. Basic sciences might integrate physics and chemistry, biology, environmental systems, aquatic science, astronomy, geology, meteorology and oceanography. AP and IB classes would include AP biology, AP chemistry, AP physics, AP environmental science, IB biology, IB chemistry, IB physics and IB environmental systems. Other advanced courses could include scientific research and design, anatomy and physiology of human systems, medical microbiology, pathophysiology, aquatic science, principles of technology I and principles of technology II (Texas Education Code, 2001, §7.102(c)(4); 2009, §28.002, and 2009, §28.025; Texas Administrative Code, 2007, Title 19, §74.63(b)(3) and §74.64(b)(3).

The minimum university requirements in high school science for admission include four years of science with at least three courses from biology I, chemistry I and physics I. The individual science courses from the various disciplines that were chosen and successfully completed were taken from the participant's official high school transcript and supporting information as listed above.

General, academic or academic rigorous differentiated the levels of high school science achievement. General includes the minimum requirements of three units of science such as biology, chemistry and physics but would not necessarily include all three of these exact courses. Students apply with various combinations of science courses similar to those listed above in the Texas high school graduation requirements. Level "2" (academic) [also known as the recommended program] included the minimum requirements taken as biology, chemistry and physics and one other advanced unit. Level "3" (academic rigorous) [also known as the advanced program] included the minimum requirements taken as biology, chemistry and physics plus at least two other advanced units. Many applicants doubled up courses in science (i.e. biology II, chemistry II, environmental science, aqua science, etc.) during one or several high school years allowing that student to earn over four credits in the discipline during their high school experience. Any combination of accumulated science over four credits was classified as Level "3" (academic rigorous).

Writing ability level. The high school senior level English grade was used to measure the writing ability of the applicant. Students who graduate from Texas public high schools have to complete the minimum English requirements of four units (one for each required year of high school). The fourth unit may be taken as English IV, research/technical writing, creative/imaginative writing, practical writing skills, literary genres, business communication, journalism or concurrent enrollment in a college English course. To satisfy the recommended and distinguished requirements as noted above, students must have taken English IV (Texas Education Code, 2001, §7.102(c)(4); 2009, §28.002, and 2009, §28.025; Texas Administrative Code, 2007, Title 19, §74.63(b)(1) and §74.64(b)(1). The University requires four English credits for admissions purposes.   The measure for this variable was the grade taken from the official high school transcript. The levels of writing ability were coded as follows: "1" (general) [also known as minimum] consisted of the grades of "C" or "D" for the senior year English grade; "2" (academic) [also known as recommended] consisted of the grade of "B" for the senior year English grade; and "3" (academically rigorous) [also known as advanced] consisted of the grade of "A" for the senior year English grade.

Foreign language units. Students who graduated from Texas public high schools had the option to take foreign language in high school in order to graduate under the general requirements until the 2004 academic school year. In order to obtain the recommended diploma types, students are required to take two credits that must consist of levels I and II in the same language. To be granted the advanced diploma, they must complete three credits consisting of levels I, II, and III in the same language. (Texas Education Code, 2001, §7.102(c)(4); 2009, §28.002, and 2009, §28.025; Texas Administrative Code, 2007, Title 19, §74.63(b)(6) and §74.64(b)(6). The University does not have any high school foreign language admissions requirement but does require a student to have two years in high school or one year in college in the same language to graduate from the University. The number of units that were successfully completed in the same foreign language reflected the applicant's level of rigor in the foreign language discipline. As noted above in the other coursework variable definitions, the information was taken from applicant supplied documentation and official transcripts. In an effort to differentiate the levels of high school foreign language achievement, the levels were coded as follows: "1" (general) consisted of zero or one unit of a foreign language; "2" (academic) [recommended program] consisted of two units of the same foreign language; and "3" (academic rigorous) [advanced program] consisted of three or more units of the same foreign language.

College level course credits concurrently achieved in high school. High school students who have mastered curriculum enough to be eligible to take college level courses in high school are either completing these courses through advanced placement courses offered through their home institutions or taking concurrent courses from local colleges or universities. Oftentimes these are freshmen core curriculum courses and allow students to start ahead of their peers during the first year. The measure for this variable was the earned hours for college level credit that was earned and recorded on an official transcript of an accredited college or university by the first full time point of entry. In addition, any courses that credit was earned through advanced placement or international baccalaureate courses with passed examinations at the achievement level that earns university credit was counted with the earned semester credit hours.

Data Analysis

Review of Psychometric Properties.

Prior to running the regression analyses, it was helpful to look at the distributional properties of both the independent and dependent variables. Table 1 shows the measurement, type of measure and distributional properties that were analyzed for the individual variables. By screening the variables, it allowed the researcher to determine if the assumptions necessary to proceed with the regression analysis have been addressed. Issues such as avoiding measurement error, assuring independent observations and variables included are not extraneous. In addition, it was important to look for evidence that any of the variables are collinear to one or more of the predictor variables. Based on the researchers experience in education, the data was thoroughly considered for logical validity.

Multiple regression – academic achievement.

After a thorough review of the data, multiple regression techniques were employed to analyze the contribution of the independent variables on academic achievement. This analyses used a three step approach including distribution statistics, Pearson Product Moment Correlation techniques and hierarchical multiple linear regression techniques. The dependent variable, academic achievement, was measured by the cumulative grade point ratio at the completion of the first year. The independent variables were added in three defined blocks defined as demographic variables, traditional admissions criteria variables and high school coursework patterns. The ninety-five percent confidence level ($p < .05$) was used as the criterion level for determining statistical significance. Each variable was reviewed by examining the mean, standard deviation, minimum, maximum and index of skewness for normal distribution properties. After this review, a Pearson Product Moment Correlation was computed to examine the relationship between each of the variables. Finally, a linear multiple regression technique was performed using each of the independent variable blocks. Each block was reviewed for a significant R value indicating the goodness of fit and a significant *F* value indicating a significant change from the previous block.

Logistic regression – persistence.

Logistic regression analysis was applied to the data in order to identify the variables that are relevant to the outcome measure of persistence as measured by enrollment in the fall term of the sophomore year. Unlike ordinary regression, "estimation in logistic regression chooses parameters that maximize the likelihood of observing sample values" (Pampel, 2000, p. 53). It was simply "regression on a dependent variable that transforms nonlinear relationships into linear relationships" (Pampel, 2000, p. 18).

Logistic regression was an appropriate statistical technique for this study because the dependent variable, persistence, was defined here as dichotomous. Two assumptions support the use of logistic regression for this study. The first assumption concerns the nature of the distribution associated with a binary outcome (Cabrera, 1994). It was assumed that each of the potential values of the persistence outcome variable (1 = persist and 0 = non-persist) have a corresponding expected probability that varies (as a function of the values of the independent variables) for each subject (Cabrera, 1994). The second assumption was concerned with the nature of the relationship between the persistence dependent variable (persist or non-persist) and the independent variables (Cabrera, 1994). The logistic distribution of this relationship was S-shaped and has values ranging from 0 to 1 (Cabrera, 1994). "Although many non-linear functions can represent the S-shaped curve, the logistic or logit transformation, because of its desirable properties and relative simplicity, has become popular" (Pampel, 2000, p. 10).

Table 1

List of Independent and Dependent Variables, Associated Measures and Distributional Properties

Name	Measurement	Type of Measure	Distributional Properties
<u>Independent</u>			
Block One			
Gender	M, F, NS	Nominal	Count & Plot
Ethnicity	W or NW	Nominal	Count & Plot
Block Two			
High School Rank Percentile	0 - 100%	Ordinal	Mean, Min, Max, Standard Deviation
SAT Test Score	200 - 1600	Ratio	Mean, Min, Max, Standard Deviation
Block Three			
Math Courses	1 – 3	Ordinal	Count & Plot
Science Courses	1 – 3	Ordinal	Count & Plot
English 12th Grade	1 – 3	Ordinal	Count & Plot
Foreign Language Courses	1 – 3	Ordinal	Count & Plot
College Level Courses	# Earned Hours	Interval	Count & Plot Mean, Min, Max, Standard Deviation
<u>Dependent</u>			
Academic Achievement	0.0 – 4.0	Ratio	Mean, Min, Max, Standard Deviation
Persistence	1 & 0	Nominal	Count & Plot

Note: Four of the five Block 3 predictor variables are using a scale of 1 to 3 with 3 being the highest value. High School Rank of 100% indicates top of class.

Therefore, the focus of analysis in logistic regression can be stated as the probability of a given outcome that, in this case, was the probability of a student persisting to the second year of college. We also found those estimates for the slope and the intercept that maximize the likelihood of reproducing the observed probability (Cabrera, 1994). Logistic regression makes no assumptions about the distributions of the predictor variables; that is, the predictors do not have to be normally distributed, linearly related, or of equal variance within each group (Tabachnick & Fidell, 1983). In this study, an estimation of alternative models for the logistic regression was followed.

Hierarchical testing of model.

Since the researcher did an initial study of the traditional variables and their relationship to academic achievement, the variables were added in three defined blocks as demographic, traditional admissions criteria and high school course pattern variables utilizing a hierarchic stepwise process. In logistic regression, it has been customary to first establish a baseline model. This was accomplished by running a logistic regression on the dependent variable (persistence). The forward stepwise process involved testing the effect of the variables in the first block, which contained demographic factors (gender, ethnicity and admit code) against the baseline model.

The core of this test rests on the maximum likelihood function, usually referred to as G^2 (or scaled deviance). "Maximum likelihood estimation finds estimates of model parameters that are most likely to give rise to the pattern of observations in the sample data" (Pampel, 2000, p. 40). This statistic provided an overall indication of how well the estimates for the parameters in the model fit the data (Cabrera, 1994). The best fitting model would be the one that yields a significantly smaller G^2. The G^2 statistical test compares the differences in G^2 between two alternative models; reductions in G^2 figures with an associated p-value less than .05 indicate that the model accounted for a significant improvement of fit.

Using G^2 associated with a particular logistic regression model whereby variables were added in a sequential manner (to the base model) comprises the hierarchic stepwise process. The validity of the added variables was assessed as to its contribution in explaining the criterion (persistence) and improving the fit of the model (Cabrera, 1994). In each case, the two models were compared by computing the difference in their log-likelihoods (Tabachnick & Fidell, 1983). This difference was multiplied by two to create a statistic distributed as chi-square (Tabachnick & Fidell, 1983). Differences in the degrees of freedom for each model were calculated in order to evaluate the chi-square (Tabachnick & Fidell, 1983). The second block of traditional admissions criteria was added next and the analysis repeated. Once completed, the third block of high school course patterns was added and analyzed.

Cabrera (1994) explains that different measures of fit should be taken into account when judging the fit of a particular model. Therefore, several statistical indicators were used in assessing the goodness of fit of the model: summary statistics (X^2) for the overall fit of the model, pseudo "R^2", the G^2 / degrees of freedom ratio and the proportion of cases correctly predicted by the model (PCP). Cabrera (1994) explains that the pseudo R^2 represents the proportion of error variance produced by an alternative model in relation to the base model. The ratio of the G^2 to its degrees of freedom provides an additional indicator of how well the model fit the data. A G^2 / degrees of freedom ratio less than 2.5 were interpreted as indicating a good fit (Cabrera, 1994). Tabachnick and Fidell (1983) explain that a large proportion of cases correctly predicted (PCP) would indicate that the model provides a good fit for the data. The PCP involved a comparison between the number of cases that the model predicted as being either 0 (non-persist) or 1 (persist) against the observed distribution of the sample size.

Odds-ratio statistics were used to estimate the overall change in the dependent variable. The statistical significance of each variable in explaining persistence were determined by calculating the individual coefficient estimates and their corresponding standard errors for each variable within a block (Cabrera, 1994). In order to compare contributions made by each variable, beta weights were calculated for each variable. Odds-ratio statistics were used to assess the marginal effect of each of the statistically significant corresponding variables on persistence. Interpretation of the odds-ratio for continuous variables signified the change in probability on the outcome variable resulting from a unit increase on the independent variable (Cabrera, 1994). Variables from the blocks which are not found significant in improving the fit of the model and those variables in which the entire block were not found to improve the overall fit of the hypothesized model were not included in the odds-ratio analysis.

In sum, data analysis followed a hierarchical process whereby variables were added in a sequential manner (to the base model) from all three blocks. The validity of the added variables was assessed as to the contribution of each of the variables in explaining the criterion measure (persistence) in order to improve the fit of the model. Multiple indicators were used to assess the goodness of fit of the model.

CHAPTER IV. RESULTS

Overview

This chapter describes the results found through this study of high school course patterns and their relationship to academic achievement and persistence. First, a pre-condition selection criterion was applied to the dataset that included only students enrolled full time in the first semester of entry and completed greater than 10 hours. This selection criterion was utilized to assist as a control value on the university dataset. Next, the demographic characteristics were compiled and analyses were conducted in several stages: 1) examination of the distributional properties of the independent and dependent variables; 2) the determination of the "best fit" predictor variables that add value to predict the dependent variable academic achievement by utilizing a hierarchical block approach for the multiple regression technique; and 3) the same determination toward the dependent variable persistence by utilizing a hierarchical block approach logistic regression technique. The validity of the added variables from the hierarchical process in both models was assessed for the strength of the contribution, as well as, the goodness of fit for each block within the models.

Using institutional records, the population included first-time enrolled students for the summer and fall of 2004, 2005, 2006, 2007 and 2008 semesters. Only first-time, full-time freshmen students were included. Approximately 2144 students met the population description.

Dataset Selection

In an effort to assure an increase in the integrity of the dataset, a precondition variable (students must have earned greater than 10 semester credit hours), was utilized.

It has been found that students who earned greater than 10 semester credit hours during their first term of enrollment at a university had a greater baccalaureate graduation rate of [between 66 and 67 percent] (Adelman, 2004). All students who did not earn more than 10 hours by the end of the first fall semester were excluded from the study. This criteria decision yielded a final sample size of 1707.

The proportions of the sample after de-selection were very similar to the population proportions, as can be seen in Table 2. The 1707 participants consisted of 18.3% from the 2004 cohort, 22.5% from the 2005 cohort, 17.7% from the 2006 cohort, 18.9% from the 2007 cohort and 22.6% from the 2008 cohort. There were 1002 (58.7%) males and 705 (41.3%) females. The study sample was comprised of 80.1% non-minority students and 19.9% non-white or minority participants. The admissions status for both the population and sample were similar with the sample resulting in 10% "top ten percent" students, 75.2% unconditional admissions and 14.8 % admitted on a provisional basis. The SAT mean for the sample (which included students who took the ACT whose scores were converted to SAT equivalents) was 1085 (combined math and verbal score). The two noticeable changes in the demographic characteristics included the students who were ranked in the first quarter of their high school and the students who were admitted provisionally. The proportion of the sample of students ranked in the first quarter dropped from 35% in the population to 22%, and the proportion of provisional admits dropped from 16.7% in the population to 14.8% in the sample. These differences are presented in Table 2, which provides a comparison of key characteristics for both the population and the study sample.

Table 2

Demographic Characteristics of the Study Population Compared to the Sample

Participants	Population N=2144		Sample N=1707	
2004[a]	420	19.6%	312	18.3%
2005[a]	454	21.2%	384	22.5%
2006[a]	373	17.4%	302	17.7%
2007[a]	425	19.8%	323	18.9%
2008[a]	472	22%	386	22.6%
Male	1308	61%	1002	58.7%
Female	836	39%	705	41.3.%
White	1724	80.4%	1368	80.1%
Non-White	420	19.6%	339	19.9%
Texas Residents	1884	87.9%	1485	86.9%
Admit Status				
Top Ten %	204	9.5%	170	10%
Regular Admit	1582	73.8%	1284	75.2%
Provisional	358	16.7%	253	14.8%
SAT Mean	1080		1085	
High School Rank				
First Quarter	750	35%	377	22%
Top Half	1441	67.3%	1144	67%

Note a. includes the summer and fall term if appropriate for the first semester.

Distributional Properties

In the first stage, frequency and distributional properties were computed for all of the variables. Properties such as count, mean, median, mode, minimum, maximum, standard deviation and indices of skewness were computed for the ratio/interval variables as shown in Table 3. This included the dependent variable, academic achievement (first year grade point average) and two of the predictor variables; SAT test scores and total college credit earned while enrolled in high school. The absolute value of the indices of skewness ranged from 2.017 to 9.06 for two of the ratio/interval variables but the total college credits earned index was 54.288. For the most part the indexes were relatively small (below 10). All variables with an index of skewness over 2.5 were examined. It was determined, for the purposes of this study, to treat them as normal distributions. For example, the first year grade point average index of skewness was 4.07 The FYGPA mean is 2.69 and ranges from .57 to 4.0. The means for the applicable predictor variables (as seen in Table 3) were 66.17% for high school rank, 1085 for SAT test scores and 4.91 hours for total credits earned while enrolled in high school. Frequency computations (Table 4) were compiled for the remaining dichotomous dependant variable, persistence and the remainder of the predictor coded variables; gender, ethnicity, math, science, English and foreign language. Table 4 summarizes the distribution of the values by grouping the data according to the selected coding schemes for this study of either 0/1 or 1/2/3 (legends for coding are listed in the notes for Table 4).

Table 3

Distributional Statistics for First Year GPA, Rank, Test Scores & Total Credits

		FY GPA	HS Rank %	SAT Scores	Total Credits
N	Valid	1707	1672	1707	1707
	Missing	0.00	35	0.00	0.00
Mean		2.692	66.17	1085.69	4.91
Median		2.7	69.50	1080.00	.00
Mode		4.0	81	1110	0.00
Minimum		.57	2	650	0.00
Maximum		4.0	100	1540	81
Standard Deviation		.68	20.59	129.35	9.11

The course sequences, which were coded increasing in rigor from 1 to 3, reflected that the majority of the students took the mid-level academic course sequence [math (56.8%), English (51%) and science (45.2%)] rather than the more rigorous option [math (29.5%), English (34%) and science (16.3%)] or the least rigorous option of general course requirements [math (13.6%), English (15%) and science (38.5%)]. For foreign language, over half of the students took the academic rigorous path at 52.5%.

Table 4

Frequency Distributions of Dichotomous Dependent Variable and Coded Predictor Variables

	N	0*	1*	General**	Academic**	Rigorous**
Persist	1707	14.8% (253)	85.2% (1454	13.6% (233)		
Gender	1705	58.7% (1002)	41.2% (703)			
Ethnicity	1707	19.9% (339)	80.1% (1368)			
Math	1707			56.8% (970)	29.5% (504)	56.8% (970)
Science	1707			38.5% (657)	45.2% (771)	16.3% (279)
English	1707			15% (256)	51% (871)	34% (580)
For. Lang.	1707			2% (34)	45.5% (777)	52.5% (896)

*Note: Coding as Follows: Persist (0 = Non-Persist, 1 = Persist), Gender (0 = Male, 1 = Female), and Ethnicity (0 = Non-White, 1 = White) and **1 General = minimum requirements; **2 Academic = 4 years of Math (including Pre-Calculus), Science and English and 2 Years of Foreign Language; and **3 Academic Rigorous = 5 years/credits including Calculus for Math and Biology, Chemistry and Physics plus and advanced credit for Science.

What is the contribution or impact of different high school course patterns on the academic achievement in the first year of college?

To answer the first research question, multiple regression techniques were used to examine the relationship between academic achievement and the 9-predictor variables. The measures examined to determine fit were PEARSON correlations, the overall fit of the model, and beta coefficients for each of the three blocks. The process included a hierarchical approach with three blocks of like data: 1) demographic data; 2) traditional criteria data; and 3) high school courses and course pattern data.

Correlation analysis.

Pearson correlations of all the variables (including both the dependent and predictor variables) were examined, as presented in Table 5. “This statistic indicates the strength, direction, and significance of the association between the predictor variables” (Aspelmeier & Pierce, 2009, p. 154). All of the correlations were considered significant ($p < .05$) except science when correlated with first year grade point average ($p = .146$). The correlation from rank to FYGPA demonstrated some strength at .294. SAT had a slightly stronger fit with FYGPA at .320. Math showed a similar fit with FYGPA at .2, rank at .229 and SAT at .324. English did show strength with FYGPA at .299 and had the strongest fit of the correlation run with rank at .379. Total college credits earned while in high school correlated with FYGPA at .217, rank at .275 and a little stronger fit with SAT at .3. Although the rest of the correlations were significant, they represented weaker relationships with other predictor variables calculating Pearson Correlations less than .2. This linear dependence between the predictor variables may indicate an area for future success research.

Table 5

Pearson Correlations of Dependant and Predictor Variables

	FYGPA	RANK	SAT	MATH	SCIENCE	ENGLISH	FOREIGN LANG	CREDITS
FYGPA	1.000							
RANK	.294**	1.000						
SAT	.320**	.133**	1.000					
MATH	.200**	.229**	.324**	1.000				
SCIENCE		.100**	.119**	.145**	1.000			
ENGLISH	.299**	.379**	.158**	.143**	.108**	1.000		
FOR LANG	.120**	.154**	.144**	.176**	.081**	.050*	1.000	
CREDITS	.217**	.275**	.300**	.191**	.114**	.147**	.126**	1.000

Note. ** = $p < .001$ and * = $p < .05$

Hierarchical regression analyses.

To discover the amount of variability that high school courses and course patterns have on academic achievement, a hierarchical regression approach was used. This technique allows for a series of hierarchical regression analyses to be run utilizing predictor variables that have been grouped into similar types to be examined with academic achievement. The analyses resulted in three models that were run in succession as demographic variables, demographic and traditional criteria, and demographic, traditional criteria and course patterns.

The first step in the hierarchical analyses was the addition of the demographic variables (gender and ethnicity) to the academic achievement base model. As a block, both gender and ethnicity demonstrated a correlation with academic achievement (R = .122), as shown in Table 6. The relationship further produced the *R* square (R^2) statistic of .015, which represents the multiple squared correlation between actual and predicted values between the demographic predictor variables and FYGPA. This result shows that gender and ethnicity only accounted for approximately 1.5% of the variance. The change statistic (R^2 changed) for Model 1 indicates a slight increase of 1.5% in the proportion of variability from the base model.

The next step in the hierarchical regression analyses was to add traditional criteria (rank and test scores) to the demographic variables. Both rank percentile and scholastic achievement test scores in combination with gender and ethnicity were found to have predictive value toward academic achievement ($R^2 = .169$, $p < .001$).

Table 6

Prediction of Academic Achievement (FYGPA) from Demographic Variables

					Change Statistics				
1	*R*	R^2	Adj R^2	Std. Error of The Estimate	R^2 Change	F Change	df1	df2	Sig. F Change
	.122[a]	.015	.014	.671364	.015	12.500	2	1667	.000

a. Predictors: (Constant), Gender Coded, WHITE/NONWHITE

Tale 7 shows a comparison of Model 1 to Model 2 resulting in the added variables (rank and test scores) creating an R^2 change of .154. This increase in variability created a model that accounts for 16.9% of the variance. An "F-test of the significance of the change in the proportion of the variability accounted for" was

Table 7

Prediction of Academic Achievement (FYGPA) from Demographic & Traditional Variables

					Change Statistics				
	R	R^2	Adj R^2	Std. Error of The Estimate	R^2 Change	F Change	df1	df2	Sig. F Change
1	.122[a]	.015	.014	.671364	.015	12.500	2	1667	.000
2	.411[b]	.169	.167	.617118	.154	153.975	2	1665	.000

a. Predictors: FYGPA, Gender, White/Non-White
b. Predictors: FYGPA, Gender, White/Non-White, Test Scores, Rank

also completed as a portion of the change statistics resulting in an F value of 153.975 ($p <$ .001). This test indicated a "unique contribution" of rank and test scores in addition to gender and ethnicity predicting first year grade point ratio (Aspelmeier & Pierce, 2009, p. 178).

The standardized coefficients are shown in Table 9. These *Beta* coefficients are an additional statistic that assists in determining which of the individual predictor variables had a greater effect (strength and direction) on academic achievement (Aspelmeier & Pierce, 2009). The beta weights for rank (.245, p < .001) and test scores (.285, p < .001) did confirm the Step 2 Model results demonstrating they held predictive value toward academic achievement. It is also clear from Tables 5, 7 and 9 that both rank and test scores are showing the tightest fit with both the dependent variable, as well as, the other predictor variables (specifically math, English and college credit earned while enrolled in high school) individually.

In the final step of the hierarchical regression analyses, the high school course pattern variables were added (math, science, English, foreign language and total college credits earned while enrolled in high school). The course patterns only demonstrated a slight increase in variability with academic achievement ($R^2 = .207$, $p < .001$). As shown in Table 8, the high school courses math, science, English, foreign language and college credit earned while enrolled in high school were analyzed and demonstrated a R^2 change statistic of .038. The F-test did support the small increase in proportion of variability for the addition of high school courses to the overall model (F = 16.033, $p < .001$). At best, the nine predictor variables have demonstrated predictive value toward academic achievement 20.7% of the time.

Table 8

Prediction of Academic Achievement (FYGPA) from Demographic, Traditional Variables and High School Course Patterns

					Change Statistics				
	R	R^2	Adj R^2	Std. Error of The Estimate	R^2 Change	F Change	df1	df2	Sig. F Change
1	.122[a]	.015	.014	.671364	.015	12.500	2	1667	.000
2	.411[b]	.169	.167	.617118	.154	153.975	2	1665	.000
3	.455[c]	.207	.203	.603642	.038	16.033	5	1660	.000

a. Predictors: FYGPA, Gender, White/Non
b. Predictors: FYGPA, Gender, White/Non, Test Scores, Rank
c. Predictors: FYGPA Gender, White/Non-White, Test Scores, Rank, Science, Foreign Language, College Credits, Math, English

In Step 3, the beta weights for rank (.158, $p < .001$) and test scores (.231, $p < .001$) did confirm the predictive value (although weaker) as shown in Step 2. English had a standardized beta coefficient of .185 ($p < .001$) that more than likely accounted for most of the 3.8% increase in variability computed upon the addition of the course pattern variables. Math (.052, $p < .05$) and college credit earned while enrolled in high school (.067, $p < .05$) did show some weak predictive value to academic achievement. Science had a negative beta coefficient (-.157, $p < .05$) indicating, with all other predictor variables kept constant, that science courses have a negative or null impact on academic achievement. Foreign language course patterns did not have a significant standardized beta coefficient.

Summary of Regression.

The multiple regressions followed a hierarchic process to determine if there was a significant relationship between high school courses and course patterns. Pearson correlations were examined to determine relationships between the variables (Aspelmeier & Pierce). All of the correlations were significant except the relationship between

Table 9

Effects of the Predictor Variables on Academic Achievement – Multiple Regression

Criteria	Step One *(Beta)*	Step Two *(Beta)*	Step Three *(Beta)*
Ethnicity	.089**	.027	.024
Gender	.090**	.035	.013
Rank		.245**	.158**
Test Scores		.285**	.231**
Math			.052*
Science			-.057*
English			.185**
Foreign Language			.039
College Credit			.067*

Note: ** = $p < .001$ and * = $p < .05$

science and FYGPA ($p = .146$). Interestingly, all correlations over .3 were either with test scores (FYGPA, math and college credits) or rank (English). The correlation between rank and English demonstrated the strongest relationship at .379 ($p < .001$).

As for the hierarchical analyses, the model gained strength, although weak in all three steps. In Step 1 the demographic variables produced an R^2 statistic of .014. When the traditional criteria was added in Step 2, the overall model gained the greatest strength at R^2 = .154. The course patterns that ran in Step 3 computed a weak R^2 = .038. The model realized a prediction value of R^2 = .207. These findings show that the nine predictor variables have demonstrated predictive value toward academic achievement 20.7% of the time.

Beta weights were also examined for each of the predictor variables. Used as an alternative statistic to identify relationships, these statistics confirmed similar predictive values produced by the model.

What is the contribution or impact of different high school course patterns on persistence to the second year of college?

Stage 3 of this study required the use of logistic regression techniques to determine which, if any, of the same predictor variables assisted in the prediction of persistence to the sophomore year of college. Due to the dichotomous nature of persistence, persist (coded 1) or non-persist (coded 0), it was necessary to use a regression model technique that transforms nonlinear relationships into linear relationships such as logistic regression.

In an effort to determine the goodness of fit of the model, four different measures were utilized: 1) summary statistics (X^2) for the overall fit of the model; 2) pseudo R^2; 3) -2 log likelihoods; and 4) the proportion of cases correctly predicted by the model (PCP) (Cabrera, 1994). In addition, the odds ratio for the predictors (exponentiation of the coefficients) were computed to estimate the overall likelihood of predicting persistence.

Hierarchical logistic regression analyses.

A hierarchical logistic regression analysis was conducted to examine the predictive value of demographic, traditional criteria and high school coursework admissions criteria to persistence. The analyses was designed to proceed sequentially in 3 steps; 1) demographic variables (gender and ethnicity); 2) traditional criteria (rank percentile and scholastic achievement percentile; and 3) high school courses and course patterns.

Prior to beginning with the predictor variables, it was necessary to run the dependent variable, persistence, to establish a base model. In the case processing summary, it was determined that there were 37 missing cases out of the 1707 sample cases, leaving 1670 students to be analyzed in this model. The first values derived in the base model provided the baseline (initial decision points) for the binary decision of persist (1423) or non-persist (247).

In step one, the demographic variables were added to the persistence baseline. In this initial regression, the demographic variables did not show significance in either the chi-square or odds-ratio "goodness of fit" tests. This indicated that neither of these variables had predictive value toward persistence. In addition, the -2 log likelihood value was 1398.303. "This statistic measures how poorly the model predicts the decisions – the smaller the statistic the better the model" (Wuensch, 2009, p. 4). By including the demographic variables, the -2 log likelihood decreased (1399.648 – 1398.303) only by 1.345. The level of the -2 log-likelihood and the fact that it remained nearly constant indicates a poor fit with persistence. The Cox and Snell R^2 (pseudo R) statistic of .001 and the Nagelkerke R^2 (pseudo R) statistic of .001 show a minute percentage of likelihood to be able to predict persistence. Table 10 shows the odds ratio (Exp B) for this step was computed as 5.684 ($p < .001$) in comparison to the baseline that computed at 5.761 ($p < .001$). This indicates a slight decline from the baseline. The odds ratio for gender computed as .871 ($p = .320$) and for ethnicity at 1.095 ($p = .595$) but neither of the variables in the equation were considered significant. In addition, the model's ability to correctly predict persistence decisions remained unchanged from the baseline at 85% indicating no additional strength was gained from the demographic variables to the relationship with persistence.

In step 2, the traditional criteria (rank and test scores) were added to the first analysis that included both persistence and the demographic variables. The Chi-square for block two (rank and test scores) was 9.215 ($p = < .05$) and increased for the model to 10.560 ($p < .05$), indicating a better fit with the addition of the traditional criteria to the model. The -2 log likelihood value of 1389.088 decreased slightly (1398.303 – 1389.088) by only 6.215, showing that although there is clearly some increased predictive value due to rank and test scores, it is still weak. The Cox and Snell R^2 statistic of .006 and the Nagelkerke R^2 statistic of .011 show a small percentage of likelihood to be able to predict persistence. The odds ratio (Exp B) for block two was computed as .991, but was not considered significant ($p = .988$). In addition, the only variable in the equation in block two that showed even a slight significance was test scores (SATTOT), with an odds ratio value of 1.001 ($p < .05$). In Step 2, gender, ethnicity, and rank were not significant in the odds ratio equation. Once again, the model's ability to correctly predict persistence remained unchanged from block one at 85%, indicating the block is not showing strength in predictive value toward persistence.

In the final regression computation, the high school courses and course patterns were added to the previous sequence of demographic and traditional criteria. The Chi-square for Step 3 (math, science, English, foreign language and college credit earned while in high school) was 17.439 (p = < .05) and increased for the model from 10.560 to 27.999 ($p < .05$), indicating an increased fit with persistence. The -2 log likelihood value of 1371.649 decreased again (1389.088 – 1371.649) by 17.439 also indicating increased fit. Even though very small, the Cox and Snell R^2 statistic of .017 and the Nagelkerke R^2 statistic of .029 show the largest percentage of likelihood to be able to predict persistence among the three blocks. As seen on Table 10, the odds ratio (Exp B) for block three was computed as 1.150 but was not considered significant (p = .839).

In addition, the only variable in the equation in block three that showed significance was college credit earned whiled enrolled in high school (TotalCredits), with an odds ratio value of 1.035 ($p < .05$). With the TotalCredits odds ratio value resulting over 1 (1.035), it indicates that the odds of persisting increase when students take more college credit while enrolled in high school (Menard, 1995). The math odds ratio computed as 1.233. Although it did not meet the stringent significance of p < .05, it was close at p = .077 and does generate some notice. The odds ratio values for each of the predictor variables were listed in Table 10. In this step, gender, ethnicity, rank, test scores, science, English and foreign language odds ratios were not significant in the equation. As in the other two steps, the model's ability to correctly predict persistence remained unchanged from the baseline at 85%.

Table 10

Effects of Admissions Criteria on Persistence – Logistic Regression

Criteria	Block One *(Exp B)*	Block Two *(Exp B)*	Block Three *(Exp B)*	Block Three (Sig.)
Ethnicity	1.095	1.001	1.043	.810
Gender	.871	.852	.814	.172
Rank		1.004	1.000	.956
Test Scores		1.001*	1.001	.311
Math			1.233^t	$.077^t$
Science			1.078	.464
English			.971	.795
Foreign Language			1.159	.269
College Credit			1.035*	.003*

Note: * = $p < .05$ and $^t = p < .1$

Summary of Logistic Regression

The logistic regression followed a hierarchic process to determine if there was a significant relationship between high school courses and course patterns. Although the Chi square goodness of fit statistic was insignificant for the first step, steps two and three were significant ($p < .05$). There was an increased fit as steps two and three were added with values in sequential order as 1389.088 and 1371.649. The X^2 statistic, if significant, provides that the overall fit of the model is improved by the addition of the variables in the blocks where the chi-square was significant.

Both the Cox & Snell R^2 and the Nagelkerke R^2 were both analyzed. "The Cox & Snell R^2 can be interpreted like R^2 in a multiple regression, but cannot reach a maximum value of 1. The Nagelkerke R^2 can reach a maximum of 1" (Wuensch, 2009, p. 4). The values for both R^2 were very small with the Nagelkerke R^2 showing only approximately 3% likelihood of predicting persistence from the model. The -2 log likelihoods are considered desirable if the values decrease as the blocks are added. In this study the -2 log likelihoods did decrease with each additional block as follows in sequential order: 1398.303, 1389.088 and 1371.649. However, the decrease overall was very small.

Tabachnick and Fidell (1983) explain that a large proportion of cases correctly predicted (PCP) would indicate that the model provides a good fit for the data. The PCP involved a comparison between the number of cases that the model predicted as being either 0 (non-persist) or 1 (persist) against the observed distribution of the sample size. The PCP from all four blocks (block 0 through block three) remained constant at 85.2 (85%). Usually, if the fit is increasing with each additional block, the PCP value will increase. Whereas in this case the goodness of fit measures that were significant reported only slight increases in predictive value and the PCP did not increase. The logistic regression in this study utilizing the hierarchical technique only supported one predictor, college credit earned while in high school (TotalCredits), and that relationship to persistence is weak at best.

Chapter V. DISCUSSION AND CONCLUSION

Introduction

College and university admissions officers are in a difficult position as they seek effective admissions credentials, which can assist in predicting freshmen success and persistence to graduation. In light of the current expectations of a large influx of students into education in Texas (Texas Higher Education Coordinating Board, 2006), the State mandated a more rigorous high school curriculum effective May 2011 (Texas Education Code, 2008; 2009). The objective of this study was to describe the relationship between admissions selection criteria such as high school class rank, standardized scholastic aptitude, high school courses and course combinations and the academic achievement and persistence of first-time full-time college freshmen.

This chapter will discuss the contributions and impacts of the admissions criteria on both academic achievement and persistence. The nine admissions criteria variables selected for this study (gender, ethnicity, high school rank, standardized test scores, math course sequences, science course sequences, English course grade, foreign language courses and college credit earned while in high school) were analyzed for success using regression techniques for their relationship to academic achievement and persistence. After the findings of these analyses are discussed, implications of the results and suggestions for future research will be presented.

The Contribution and Impact of Different High School Course Patterns on the Academic Achievement in the First Year of College

This study found a weak predictive contribution toward academic achievement from the course pattern variables. With acknowledging this weak relationship, the variables that demonstrated the strongest relationship to academic achievement were rank and test scores, which accounted for 16.7% of the variance. Both gender and ethnicity contributed minute predictive value. At only a 20.7% total, it appears that university administrators still have factors to investigate to determine what additional criteria will create a tighter relationship to success.

With the demographics in Texas changing rapidly toward a more diverse population, success solutions must be found for underrepresented students. The top 10% rule (Texas Education Code, 1997; 2009) and current Closing the Gaps efforts (Texas Higher Education Coordinating Board, 2010) are policies to assure access but not necessarily success. In this regard, the study included both ethnicity and gender variables to examine their relationship to academic achievement. In addition, the relationships with the other predictor variables are another way to gain understanding of their impact toward success. This study found very weak relationships with the demographic variables (1.5%).

The findings for traditional criteria, while small, are nonetheless revealing in many ways. First, with all the touting that test scores are not valid to predict first year success (Mouw & Khanna, 1993) and that they should not be used due to various biases (Atkinson, 2001; Guinier, 2001; Lawlor, et al., 1997; McDonough, 1994; The Journal of Blacks in Higher Education, 2005/2006), the results of this study show test scores as the strongest predictor of success in all three measures (model fit, Pearson Correlations and Beta Coefficients). Other studies of standardized tests as predictors of academic achievement in college have found similar results for test score predictive value between 20% and 30%. At this level of prediction, it should not be considered strong enough to be a stand alone predictor of first year success (Hu, 2002; Linn, 1990; Mouw & Khanna, 1993). Studies continue to find that test scores are a valid predictor (Hezlett, Kuncel, Vey, Ahart, Ones, Campbell & Camara, 2001; Kirkup, Wheater, Morrison & Dublin, 2010; Speyer, 2004). Researchers continue to search for other criteria that, when added with test scores and other known criteria, create a better model for predicting achievement. For the subject institution, they will have to take recommendations that test scores be used with caution (National Center for Fair and Open Testing, 2003) and analyze in what part of the admissions process they should be utilized.

This same concept can be applied to rank that demonstrated the second strongest relationship to academic achievement. It has been clearly shown in the literature that rank (and high school grade point average) has been an indicator of academic performance and predictor of success in college (Astin, 1971; Benford & Gess-Newsome, 2006; Ruban & Nora, 2002; Zwick, 2007). The reliance on these results are often mixed with the realization that transcripts are non-standardized, grades are computed with unequal weightings and inconsistent ranking formats (or not ranking) occur across schools. Although there was apparent prediction value, these inconsistencies make comparing and using such rankings difficult (Cizek, 2000; Ziomek & Svec, 1995). With this knowledge, researchers have tried to find ways to use rank more comprehensively in combination with other factors to predict success (Hosler & Anderson, 2005; Ruban & Nora, 2002). This is an area that may warrant additional examination by the researching institution.

The research institution expected similar predictive value of the traditional criteria as they had experienced in a 2002 study (r^2 = .23), but more research was required to determine a stronger model for freshmen admissions (Grefenstette-Moon, 2002). By examining high school curricula, specifically core curriculum course patterns, in conjunction with traditional criteria, they were hoping the fit with academic achievement and persistence might be improved. Although the study found weak relationships between academic achievement and course patterns, it did indicate potential relationships between predictor variables that would benefit from a closer look. For example, both test scores (.324) and rank (.229) have moderate correlations as evidenced in this study to math (Adelman, Daniel & Berkovits, 2003; Choy, 2002). ACT states "less than half of all students take the courses they need to be prepared in mathematics and science" (ACT, Inc., 2005b, p. vi). Math did correlate with first year grade point ratio (.20, $p < .001$), but did not provide additional strength to the model once test scores and rank were added. This could indicate some colineararity between these variables.

The relationship between test scores and individual courses in college has also been examined by the testing agencies. ACT has found if students score a 22 on the ACT Science exam, they have a 75% chance of earning a grade of C or better in college biology and algebra classes (ACT Activity, 2004). Ruban and Nora found students who enrolled in high school calculus were 28 times more likely to be successful in college (2002). Tai and Sadler (2001) found students did better in math based physics if they had completed calculus in high school. The literature is more clear when high school math and science are examined together. It has been found that a student's achievement in high school math and science corresponds to their achievement in college (Ruban & Nora, 2002). This was confirmed by Hart and Cottle (1993) when they found if students took a high school physics class and made high grades in high school math, they were more likely to be successful in college level physics (also see Sadler & Tai, 2001). In this study, science did not correlate to the cumulative first year grade point ratio. Further study may be needed to look at high school coursework and their predictability toward individual college course achievement.

On the other hand, English course grades (.299, $p < .001$) and foreign language (.120, $p < .001$) did show significance. Some other studies that have shown relationships with other admissions criteria included high school English grades predicting college level biology (Benford & Gess-Newsome, 2006) and foreign language courses increasing success in college level English (ACT, Inc., 2005b).

The last variable studied in the regression analysis was total credits earned while enrolled in high school, which correlated with first year grade point ratio at .217 ($p < .001$). These courses have been shown to increase the rigor of high school course experiences (Karp & Hughes, 2008; Manzo, 2007). They are also believed to improve the transition to college (Holstead, Spradlin, McGillivray & Burroughs, 2010). The Texas Higher Education Coordinating Board found students who took college courses during high school earned more college credits their first year, higher freshmen grade point averages and they earn degrees at higher rates (2008a; 2008d). Although the goodness of fit of the model with total credits was only slightly better, the relationship to academic achievement was present and significant indicating that it may be worthwhile looking at this relationship further in future studies.

The Contribution and Impact of Different High School Course Patterns on Persistence to the second Year of College

This study resulted in only one predictor variable that showed any strength to estimate the likelihood of persistence. Although very slight at an in odds (B) statistic of .035 ($p < .05$), college credit earned while enrolled in high school was identified. The high school patterns of math, science, English and foreign language did not improve the predictive validity of the model and were not significant. Rank was also found not significant and test scores, although significant, indicated a very small (between 1% and 2%) ability to predict persistence.

Pre-college academic factors have been examined in past studies, but researchers of persistence have found they are more useful in the prediction puzzle when they are combined or nested with other criteria (Bandura, 1997; Bandura & Cervone, 1986; Nora, 1990, 2003; Tinto, 1975, 1987). Academic success is a necessary factor in higher education in order to persist to graduation. Many studies have looked at the same pre-college variables for both academic achievement and persistence (Astin & Oseguera, 2005; Nora, 2003; Nora & Cabrera, 1996; Glynn, Sauer & Miller, 2006; Tinto, 1987, 1997).

Regarding the demographic variables, literature demonstrates that minority students are more likely to leave their institutions (Ishitani & Snider, 2004). In this study, however, the ethnic variable was not considered significant to the persistence model. There have also been studies that examined gender in relation to standard achievement tests (Langenfeld, 1997). The literature has shown studies where females perform better than males in college (Lahmers & Zulauf, 2000) but are outperformed by males on the SAT and ACT (Bridgeman & Lewis, 1996; Linn, 1990). This was not seen in this study as neither ethnicity (p = .545) nor gender (p = .301) proved significant.

In examining the results of the traditional criteria variables, it was found that test scores were significant ($p < .05$) but indicated a weak relationship. Studies show that test scores (Nora & Cabrera, 1996) and rank (Glynn, Sauer & Miller, 2006) explained the greatest proportion of persistence (Astin, 1997). In contrast, the study did not find rank significant but researchers such as Ishitani and Snider (2004) found students that ranked in the 4^{th} quarter were 2.5 times more likely to depart than students ranked in the first, second and third quartiles. The statistical insignificance of rank is somewhat surprising as other studies have reflected the construct to be an effective factor to predict who would persist (Henson & Sanders, 2000; Ruban & Nora, 2002). Some of the insignificance may be attributed to inconsistencies in grade and rank calculations (Cizek, 2000; Ziomek & Svec, 1995). High school graduating class size and course offerings may also be affecting this result.

The last group of variables added to the model were the high school course patterns for math, science, English, foreign language and college credit earned while in high school. With the Texas mandate for a more rigorous curriculum (Texas Education Code, 2008; 2009, §28.002), it has become both important and easier to study whether more rigorous curriculum predicts students to persist to the second year of college. Science, English and foreign language courses, and their sequences, were not considered significant.

Interestingly, math at $p = .077$ was considered statistically insignificant as well. Adelman has found students can increase their chances of a bachelor's degree with each higher level of mathematics course completed in high school (1999). In addition, "Students whose highest level of mathematics in high school was at the Trigonometry, Pre-calculus, or Calculus level had a bachelor's degree completion rates above 60%; for students who completed a Calculus course in high school, the bachelor's degree completion rate was 83%" (Adelman, Daniel & Berkovits, 2003, p. 7). This study does not support such research that states college preparatory mathematics and science classes lead to outcomes in college (Nora & Rendon, 1990; Ruban & Nora, 2002) as was expected.

The only course sequence that did provide slight evidence was college credits earned while enrolled in high school ($p < .05$). Arguably, the increased rigor these courses offer may be preparing the students for college level coursework better than high school level courses (Adelman, 1999; 2006; Holstead, Spradlin, McGillivray & Burroughs, 2010; Karp & Hughes, 2008; Manzo, 2007). Texas is supporting advanced placement and dual credit opportunities as a way to add rigor and challenge to high school curricula (US Code, 2010, §6532; Texas Education Code, 2009, §28.009). This practice has grown significantly (Texas Higher Education Coordinating Board, 2008, 2010; Texas Education Agency News Releases Online, 2010) even with diverse students who do not normally have all of the opportunities available (Buckley & Muraskin, 2009). Of the 1,707 sample students, 681 students completed college credits with a mean of 4.91 credits (standard deviation of 9.108). Although support for including the chosen variables in this study was confirmed by the literature, the final percentage of correctly predicted cases (PCP) for this logistic regression never changed from the base model. There was no improvement in predictive value toward persistence shown for any of the predictor variables in this study.

Implications

This study did not produce any strong predictors of neither academic achievement nor persistence, but it did leave potential implications for practitioners. First, the study did identify a weak relationship between success and test scores. This predictor has seen much debate over the last few years but still holds, as also shown in the literature, to add approximately 20% prediction value. In addition to test scores, rank was the other variable that demonstrated a weak relationship with success. Admissions officers may choose to continue to use test scores and rank in their admissions models until additional factors are identified that demonstrate more strength.

Another area of interest is advanced placement and dual credit courses. College credit earned while enrolled in high school was the only significant predictor, although weak, of the coursework variables found in the logistic regression for persistence. In addition, it did correlate with individual predictor variables such as rank (.275, $p < .05$), test scores (.300, $p < .05$) and first year grade point average (.217, $p < .05$) in the regression for academic achievement. With Adelman's research stating students who earned greater than 10 semester credit hours during their first term of enrollment achieved a greater graduation rate (between 66 and 67 percent) of earning a bachelors degree (2004), perhaps this relationship, regardless of strength at this stage, is pointing to a potential predictor criteria that admissions officers should recommend to high school administrators and students. In addition to assisting local feeder schools with developing these programs, colleges and universities should consider how the variables might be included with admissions criteria.

Lastly, perhaps there were not enough high achieving students in the sample to find a relationship between the coursework patterns and academic achievement and persistence, and the subject institution should review and update their admissions standards requiring higher standards in high school coursework. If the demographics change in Texas as expected (Texas Higher Education Coordinating Board, 2008c; 2010), success predictors for underrepresented students will become critical so administrators may have to develop several admissions models in addition to intervention and remediation programs to foster potential success and persistence.

Future Research

This study was conducted as a starting point for institutions to begin to look at traditional criteria in combination with high school courses and high school course patterns. While there is certainly an abundance of literature on academic achievement and persistence with regard to pre-college academic factors (ACT Inc., 2005a; ACT Inc., 2007; Adelman, 2004; Braxton, 2000; Camara & Schmidt, 1999; Hawkins & Clinedinst, 2006; Herzog, 2005; Horn & Carroll, 1998; Mouw & Khanna, 1993; Pascarella & Terenzini, 2005; Payne, Rapley & Wells, 1973), this study indicated that the research should continue. Researchers should look at curricular patterns that are more rigorous than the new 4 by 4 program mandated by the state to see if increased readiness has more prediction value for success and persistence.

In addition, future studies should include qualitative factors in combination with pre-college academic variables to see if perceived levels of readiness indicate additional strength to the model. Even though most of the coursework was not significant to the dependent variables, they did correlate with each other in various combinations and those might be another source of prediction information. Regardless, students and institutions cannot move forward with an 80% chance of error in predicting success and persistence in higher education. Students and administrators are being pushed to accomplish more rigorous coursework and deserve the continued effort of researchers to find the best possible model to guide them and others in college preparedness and potential success decisions.

The continued efforts to identify prediction models would gain additional strength and confidence if the communication between K-12 and post secondary institutions increased. Higher education administrators and faculty creating better relationships with local high school teachers and counselors in order to keep academic expectations consistent for what preparation is needed to be successful could obtain additional value. In addition, relationships with high school junior and senior students may assist higher education administrators in their discovery of predictor variables.

Limitations of the Study

While this study has indications for both further research and practitioners, there are limitations that may limit the study from being generalized to larger, research institutions. First, there are many factors that occur prior to and during college including illness, injury, alcohol and/or drug abuse, family and financial concerns that limit the ability of the study to predict achievement and persistence.

Another drawback of this study pertains to high school curricula, grade scales, and teacher quality that often vary from school to school. From a theoretical perspective, there are some validity concerns with grade point average and high school rank comparisons between high schools and even programs within specific high schools. It is possible that the variation of academic rigor from course to course could produce students from the same school that have different academic and social characteristics.

The third limitation of the study pertains to the sample and the fact that it is drawn from a single special purpose institution. The population may not be representative of the other institutions of the general college going population.

Lastly, this study pertains to the use of units versus grades for the evidence of high school course and course combination success. The data maintained by the Texas Common Application is measured by course in units completed successfully or being taken concurrently. The only grade recorded in the high school course data file is senior level English. Once high school transcripts are loaded electronically like college and university transcripts are today, grade and achievement levels in high school have the potential to be included in research more often. Further studies need to be conducted regarding college achievement and success to assist administrators and admissions professionals with this very complex issue.

Conclusions

In summary, this study did not provide any additional prediction information toward academic achievement or persistence than was already known. However, it does indicate that predicting success during the first year and persistence to graduation is very complex (Cabrera, Castaneda, Nora, & Hengstler, 1992). There are many things that occur on college campuses that produce multiple outcomes (Nora, 2003). Many studies suggest nesting or combining multiple indicators (Cabrera, Castaneda, Nora, &

Hengstler, 1992; Nora & Cabrera, 1996) in addition to high school curriculum and traditional criteria, including cognitive factors such as self confidence (Bandura, 1997), study skills and commitment (Cabrera, Nora & Castaneda, 1993).

The findings did confirm that high school rank and standardized tests do have some predictive value toward success during the first year of enrollment (Hezlett, Kuncel, Vey, Ahart, Ones, Campbell & Camara, 2001; Speyer, 2004). Studies have indicated test score reliance should be reduced due to biases and unequal opportunities (Guinier, 2001; Lawlor, et al., 1997; The Journal of Blacks in Higher Education, 2005/2006). Perhaps administrators and lawmakers should look for ways to provide consistent opportunities or other testing instruments that diminish ethnic biases since test scores continue to show predictive value toward success (Adelman; 1999, 2006; Schmidt, 1999).

Although the research institution devised this study to find additional factors that would strengthen the rank and test score fit with achievement and persistence, the coursework measures did not add any value. This may be due to the fact that the interval levels developed (general, academic and academic rigorous) were not distinguishable enough and lacking the variability to predict improvement to the model. While the findings are limited, they suggest further study is needed to explore if individual grades in high school courses or other critical high school contributions might yield more significant results.

The researching institution will continue to seek ways to use high school course patterns in their admissions selection models but can accept their use of test scores and rank as valid admissions predictors. As the study only considered students who successfully completed more than 10 hours during the first term, it did show a retention rate of 85% that certainly indicates many strengths of the institution. The test score averages of 1085, rank averaging right in the middle of the second quarter and course achievements at the recommended level demonstrate that the quality of the freshmen class is evident. As a small, special purpose institution, it has the advantages of small classes, high residential population, research level faculties and strong mentorship support. This small collegial university has many qualities that could potentially add strength to future studies in search of additional success and persistence predictors. In summary, research should continue to seek success and persistence indicators so that students can succeed to graduation and institutions of higher education can provide the coursework and programming needed to support them to this goal.

REFERENCES

ACT Inc. (2003). *ACT National Curriculum Survey 2003.* ACT, Inc. Retrieved from http://www.act.org/research/policymakers/pdf/NationalCurriculumSurvey2003.pdf

ACT Inc. (2005a). *Courses count: preparing students for postsecondary success.* ACT Policy Report. Retrieved from www.eric.ed.gov/PDFS/ED500454.pdf

ACT, Inc. (2005b). *The Sensitivity of the ACT to instruction. College Readiness: Issues in College Readiness.* Retrieved from http:/www.act.org/research/policymakers/pdf/2004-3.pdf

ACT Inc. (2007). *Rigor at risk: reaffirming quality in the high school core curriculum.* Issues in College Readiness. Retrieved from http://www.act.org/research/policymakers/pdf/rigor_report.pdf

ACT Inc. (2009). *ACT National Curriculum Survey 2009.* ACT, Inc. Retrieved from http://www.act.org/research/policymakers/pdf/NationalCurriculumSurvey2009.pdf

ACT, Inc. (2010). *The condition of college & career readiness 2010.* ACT, Inc. Retrieved from http:/www.act.org/research/policymakers/cccr10/pdf/ConditionofCollegeandCareerReadiness2010.pdf

ACT Activity. (2004). National ACT scores up but readiness challenge continues. *ACT, Inc.* 24(3), 1-8.

Adebayo, B.A. (1993). Predicting the academic success of re-entry college students from placement test scores: *College Quarterly*. 1 (2): 18-21.

Adebayo, B. (2008). Cognitive and non-cognitive factors: affecting the academic performance and retention of conditionally admitted freshmen. *Journal of College Admission.*

Adelman, C. (1999). Answers in the toolbox: Academic intensity, attendance patterns, and bachelor's degree attainment. *Washington, DC:* U.S. Department of Education, Office of Educational Research and Improvement.

Adelman, C. (2004). National Educational Longitudinal Survey (NELS:88/2000*). U. S. Department of Education.*

Adelman, C. (2004). Principal indicators of student academic histories in postsecondary education, 1972-2000. *Washington, D. C.: U.S. Department of Education*.

Adelman, C. (2006). The toolbox revisited: paths to degree completion from high school through college. *US Department of Education*.

Adelman, C., Daniel, B., & Berkovits, I. (2003). Postsecondary attainment, attendance, curriculum, and performance: selected results from NELS:88/2000 Postsecondary Education Transcript Study (PETS) 2000. E. D. Tabs. *US Department of Education,* National Center for Educational Statistics (ED), Washington, DC.

Alters, B. J. (1995). Counseling physics students: A research basis. *The Physics Teacher*, *33*, 413-415.

Anderson, E. S., & Keith, T.Z. (1997). A longitudinal test of a model of academic success for at-risk high school students. *Journal of Educational Research*, *90*(5), 259-268.

Arbona, C., & Nora, A. (2007). The influence of academic and environmental factors on Hispanic college degree attainment. *Review of Higher Education*, *30*(3), 247-269.

Arnone, M. (2003). The Wannabes. *Chronicle of Higher Education, 49*(17), A18-A20.

Aspelmeier, J. E. & Pierce, T. W. (2009). *SPSS: A user-friendly approach.* New York, NY: Worth Publishers.

Astin, A. W. (1971). Predicting academic performance in college. *New York: Free Press.*

Astin, A. W. (1972). A degree and what else? *Educational Studies, 3*(4), 232.

Astin, A. W. (1997). How "good" is your institution's retention rate? *Research in Higher Education, 38*(6), 647-658.

Astin, A.W. & Oseguera, L. (2005). Pre-college and institutional influences on degree attainment. In *College Student Retention: Formula for Student Success,* edited by A. Seidman. Westport, CT: Praeger Publishers.

Atkinson, R. C. (2001). Rethinking the SAT. *Presidency, 4*(2), 20-27.

Attinasi, L. C., Jr. (1989). Getting in: Mexican Americans' perceptions of university attendance and the implications for freshman year persistence. *Journal of Higher Education, 60*(3), 247-277.

Attinasi, L. C. Jr. (1992). Rethinking the study of the outcomes of college attendance. *Journal of College Student Development*, *33*(1), 61-70.

Attinasi, L. C., Jr. (1994). *Is going to college a rite of passage?* Paper presented at the Annual Meeting of the American Educational Research Association, New Orleans, LA.

Bandura, A., & Cervone, D. (1986). Differential engagement of self-reactive influences in cognitive motivation. *Organizational Behavior and Human Decision Processes, 38*, 92-113.

Bandura, A. (1997). Self-efficacy: The Exercise of Control. *W.H. Freeman and*

Company.

Bean, J. P. (1982). Student attrition, intentions, and confidence: Interaction effects in a path model. *Research in Higher Education, 17*(4), 291-320.

Bean, J. P. (1983). The application of a model of turnover in work organizations to the student attrition process. *Research in Higher Education, 6*(2), 129-148.

Bean, J. P. (1985). Interaction effects based on class level in an exploratory model of college student dropout syndrome. *American Education Research Journal, 22*(1), 35-64.

Bean, J.P. (1990). Why students leave: insights from research. In D. Hossler and associates (eds.), *The Strategic Management of College Enrollments* (pp. 147-169). San Francisco: Jossey-Bass.

Benford, R., & Gess-Newsome, J. (2006). Factors Affecting Student Academic Success in Gateway Courses at Northern Arizona University. Center for Science Teaching and Learning, Northern Arizona University.

Bernholc, A., Baenen, N., & Howell, T. (2000). Advanced placement exam results, 1998-99. Measuring up. (Report No. E&RR-00.21). *Raleigh, NC: Department of Evaluation and Research.* (ERIC Document Reproduction Service No. ED445090).

Biermann, C. A., & Sarinsky, G. B. (1989). Selected factors associated with achievement of biology preparatory student and their follow-up to higher level biology courses. *Journal of Research in Science Teaching, 26*(7), 575-586.

Bishop, J. H. (2003). Nerd harassment and grade inflation: are college admissions policies partly responsible? *Cornell University,* 1-23.

Blanchfield, W.C. (1971). College dropout identification: a case study. *Journal of Experimental Education. 40*, 1-4.

BouJaoude, S. B., & Giuliano, F. J. (1994). Relationships between achievement and selective variables in a chemistry course for nonmajors. *School Science and Mathematics, 94*(6), 296-302.

Braxton, J. M. (Ed). (2000). *Reworking the student departure puzzle.* Nashville, TN: Vanderbuilt University Press.

Braxton, J. & Lien, L. (2000). The viability of academic integration as a central construct in Tinto's internationalists theory of college student departure. In J. Braxton (Ed) *Reworking the student departure puzzle.* Nashville: Vanderbuilt University Press, 11-28.

Braxton, J., Sullivan, A., & Johnson, R. (1997). Appraising Tinto's theory of college student departure. *J.C. Smart (Ed.) Higher education: Handbook of theory and research, 12*.

Bridgeman, B. & Lewis, C. (1996). Gender differences in college mathematics grades and SAT-M scores: a reanalysis of Wainer and Steinberg. *Journal of Educational Measurement, 33*, 257-270.

Bridgeman, B., Pollack, J., & Burton, N. (2004). Understanding what SAT reasoning test scores add to high school grades: a straightforward approach. (College Board Research Report No. 2004-4). *New York: College Entrance Examination Board*.

Buckley, P., & Muraskin, L. (2009). Graduates of Denver public schools: college access and success. *Denver Public Schools.*

Burton, N.W. & Ramist, L. (2001). Predicting long-term success in undergraduate school: A review of predictive validity studies. Princeton, N.J.: Educational Testing Service.

Cabrera, A. F. (1994). Logistic regression analysis in higher education: an applied perspective. *John C. Smart (ed.), Higher Education: Handbook of Theory and Research, 10*, 225-256.

Cabrera, A. F., Castaneda, M. A., Nora, A., & Hengstler, D. (1992). The convergence between two theories of college persistence. *Journal of Higher Education*, *63*(2), 143-164.

Cabrera, A. F., Nora, A., & Castaneda, M.B. (1992). The role of finances in the persistence process: a structural model. *Research in Higher Education*, *33*(5).

Cabrera, A. F., Nora, A., & Castaneda, M. B. (1993). College persistence: Structural equations modeling test of an integrated model of student retention. *Journal of Higher Education, 64*(2), 123-139.

Cabrera, A. F., Nora, A., Terenzini, P. T., Pascarella, E., & Hagedorn, L. S. (1999). Campus racial climate and the adjustment of students to college: a comparison between white students and African American students. *Journal of Higher Education, 70*(2), 134-160.

Caison, A.L. (2005). Determinants of systemic retention: Implications for improving retention practice in higher education. *Journal of College Student Retention.* 6(4): 25-441.

Camara, W. (1998). High school grading policies. College Board Research Note No. RN-04. *New York: College Board.* Retrieved November 30, 2010 from www.collegeboard.com/research/pdf/high_school_grading_10506.pdf

Camara, W. J., & Schmidt, A.E. (1999). Group differences in standardized testing and social stratification (college board report 99-5). *New York: College Entrance Examination Board*.

Camara, W. & Echternacht, G. (2000). The SAT I and high school grades: Utility in predicting success in college. College Board Report No. RN-10. *New York: College Board.* Retrieved November 30, 2010 from www.collegeboard.com/research/pdf/rn10_10755.pdf

Camara, W.J. (2005). Broadening predictors of college success. In W.J. Camara and E.W. Kimmel (Eds). Choosing students, higher education admission tools for the 21st century. *Mahwah, NJ: Lawrence Erlbaum.*

Carey, K. A. (2004). *A matter of degrees: Improving graduation rates in four-year colleges and universities.* Washington, D.C.: The Education Trust.

Carmichael, J. W. (1986). Predictors of success of black Americans in a college-level pre-health professions program. *Advisor, 6*, 5-11.

Chase, S. (1970). Against a common. *Bulletin of the Atomic Scientist.*

Chaskes, J. (1996). The first-year student as immigrant. *Journal of the Freshman Year Experience & Students in Transition*, *8*(1), 79-91.

Choy, S. P. (2002). *Access and persistence: Findings from 10 years of longitudinal research on students.* Washington, D.C.: American Council on Education, Center for Policy Analysis.

Chronicle of Higher Education. (2007). Report calls for more analysis as college rankings catch on worldwide. A45.

Cizek, G. J. (2000). Pockets of resistance in the assessment revolution. *Educational Measurement: Issues and Practice*, 19, 16-23, 33.

Clarke, M. & Shore, A. (2001). *The roles of testing and diversity in college admissions.* (No. ED 464 535). Boston, MA: National Board on Educational Testing and Public Policy, Lynch School of Education, Boston College.

Conger, S.B. & Tell, C. (2007). Curriculum and assessment systems. In *More Student Success: A Systematic Solution.* Boulder, CO: State Higher Education Executive Officers. Retrieved November 29, 2010 from www.sheeo.org/k16/studsucc2.pdf

Coyner, S. C. (1993). Relationship between academic achievement and preadmission testing criteria for teacher education students at the University of Akron. *ERIC Online Database.*

Craney, C. L., & Armstrong, R. W. (1985). Predictors of grades in general chemistry for allied health students. *Journal of Chemical Education, 62*, 127-129.

Curry, W., MacDonald, W., & Morgan, R. (1999). The advanced placement program: access to excellence. *The Journal of Secondary Gifted Education*, 11, 17-23.

Daempfle, P. A. (2004). An analysis of the high attrition rates among first year college science, math and engineering majors. *Journal of College Student Retention: Research, Theory & Practice*, *5*(1), 37-52.

Dodd, B.G., Fitzpatrick, S.J., De Ayala, R.J., & Jennings, J.A. (2002). An investigation of the validity of AP grades of 3 and a comparison of AP and non-AP student groups (The College Board Research Report No. 2002-9). Retrieved November

28, 2010 from http://www.collegeboard.com/research/pdf/research.report20029v2_18667.pdf

Domer, D. E. & Johnson, A.E., Jr. (1982). Selective admissions and academic success: an admissions model for architecture students. *College and University*, *58*(1), 20-30.

Duranczyk, M. & Higbee, J. (2006). Developmental mathematics in 4-year institutions: Denying access. *Journal of Developmental Education,* 30 (1), 22-31.

Durkheim, E. (1951). *Suicide: A study in sociology.* New York, NY: The Free Press.

Erekson, O. H. (1992). Joint determination of college student achievement and effort: Implications for college teaching. *Research in Higher Education*, *33*(4), 433-446.

Geiser, S., & Santelices, M. (2007). Validity of high-school grades in predicting student success beyond the freshman year: High-school record vs. standardized tests as indicators of four-year college outcomes. University of California, Berkeley, Research and Occasional Paper Series: CSHE.607. Retrieved November 30, 2010 from http://cshe.berkely.edu/publications/docs/ROPS.GEISER._SAT_6.12.07.pdf

Glynn, J.G., Sauer, P.L., & Miller, T.E. (2006). Configurable invariance of a model of student attrition. *Journal of College Student Retention*, 7(3-4), 263-281.

Grefenstette-Moon, C. (2002). Traditional admissions criteria as they relate to freshman success.

Guinier, L. (2001). Colleges should take 'confirmative action' in admissions. *Chronicle of Higher Education*, *48*(16), B10.

Hagedorn, L. S. (1999). Vocational Education and the collegiate ideal: the threat and the challenge of limited resources. *New Directions for Higher Education, 105*, 91-100.

Handwerk, P., Tognatta, N., Coley, R. J. & Gitomer, D. H. (2008). *Access to success: patterns of advanced placement participation in U.S. high schools.* ETS: Educational Testing Service. (Policy Information Report). Retrieved from www.ets.org/research/pic

Hargrove, L., Godin, D. & Dodd, B. (2008). College outcomes comparisons by AP and non-AP high school experiences. *New York, NY: The College Board.*

Hart, G. E. & Cottle, P. D. (1993). Academic backgrounds and achievement in college physics. *The Physics Teacher, 31*, 470-475.

Hawkins, D. & Clinedinst, M. (2006). State of college admission 2006. *National Association of College Admission Counseling.* Retrieved November 30, 2010 from www.nacacnet.org/NR/rdonlyres/4B4C0DF4-BF0A-4B10-89F4-A3D631061305/0/06StateofCollegeAdmissionpdf.pdf

Hebel, S. (2004). Segregation's legacy still troubles campuses. *The Chronicle of Higher Education,* A24-A27.

Helseth, E. A., Yeany, H. R., & Barstow, W. (1981). *Predicting science achievement of university students on the basis of selected entry characteristics.* Paper presented at the 54th Annual Meeting of the National Association for Research in Science Teaching.

Henson, J., & Sanders, N. (2000). Financial Aid in 2010: A cloudy crystal ball. *College Board Review*, 189, 190, 20-25.

Herzog, S. (2005). Measuring determinants of student return vs. dropout/stopout vs. transfer: a first-to-second year analysis of new freshmen. *Research in Higher Education, 46*(8), 883-928.

Hezlett, S.A., Kuncel, N., Vey, M.A., Ahart, A.M., Ones, D.S., Campbell, J.P. & Camara, W.J. (2001, April). *The effectiveness of the SAT in predicting success early and late in college: A comprehensive meta-analysis.* Paper presented at the annual meeting of the National Council on Measurement in Education, Seattle, WA.

Hoffman, J.L., & Lowitzki, K.E. (2005). Predicting college success with high school grades and test scores: limitations for minority students. *Review of Higher Education, 28*(4), 455-474.

Holstead, M.S., Spradlin, T.E., McGillivray, M.E. & Burroughs, N. (2010). The impact of advanced placement incentive programs. *Center for Evaluation & Education Policy: Education Policy Brief*, *8*(1), 1-12.

Hood, D.W. (1992). Academic and non-cognitive factors affecting the retention of black men at a predominantly white university. *Journal of Negro Education*, *61*(1), 12-24.

Horn, L. J., & Carroll, C.D. (1998). Stopouts or stayouts? Undergraduates who leave college in their first year. *US Department of Education*.

Horn, L. & Kojaku, L.K. (2001). High school academic curriculum and the persistence path through college: Persistence and transfer behavior of undergraduates 3 years after entering 4-year institutes. Postsecondary education descriptive analysis reports. (Report No. NCES-2001-163). *Washington, DC: National Center for Education Statistics.* (ERIC Document Reproduction Service No. ED456694).

Horn, L. & Malizio, A.G. (2002). Profile of undergraduates in U.S. postsecondary institutions: 1999-2000. *US Department of Education*.

Horn, L. & Nunez, A. M. (2000). *Mapping the road to college: First-generation students' math track, planning strategies, and context of support (NCES 2000-153).* U.S. Department of Education, National Center for Education Statistics.

Hosler, D. & Anderson, D.K. (2005). The enrollment management process. In *Challenging and Supporting the First-Year Student.* Edited, M.L. Upcraft, J.N. Gardner, B.O. Barefoot, and Associates. San Francisco: Jossey-Bass.

Hossler, D. (1984). Enrollment management: an integrated approach. New York: *College Board Publications.*

Hu, N. B. (2002). Measuring the weight of high school GPA and SAT scores with second term GPA to determine admission/financial aid index--a case study. *ERIC Online Database.*

Ishitani, T. T., & Snider, K.G. (2004). Longitudinal effects of college preparation programs on college retention. *ERIC Online Database.*

The Journal of Blacks in Higher Education. (2005/2006). The growing list of colleges that have rejected the use of the SAT. *The Journal of Blacks in Higher Education, 50* (Winter), 45-46.

Karp, M. M., & Hughes, K.L. (2008). Study: dual enrollment can benefit a broad range of students. *Techniques: Connecting Education and Careers.* 38(7): 14-17.

Keng, L. & Dodd, B.G. (2008). A comparison of college performances of AP and non-AP student groups in 10 subject areas. *Princeton, NJ: The College Board.*

Kirkup, C., Wheater, R., Morrison, J. & Durbin, B. (2010). *Use of an aptitude test in university entrance – a validity study: updated analyses of higher education* *destinations, including 207 entrants*. (National Foundation of Educational Research). Retrieved from http://www.eric.ed.gov/PDFS/ED511392.pdf

Kirst, M. W. & Venezia, A. (2006). What states must do. *Chronicle of Higher Education, 52*(27), p. B36-B37.

Kobrin, J. L., Milewski, G. B., Everson, H., The College Board, Zhou, Y., & Fordham University. (2003). An investigation of school-level factors for students with discrepant high school GPA and SAT scores. *U.S. Department of Education.*

Kobrin, J. L., & Michel, R.S. (2006). The SAT as a predictor of different levels of college performance. *The College Board*. Retrieved from http://professionals.collegeboard.com/profdownload/pdf/06-1007.RD.CB%20Report%20-06-3Cvr.pdf

Lahmers, A. G. & Zulauf, C. R. (2000). Factors associates with academic time use and academic performance of college students: a recursive approach. *Journal of College Student Development, 41(5)*, 544-556.

Langenfeld, T. E. (1997). Test fairness: Internal and external investigations of gender bias in mathematics testing. *Educational Measurement: Issues and Practice, 16,* 20-26.

Lawhorn, J.A. (1971). A study of persisters and dropouts in the secretarial science program at Miami-Dade Junior College. *Unpublished doctoral dissertation, The University of Miami.*

Lawlor, S., Richman, C.L. & Richman, S. (1997). The validity of using the SAT as a criterion for black and white students' admission to college. *College Student Journal, 31,* 507-515.

Linn, R. L. (1990). Admissions testing: recommended uses, validity, differential prediction, and coaching/. *Applied Measurement in Education*, *3*(4), 297-318.

Lent, Brown, & Larkin (1987). Comparison of Three Theoretically Derived Variables in Predicting Career and Academic Behavior: Self-Efficacy, Interest Congruence, and Consequence Thinking. *Journal of Counseling Psychology, 34*, 3, p 293-298.

Manise, J., Blank, R.K., Pewett, C., Potts, A., & Williams, A. (2002). State education indicators with a focus on title I: 1999-2000. *ED Pubs.*

Manzo, K. K. (2007). Students taking more demanding courses. *Education Week, 26*(25), 1, 17.

Mattson, C. E. (2007). Beyond admission: understanding pre-college variables and the success of at-risk students. *Journal of College Admission*, *196*, 8-13.

McCabe, R. H. (2000). *No one to waste: a report to public decision-makers and community college leaders*. Washington, D. C.: Community College Press.

McDonough, P. M. (1994). Competitive advantage for sale: private college counselors and the students who use them. *Association for the Study of Higher Education.*

Merisotis, J., & Phipps, R. (2000). Remedial education in colleges and universities: What's really going on? *The Review of Higher Education, 24*(1), 67-86.

Micceri, T., Brigman, L. & Spatig, R. (2009). Assessing the rigor of HS curriculum in admissions decisions: a functional method, plus practical advising for prospective students and high school counselors. Paper presented at the Annual AIR Forum (Atlanta, GA, May 30-Jun 3, 2009). *University of South Florida.* Retrieved from www.eric.ed.gov/PDFS/ED510111.pdf

Micceri, T. (2010). Assessing the usefulness of SAT and ACT tests in minority admissions. *University of South Florida.*

Miller, M.A. (2006). The legitimacy of assessment. *The Chronicle of Higher Education,* B24.

Miller, T.E. & Herreid, C.H. (2008). Analysis of variables to predict first-year persistence using logistic regression analysis at the University of South Florida. *College and University, 83*(3), 2-11.

Miller, T.E. & Herreid, C.H. (2009). Analysis of variables: Predicting sophomore persistence using logistic regression analysis at the University of South Florida. *College and University: Educating the Modern Higher Education Administration Professional*, *85*(1), 2-11.

Morgan, R. & Maneckshana, B. (2000). Advanced placement students in college: An investigation of their course-taking patterns and college majors (Educational Testing Service Report No. SR-2000-09). Retrieved November 29, 2010 from http://apcentral.collegeboard.com/article/0,3045,152-167-0-11592,00.html#morganandm

Morrison, M.C. & Schmit, S. (2010). Predicting success in a gateway mathematics course. 1-25.

Mouw, J. & Khanna, R. (1993). Prediction of academic success: A review of the literature and some recommendations. *College Student Journal*, *27*(3), 328-336.

Murdock, S. (2007). Population change in Texas: Implications for human and socioeconomic resources in the 21st century. *Institute for Demographic and*

Socioeconomic Research, The University of Texas at San Antonio, 1-78 (2007_08_20_Ernst_and_Bastrop.ppt).

National Center for Education Statistics Institute of Education Sciences. (2003). Status and trends in the education of Hispanics. *U.S. Department of Education.*

National Center for Fair and Open Testing. (2003, October). SAT race, gender gaps increase. Retrieved from: http://www.fairtest.org/sat-race-gender-gaps-increase

National Science Foundation. (1994). *Women, minorities, and the disabled in science and engineering: 1994.* Washington, DC: U.S. Government Printing Office.

Neuschatz, M., & McFarling, M. (1999). Maintaining momentum: high school physics for a new millennium. *American Institute of Physics.*

Noble, J. & Sawyer, R. (1987). Predicting grades in specific college freshman courses from ACT test scores and self-reported high school grades. ACT Research Report Series 87-20. Iowa City, IA: American College Testing Program.

Noble, J. P. & Sawyer, R. L. (1989). Predicting grades in college freshman English and mathematics courses. *Journal of College Student Development, 30,* 345-353.

Noble, J. & Sawyer, R. (2002). Predicting different levels of academic success in college using high school GPA and ACT composite score. ACT Research Report No. 2002-4. Iowa City, IA: ACT, Inc.

Noble, J.P. & Sawyer, R.L. (2002). Accuracy of high school grades and college admissions test scores for predicting different levels of academic achievement in college. Paper presented at the 42nd annual forum of the association for institutional research, Toronto. (ERIC Document Reproduction Service No. ED473070).

Noble, J. P. & Sawyer, R.L. (2004). Is high school GPA better than admission test scores for predicting academic success in college? *College and University*, *79*(4), 17-22.

Nora, A. (1990). Campus-based aid programs as determinants of retention among Hispanic community college students. *Journal of Higher Education, 61*(3), 312-331.

Nora, A. (2003). Access to higher education for Hispanic students: real and illusory? *Sterling, VA: Stylus Publishing*. 47-67.

Nora, A., & Cabrera, A. F. (1996). The role of perception of prejudice and discrimination on the adjustment of minority students to college. *Journal of Higher Education, 67*(2), 119-148.

Nora, A., Castaneda, M. A., & Cabrera, A. F. (1992). *Student persistence: The testing of a comprehensive structural model of retention*. Paper presented at the Association for the Study of Higher Education, Minneapolis.

Nora, A. & Rendon, L. (1990). Differences in mathematics and science preparation and participation among community college minority and non-minority students. *Community College Review*, *18*(2), 29-40.

Oakes, J. (1990). Lost talent: the underparticipation of women, minorities, and disabled persons in science. *ERIC Online Database.*

Pampel, F. C. (2000). *Logistic regression: a primer.* (Sage University Papers Series on Quantitative Applications in the Social Sciences, series no. 07-132). Thousand Oaks, CA: Sage.

Paredes, R.A. (2010). Texas college readiness standards. *Texas Higher Education Coordinating Board.*

Parsad, B., & Lewis, L. (2003). *Remedial education at degree-granting postsecondary institutions in the Fall 2000 (NCES 2004-010).* Washington, D. C.: U.S. Department of Education, National Center for Education Statistics.

Pascarella, E.T., Duby, P.B, Miller, V.A. & Rasher, S.P. (1981). Preenrollment variables and academic performance as predictors of freshmen year persistence, early withdrawal stopout behavior in an urban, nonresidential university. *Research in Higher Education, 15*, 329-342.

Pascarella, E., & Terenzini, P. (1980). Predicting freshman persistence and voluntary dropout decisions from a theoretical model. *Journal of Higher Education, 51*(1), 60-75.

Pascarella, E. & Terenzini, P. (1983). Predicting voluntary freshman year persistence / withdrawal behavior in a residential university: A path analytic validation of Tinto's model. *Journal of Educational Psychology*, *75*(2), 215-226.

Pascarella, E. T., & Terenzini, P.T. (1998). Studying college students in the 21st century: meeting new challenges. *Review of Higher Education*, *21*(2), 151-165.

Pascarella, E. T., & Terenzini, P.T. (2005). How college affects students: a third decade of research. *Jossey-Bass Reader, 2*.

Payne, D., Rapley, F., & Wells, R. (1973). Application of a biographical data inventory to estimate college academic achievement. *Measurement and Evaluation in Guidance, 6*(3), 152-156.

Perkhounkova, Y., McLaughlin, G. W. & Noble, J. P. (2006). *Factors related to persistence of freshmen, freshman transfers, and nonfreshman transfer students.*

(Association for Institutional Research Professional File number 99). Retrieved from http://www.eric.ed.gov/PDFS/ED512355.pdf

Peter D. Hart Research Associates. (1995). Valuable views: a public opinion research report on the views of AFT teachers on professional issues. *Washington, D.C: American Federation of Teachers.* 1-24. Retrieved from www.eric.ed.gov/PDFS/ED389681.pdf

Peter D. Hart Research Associates, Inc. & The Winston Group. (2006). Keeping our edge: Americans speak on education and competitiveness. Retrieved from the Educational Testing Service at http://www.ets.org/media/Education_Topics/pdf/2007keepingyouredge.pdf

Pike, G. R. & Saupe, J. L. (2002). Does High School Matter? An Analysis of Three Methods of Predicting First-Year Grades. *Research in Higher Education, 43,* 187-207.

Reason, R. D. (2003). Student variables that predict retention: recent research and new developments. *NASPA Journal, 40*(4).

Richards, J. M., Holland, J. L., & Lutz, S. W. (1966). *The prediction of student accomplishment in college.* Iowa City, Iowa: American College Testing Program.

Rigol, G. W. (2004). *Selection through individualized review: A report on phase IV of the Admissions Models project.*: The College Board.

Ruban, L. & Nora, A. (2002, April). *Factors impacting the academic status of undergraduate students at four-year institutions.* Paper presented at the annual meeting of the American Educational Research Association, New Orleans, LA. Retrieved from http://www.eric.ed.gov/PDFS/ED465337.pdf

Ruppert, S. S. (2003). Closing the college participation gap: A national summary. (Publication. Retrieved November 18, 2007, from Denver, CO: Education Commission of the States: http://www.communitycollegepolicy.org/

Sadler, P. M., & Tai, R. H. (2001). Success in introductory college physics: the role of high school preparation. *Science Education, 85*(2), 111-136.

Sanoff, A. P. (2006). A perception gap over students' preparation. *Chronicle of Higher Education, 52*(27), B9-B14.

Schmidt, A.E. (1999). Explaining racial and ethnic differences in large-scale assessments. *American Educational Research Association.*

Schmidt, W. H., McKnight, C.C. & Raizen, S.A. (1997). A splintered vision: an analysis of U.S. mathematics and science curricula. *Kluwer Academic Publishers.*

Schroeder, L. D., Sjoquist, D. L. & Stephan, P. E. (1986). *Understanding regression analysis: an introductory guide.* Series: Quantitative Applications in the Social Sciences. Sage Publications, Inc.: Newbury Park, California

Schwartz, R.A., & Washington, C.M. (2002). Predicting academic performance and retention among African American freshmen men. *NASPA Journal, 39*(4), 354-70.

Sedlacek, W. E. (2004). Beyond the big test: noncognitive assessment in higher education. *Jossey-Bass Reader*.

Sedlacek, W.E. (2007). The wrong traditions in admissions. *Inside Higher Education.* Retrieved November 30, 2010 from http://insidehighered.com/views/2007/07/27/sedlacek

Sewell, W. H., & Shah, V.P. (1967). Socioeconomic status, intelligence, and the attainment of higher education. *Sociology of Education, 40,* 1-23.

Smith, J. (1971). A multivariate combination of academic and non-academic factors related to student attrition. *Unpublished doctoral dissertation, University of Pittsburgh.*

Smith, L. (2007). ACT scores edge up in 2007 but suggest that many students are unprepared for college-level work. *The Chronicle of Higher Education.* Retrieved November 29, 2010 from http://chronicle.com/daily/2007/08/2007081503n.htm

Speyer, M. (2004). Our numbers are up! (Is that good?). *Journal of College Admission, 182*, 8-15.

Stewart, D.S. (1999). Standardized testing and social stratification. *Macalester College Forum on Higher Education.*

Tabachnick, B.G. & Fidell, L.S. (1983). Using multivariate statistics. *New York: Harper and Row Publishers.*

Tabachnick, B.G. & Fidell, L.S. (2001). Using multivariate statistics (4th ed.). *Boston, MA: Allyn & Bacon,*

Tai, R. H., & Sadler, P.M. (2001). Gender differences in introductory undergraduate physics performance: university physics versus college physics in the USA. *International Journal of Science Education, 23*(10), 1017-1037.

Tam, M.S. & Sukhatme, U. (2003). The importance of high school quality in university admissions decisions. *College and University, 78*(3), 3-8.

Taylor, R., & Hanson, G. (1970). Interest and persistence. *Journal of Counseling Psychology,* 17, 506-509.

Texas A&M University at Galveston, Catalog 132, 2010.

Texas Administrative Code. (2007). Title 19, Part 2, Chapter 74, Subchapter F, §17.63, §74.63 - §74.64. Recommended and Distinguished High School Programs.

Texas Common Application. (2007-2008). Austin, Texas.

Texas Education Agency. (2010). Dropout information: how Texas identifies, prevents and recovers dropouts. Austin, Texas.

Texas Education Agency. (2010). Secondary School Completion and Dropouts in Texas Public Schools 2008-09. Austin, Texas.

Texas Education Agency News Releases Online. (2010). Texas experiences exceptional increase in Advanced Placement program. Retrieved November 10, 2010 from http://www.tea.state.tx.us/news_release.aspx?id=2147486763

Texas Education Code. (1995). Title 2, Subtitle C, Chapter 11, Subchapter A, Section 11.202.

Texas Education Code. (1997; 2009; 2010). Title 3, Subtitle A, Chapter 51, Subchapter U, Section 51.802-51.805: Uniform admission policy.

Texas Education Code. (2001). Title 2, Subtitle B, Chapter 7, Subchapter A, Section 7.102(c)(4): State Board of Education powers and duties..

Texas Education Code. (2008). Subchapter F, Chapter 74: Curriculum requirements subchapter F. Graduation Requirements, beginning with school year 2007-2008. *Texas Education.*

Texas Education Code. (2009). Title 2, Subtitle F, Chapter 28, Subchapter A, Section 28.002: Required curriculum.

Texas Education Code. (2009). Title 2, Subtitle F, Chapter 28, Subchapter A, Section 28.009: College credit program.

Texas Education Code. (2009). Title 2, Subtitle F, Chapter 28, Subchapter A, Section 28.025: High school diploma and certificate; academic achievement record.

Texas Education Code. (2009). Title 3, Subtitle A, Chapter 51, Subchapter U, Section 51.805(b): Other admissions.

Texas Higher Education Coordinating Board. (2000a). Access and equity 2000. The Texas educational opportunity plan for public higher education. *Coordinating Board.*

Texas Higher Education Coordinating Board. (2000b). Report on alternative admissions criteria study. *U.S. Department of Education.*

Texas Higher Education Coordinating Board. (2000c). Closing the Gaps. Austin, TX: *Texas Higher Education Coordinating Board.*

Texas Higher Education Coordinating Board. (2006). Texas higher education facts-2006. *Austin, Texas.*

Texas Higher Education Coordinating Board. (2008a). Higher education outcomes for students who take college-level courses in high school: a study of 2000 and 2001 Texas public high school graduates. Retrieved from www.thecb.state.tx.us/Reports/PDF/1544.PDF

Texas Higher Education Coordinating Board. (2008b). High school algebra coursework and public higher education enrollment rates: a study of 1997-2004 Texas public high school graduates.

Texas Higher Education Coordinating Board. (2008c). Closing the Gaps: The Texas Higher Education Plan. Texas higher education quick facts 2008. Austin, TX: *Texas Higher Education Coordinating Board.*

Texas Higher Education Coordinating Board. (2008d). High school senior-year academic courses and college outcomes: 1998 and 2001 Texas public high school graduates. *Texas Administrative Code.*

Texas Higher Education Coordinating Board. (2009). Rules applying to public universities and health-related institutions of higher education in Texas: general provisions: uniform admission policy. *Clarification Memorandum & Texas Administrative Code.*

Texas Higher Education Coordinating Board. (2010). Closing the gaps progress report 2010. Austin, TX: *Texas Higher Education Coordinating Board.*

The College Board and ACT, Inc. (2006). Concordance study by ACT and the College Board. Retrieved from http://professionals.collegeboard.com/data-reports-research/sat/sat-act

Thompson, T. & Rust, J. (2007). Follow-up of advanced placement students in college. *College Student Journal*, 41(2), 416-422. Retrieved from ERIC database.

Tierney, W. (1992). An anthropological analysis of student participation in college. *Journal of Higher Education*, *63*(6), 603-618.

Ting, S. M. (1998). Predicting first-year grades and academic progress of college students of first-generation and low-income families. *Journal of College Admission*, *158*, 14-23.

Tinto, V. (1975). Dropout from higher education: A theoretical synthesis of recent research. *Review of Educational Research, 45*(1), 89-125.

Tinto, V. (1987). *Leaving College: Rethinking the Causes and Cures of Student Attrition*. Chicago, Illinois: University of Chicago Press.

Tinto, V. (1988). Stages of student departure: Reflections of the longitudinal character of student leaving. *Journal of Higher Education, 59*, 438-455.

Tinto, V. (1993). *Leaving college: Rethinking the cause and cures of student attrition.* Chicago, Ill: University of Chicago.

Tinto, V. (1997). Classrooms as communities: Exploring the educational character of student persistence. *Journal of Higher Education, 68*(6), 599-623.

Tinto, V. (2003). Leaving college: rethinking the causes and cures of student attrition, 2nd ed. Chicago: The University of Chicago Press.

Tracey, T.J. & Sedlacek, W.E. (1989). Factor structure of the non-cognitive questionnaire-revised across samples of black and white college students. *Educational and Psychological Measurement, 49*, 637-648.

Troutman, J. (1978). Cognitive predictors of final grades in finite mathematics. *Educational and Psychological Measurement, 38*, 401-404.

Trusty, J. & Niles, S.G. (2004). Realized potential or lost talent: High school variables and bachelor's degree completion. *The Career Development Quarterly, 53*(1), 2-15.

Upcraft, M. L., & Gardner, J.N. (1989). The freshman year experience. Helping students survive and succeed in college. *Jossey-Bass Inc.*

Updegraph, K. A., Ecceles, J. S., Barber, B. L. & O'Brien, K. M. (1996). Course enrollment as self-regulatory behavior: Who takes optimal high school courses? *Learning and Individual Differences, 8*(3), 239-259.

U.S. Census Bureau. (2000). *Population projections.* Washington, D.C.: Author.

U.S. Code, Title 20, Chapter 70, Subchapter 1, Part G, §6532. (2010). Strengthening and improvement of elementary and secondary schools: Improving the academic achievement of the disadvantaged, purposes of the advanced placement program. Retrieved November 10, 2010 from http://www.law.cornell.edu/uscode/20/usc_sec_20_00006532----000-.html

U.S. Department of Education. (2003). *Education Transcript Study (PETS) 2000.* Washington, D.C.

U.S. Department of Education: National Center for Educational Statistics. (2001). *Digest of Educational Statistics, 2000.* Washington, DC

U.S. Department of Education: National Center for Education Statistics. (2006). *Digest of education statistics 2006.* Washington, D. C.

U.S. General Accounting Office. (2003). College completion: Additional efforts could help education with its completion goals. United States General Accounting Office Report to Congressional Requesters GAO-03-568. Retrieved November 29, 2010 from www.gao.gov/new.items/do3568.pdf

Venezia, A. (2001). A student-centered P-16 accountability model: Encouraging high standards, equitable educational opportunities and outcomes, and flexibility within a seamless system of education. (Publication. Retrieved November 3, 2007, from Denver, CO: Education Commission of the States: http://bridgeproject.stanford.edu/

Venezia, A. (2003). Connecting the systems: what can postsecondary education do to work with K-12 to help students better prepare for college? *Peer Review*, *5*(2), 27-30.

Venezia, A., & Kirst, M.W. (2005). Inequitable opportunities: how current education systems and policies undermine the chances for student persistence and success in college. *Educational Policy, 19*(2), 283-307.

Warburton, E. C., Bugarin, R. & Nunez, A.-M. (2001). *Bridging the gap: Academic preparation and postsecondary success of first-generation students (NCES 2001-153).* Washington, D. C.: U.S. Department of Education, National Center for Education Statistics.

Williams, A., Blank, R.K., Potts, A., & Toye, C. (2004). State education indicators with a focus on title I, 2000-01. *Washington, DC: US Department of Education.*

Williford, A.M. (2009). Secondary school course grades and success in college. *College and University: Educating the Modern Higher Education Administration Professional, 85*(1), 22-33.

Wolfe, R. N. & Johnson, S.D. (1995). Personality as a predictor of college performance. *Educational and Psychological Measurement, 55*(2), 177-185.

Wuensch, K. L. (2009). Binary logistic regression with PASW/SPSS. Annotated SPSS Output: Logistic Regression. Retrieved from: www.ats.ucla.edu > STAT COMPUTING > SPSS.

Ziomek, R.L. & Svec, J.C. (1995). High school grades and achievement: Evidence of grade inflation. (ACT Research Report Series 95-3). *Iowa City, IA: The American College Testing Program.*

Zwick, R. (March – April, 2001). What causes the test score gap in higher education? Perspectives on the Office for Civil Rights Resource Guide on high-stakes testing. Change, 33, 2, p32-37.

Zwick, R. (2007). College admission testing. *National Association for College Admission Counseling.* Retrieved November 30, 2010 from www.nacacnet.org/NR/rdonlyres/26606B59-5725-4A4B-9203-8DI2D8)5B7C8/0/FinalStandardizedTestingWhitePaper.pdf

APPENDIX A

MATH HIGH SCHOOL GRADUATION CREDIT REQUIREMENTS 2008 & 2011

Appendix A: Math High School Graduation Credit Requirements 2008 & 2011

Subject	CR	High School Graduates 2008 - Recommended	CR	High School Graduates 2011 – Recommended	CR	High School Graduates 2008 - Distinguished	CR	High School Graduates 2011 – Distinguished
Credits		24		26		24		26
Math	3	• Algebra I • Algebra II • Geometry	4	• Algebra I • Algebra II • Geometry Additional CR may be selected from following & completed prior to Algebra II: • Mathematical Models • Mathematical Applications Fourth credit may be selected from following after completion of Algebra I, Algebra II, and Geometry: • Precalculus • Independent Study in Mathematics • AP Statistics • AP Calculus AB • AP Calculus BC • AP Computer Science • IB Mathematical Studies Stand. Lvl. • IB Mathematics Stand. Lvl. • IB Mathematics Higher Lvl. • IB Further Mathematics Stand. Lvl. • Engineering Mathematics (CTE) • Statistics & Risk Management (CTE)	3	• Algebra I • Algebra II • Geometry	4	• Algebra I • Algebra II • Geometry Fourth CR may be selected from following after completion of Algebra I, Algebra II, and Geometry: • Pre-calculus • Independent Study in Mathematics • AP Statistics • AP Calculus AB • AP Calculus BC • AP Computer Science • IB Mathematical Studies Stand. Lvl. • IB Mathematics Stand. Lvl. • IB Mathematics Higher Lvl. • IB Further Mathematics Stand. Lvl. • Engineering Mathematics (CTE) • Statistics & Risk Management (CTE)

APPENDIX B

SCIENCE HIGH SCHOOL GRADUATION REQUIREMENTS 2008 & 2011

Appendix B: Science High School Graduation Credit Requirements 2008 & 2011

Subject	CR	High School Graduates 2008 - Recommended	CR	High School Graduates 2011 – Recommended	CR	High School Graduates 2008 - Distinguished	CR	High School Graduates 2011 – Distinguished
Credits		24		26		24		26
Science	3	• 1 CR from Biology, AP Biology, or IB Biology • 2 CR chosen from 2 other areas, but not same area: A. Integrated Physics & Chemistry B. Chemistry, AP Chemistry, or IB Chemistry C. Physics, Principles of Technology I, AP Physics, or IB Physics	4	• Biology, AP Biology, or IB Biology • Chemistry, AP Chemistry, IB Chemistry • Physics, Principles of Technology I, AP Physics, or IB Physics Additional CR may be IPC & completed prior to Chemistry or Physics. Fourth CR chosen from approved list: • Aquatic Science • Astronomy • Earth & Space Science • Environmental Science • AP Biology • AP Chemistry • AP Physics B • AP Physics C • AP Environmental Science • IB Biology • IB Chemistry • IB Physics • IB Environmental Systems • Scientific Research & Design (CTE) • Anatomy & Physiology (CTE) • Engineering Design & Problem Solving (CTE) • Medical Microbiology (CTE) • Pathophysiology (CTE) • Advanced Animal Science (CTE) • Advanced Biotechnology (CTE) • Advanced Plant & Soil Science (CTE) • Food Science (CTE) • Forensic Science (CTE)	3	• 1 CR from Biology, AP Biology, or IB Biology • 2 CR chosen from 2 other areas, but not same area: A. integrated Physics & Chemistry B. Chemistry, AP Chemistry, or IB Chemistry C. Physics, Principles of Technology I, AP Physics, or IB Physics	4	• Biology, AP Biology, or IB Biology • Chemistry, AP Chemistry, IB Chemistry • Physics, Principles of Technology I, AP Physics, or IB Physics After completion of Biology, Chemistry, & Physics course, fourth CR can be selected from following: • Aquatic Science • Astronomy • Earth & Space Science • Environmental Systems • AP Biology • AP Chemistry • AP Physics B • AP Physics C • AP Environmental Science • IB Biology • IB Chemistry • IB Physics • IB Environmental Systems • Scientific Research & Design (CTE) • Anatomy & Physiology (CTE) • Engineering Design & Problem Solving (CTE) • Medical Microbiology (CTE) • Pathophysiology (CTE) • Advanced Animal Science (CTE) • Advanced Biotechnology (CTE) • Advanced Plant & Soil Science (CTE) • Food Science • Forensic Science

APPENDIX C

GRADUATION CREDIT REQUIREMENTS 2008 & 2011 (EXCEPT MATH & SCIENCE)

Appendix C: Graduation Credit Requirements 2008 & 2011 (except Math & Science)

Subject	CR	High School Graduates 2008 - Recommended	CR	High School Graduates 2011 – Recommended	CR	High School Graduates 2008 - Distinguished	CR	High School Graduates 2011 – Distinguished
Credits		24		26		24		26
English	4	English I, II, III, and IV	4	English I, II, III, and IV	4	English I, II, III, and IV	4	English I, II, III, and IV
Social Studies	3.5	• World History Studies • World Geography Studies • United States Since Reconstruction • United States Govt.	3.5	• World History Studies • World Geography Studies • United States Since Reconstruction • United States Govt.	3.5	• World History Studies • World Geography Studies • United States Since Reconstruction • United States Govt.	3.5	• World History Studies • World Geography Studies • United States Since Reconstruction • United States Govt.
Economics	0.5	Economics	0.5	Economics	0.5	Economics	0.5	Economics
Foreign Language	2	Any two levels in the same langua	2	Any two levels in the same language.	3	Any three levels in the same langu	3	Any three levels in the same language.
Physical Education	1	1 full CR from list	1	1 full CR from list	1	1 full CR from list	1	1 full CR from list
Speech	0.5	Comm. Applications	0.5	Comm. Application or Professional Communications	0.5	Comm. Applications	0.5	Comm. Application or Professional Communications
Fine Arts	1	1 full credit from list	1	1 credit from list	1	1 full credit from list	1	1 credit from list
Elective	5.5	Chosen from approved list	5.5	Chosen from approved list	4.5	Chosen from approved list	4.5	Chosen from approved list
Advanced Measures						Original project Test Data College Academic Courses		

APPENDIX D

APPROVED SOCIOECONOMIC INDICATORS/FACTORS FOR FRESHMAN ADMISSIONS

Appendix D
Approved Socioeconomic Indicators/Factors for Freshman Admissions
Education Code Sec. 51.80 3(B)

1. Applicant's academic record
2. Socioeconomic background
    a. Family above/below poverty
    b. Household income
    c. Parents' level of education
3. Applicant first generation of family to attend or graduate from institution of higher education
4. Applicant has bilingual proficiency
5. Financial status of the applicant's school district
6. Performance level of applicants school
7. Applicant's responsibilities while attending school
    a. Employment
    b. Helped to raise children
    c. Or similar factors
8. Applicant's region of residence
9. Applicant is a resident of a rural, urban, central city or suburban area in the state
10. Applicant's performance on standardized tests
11. Applicant's performance on standardized tests in comparison with other students from similar socioeconomic backgrounds
12. Applicant attended any school while school was under court-ordered desegregation plan
13. Applicant's involvement in community activities
14. Applicant's extracurricular activities
15. Applicant's commitment to a particular field of study
16. Applicant's personal interview
17. Applicant's admission to comparable accredited out of state institution
18. Any other consideration the institution considers necessary

APPENDIX E

CONCORDANCE BETWEEN ACT COMPOSITE SCORE AND SUM OF SAT CRITICAL READING AND MATHEMATICS SCORES

Appendix E: Concordance between ACT Composite Score and Sum of SAT Critical Reading and Mathematics Scores

SAT CR+M (Score Range)	ACT Composite Score	**SAT CR+M (Single Score)**
1600	36	1600
1540-1590	35	1560
1490-1530	34	1510
1440-1480	33	1460
1400-1430	32	1420
1360-1390	31	1380
1330-1350	30	1340
1290-1320	29	1300
1250-1280	28	1260
1210-1240	27	1220
1170-1200	26	1190
1130-1160	25	1150
1090-1120	24	1110
1050-1080	23	1070
1020-1040	22	1030
980-1010	21	990
940-970	20	950
900-930	19	910
860-890	18	870
820-850	17	830
770-810	16	790
720-760	15	740
670-710	14	690
620-660	13	640
560-610	12	590
510-550	11	530

Note: Derived using ACT sum.

Obtained from the College Board Website: http://professionals.collegeboard.com/data-reports-research/sat/sat-act

The College Board and ACT, Inc. (1999; 2006)