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Predictive Measures Of College Academic Success For Secondary Students At An Hispanic Serving Institution

Steven Smith
University of Texas at El Paso

PREDICTIVE MEASURES OF COLLEGE ACADEMIC SUCCESS

FOR SECONDARY STUDENTS AT AN

HISPANIC SERVING INSTITUTION

STEVEN E. SMITH

Doctoral Program in Educational Leadership and Administration

APPROVED:

Arturo Olivárez Jr., Ph.D., Chair

Penelope Espinoza, Ph.D.

Jesus Cisneros, Ph.D.

David Knight, Ph.D.

Stephen L. Crites, Jr., Ph.D.
Dean of the Graduate School

Dedication

This thesis is dedicated to Joy, my beautiful wife of 39 years. Your unwavering support over the years has made this and many other things possible. I love you dearly.

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STEVEN E. SMITH, MA

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Abstract

The purpose of this study was to examine the effectiveness of one of the latest Texas legislative efforts to increase the college readiness of Texas high school graduates. The study assessed whether students falling under this mandated measure of college readiness are as successful in their college level math and English courses as students who pass the Texas Success Initiative Assessment. Using a secondary data set, a set of binary logistic regression models were developed to analyze the predictive value of six variables in determining student success in their first college level math or English course. Descriptive statistics were used to further examine similarity and differences between student populations disaggregated by study variables.

The study identified two predictor variables for success in college level math courses including the method students used to demonstrate college readiness and high school GPA. For success in college level English courses, four predictors were found including the method students used to demonstrate college readiness, high school GPA, gender and first-generation status. Although significance was found in each model, effect sizes were relatively small.

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Chapter 1: Introduction

The issues surrounding the college readiness of high school graduates are longstanding challenges for educators in both the K-12 and post-secondary systems. In Texas, the legislature has undertaken numerous attempts to increase the college readiness of graduating high school seniors in the State. These attempts have included curriculum revisions, developmental education reforms and accountability measures applied to both secondary and post-secondary institutions. Driven by what were perceived to be low graduation rates, states began to adjust college funding to incentivize student success. By 2013, nearly two thirds of the states nationally either had enacted performance based funding models or were actively working on such legislation (Bailey, Smith Jaggars, & Jenkins, 2015). In Texas, the funding model for two-year public higher education institutions now includes momentum points (sometimes referred to as success points), which is a form of performance based funding (Texas Higher Education Coordinating Board, 2015b). These points are additional measures of student success beyond the final metric of degree attainment. They are measurable attainments correlated with the completion of a milestone such as achieving a certain number of college credits. By quantifying them for each college, the State can accurately gauge community college districts' progress in helping students succeed. In 2013, the 83rd Texas Legislature approved the use of Success Points for determining a percentage of the state funding that is allocated to community colleges.

Three of these momentum points are directly applicable to this study. These include the awarding of points when students are deemed college ready as well as the awarding of points for students completing the first college level math and the first college-level writing course. Colleges receive additional levels of funding for each point awarded. Such accountability measures send clear signals regarding the State's priorities for higher education institutions.

While not a primary focus of this study, resource dependency theory suggests that organizations will move to mitigate the effect of scarce resources (Nienhüser, 2008). The college in this study is no exception and funding is a significant motivational factor precipitating this desire for change.

In addition to the factors stated above, the mechanisms and standards by which students are deemed college ready have changed regularly over time. Further, the number of exemptions that allow students to be automatically deemed college ready have increased. Despite these efforts, large numbers of high school graduates remain unprepared for college level work in English and math, with 41 percent of 2-year college students reporting they have taken remedial courses (Chen, 2016).

Although no single definition of college readiness is agreed upon in the literature, one definition is that a student is defined as college ready if they are able to enter a postsecondary institution without the need for remediation and are able to navigate college systems to achieve their degree (Tierney & Duncheon, 2015). Such a definition implies that there are additional characteristics associated with college readiness besides high school graduation and college entrance exam scores. Some of the factors that make a student college ready or predict success in college include class attendance, self-awareness, self-management, social awareness, relationship skills, and responsible decision-making (Hein, Smerdon, & Sambolt, 2013). In practice, however, few of these factors are part of a student's academic record and college readiness often comes down to a student's scores on one or more college entrance exams (Conley, 2007a). As I will explain in chapters two and three, only those factors that are tracked and become part of a student's educational record will be used for the purposes of this study.

To complicate further the issue of college readiness, there has been a longstanding gap between what high schools consider as a standard for graduation and what colleges consider as standards of college readiness for an entering student. This issue lies at the heart of how a student can successfully graduate from high school, but needs developmental support before taking college level coursework. Moreover, the perceptions of high school teachers in gauging the college readiness of their seniors and college faculty in gauging the college readiness of incoming freshmen varied markedly. High school teachers were much more likely to perceive their graduates as college ready than were the college faculty (Reed, 2014).

In Texas 2-year public colleges, the challenge of college readiness is quite pronounced with 60.25 percent of the Fall 2015 cohort unprepared to be successful in entry-level credit-bearing courses at a college or university (Texas Higher Education Coordinating Board, 2017). This ongoing challenge lies at the heart of this study, which will examine one of the latest efforts of the Texas legislature to increase the percentage of college ready high school graduates. Specifically, this study will focus on a 2-year public college in the southwest region of Texas and the mandates of House Bill 5 (HB5) of the 2013 Texas Legislature. HB5 created yet another method by which students graduating high school can demonstrate college readiness. In this study, I will examine the relevant mandates of the bill and seek to evaluate the effectiveness of these mandates. Specifically, the study will focus on Section 10 of the bill which mandates the development of two college preparatory courses, one in math and one in English language arts, which high school seniors may take to demonstrate college readiness. The goal of this study is to determine the effectiveness of this effort across multiple student demographics and to attempt to develop predictive models of student success based on study variables.

Problem Background

College participation rates and college readiness issues have both national and regional implications. Changing workforce trends show that 73% of the fastest growing career options will require training beyond high school (Barnes & Slate, 2014). Nationally, students entering college needing some form of remediation account for approximately 20% of incoming freshmen. In Texas, where this study was focused, the challenge is greater with thirty-two percent of high school graduates needing some form of remediation in either English or Mathematics upon entering college (Texas Higher Education Coordinating Board, 2016a). Complicating the issue is the fact that students can be deemed eligible to graduate from high school but lack sufficient knowledge and skills to meet minimal college readiness standards. This gap between high school graduation criteria and college readiness standards is an ongoing topic of dialogue in education as well as with legislators and other constituents.

National and State Legislative Efforts to Increase College Readiness

There have been numerous policy efforts to increase college readiness rates. National efforts such as the No Child Left Behind Act of 2001 (NCLB) and state efforts such as developmental education reform, HB5 college preparatory courses and, performance-based funding implementation have attempted to either incentivize institutions to increase college readiness or penalize institutions for low college readiness rates. Dual credit and Early College High Schools are additional legislative attempts to incentivize students to become college ready while still in high school.

Texas' Educational Strategic Plan: 60x30TX

In 2015, the Texas Higher Education Coordinating Board released the state's Texas Higher Education Strategic Plan: 2015–2030 entitled 60x30TX (Texas Higher Education

Coordinating Board, 2015a). This plan contains four goals, but its first and overarching goal calls for 60% of the 25 to 34-year-old Texas population to hold a certificate or degree by 2030. It is a bold plan, since at the time of the plan's publishing, only 38% of the target populations held a postsecondary credential. However, as stated in the plan, "without bold action, Texas faces a future of diminished incomes, opportunities, and resources." One underlying thread of the state's educational strategic plan is that without an educated workforce, Texas will face dire economic consequences. The following quote from the strategic plan is indicative of the policy call to action.

> For Texas to solve problems and address public concerns now and in the future, it must have a large workforce with the skills and knowledge to push the state forward. This workforce must be educated and able to adapt and compete at the highest levels to maintain a strong state economy (Texas Higher Education Coordinating Board, 2015a, p vi).

An in-depth review of 60x30TX is beyond the scope of this study; however, there are several key elements that are relevant to this study and to its underlying framework. First, the demand for qualified workers continues to outpace workforce supply in Texas. In the 24 to 34-year-old target population, the state has seen a relative decline in educational attainment (Texas Higher Education Coordinating Board, 2015a). The plan suggests that this trend must be reversed to ensure the economic future of the state. This places great pressure on the education systems in Texas to generate college graduates in an environment of declining college participation rates. Having a population with lower education attainment levels has shown to result in increased health care costs, higher unemployment, increased incarceration levels and higher burdens on welfare programs (Montecel, 2010).

Second, the target population's demographics will be increasingly minority and poor. Between the years 2015 and 2030, the percentage of the target population that is non-white will increase from 61% to 71% (Texas Higher Education Coordinating Board, 2015a). Hispanics will make up the largest portion of this shift and will increase from 43% to 52% of the target population. With this understanding, the plan states that "students of all backgrounds must complete certificates or degrees in larger numbers if the 25 to 34-year-old workforce of Texas is to be globally competitive in 2030." However, as I detail in the following literature review, poor and minority students face a number of systemic and cultural hurdles in graduating from high school, enrolling in higher education and subsequently graduating from postsecondary institutions.

In Texas, economic disadvantage is the leading indicator of whether a student will continue their education past high school (Hahn et al, 2015). The plan authors state that "Although the state has made strides among Hispanic Texans, poverty among this population has increased, especially among those with lower levels of education" (p. 5). Unfortunately, the rich/poor divide in the U.S. is getting worse, with segregation by wealth and race higher than ever before as reported by Hacker and Marcus (2015). Data from the Texas strategic plan indicates that out of the 2013 8th grade cohort, economically disadvantaged students were 26% less likely to enroll in higher education and 20% less likely to earn a degree or certificate.

Understanding the burden on the economically disadvantaged and the future Texas demographic shift towards the poor, the state targeted its fourth goal as student debt. With colleges and universities under increasing scrutiny regarding increasing educational costs, Texas has taken a bold stand on the issue. The fourth goal of the state strategic plan states that by 2030, undergraduate student loan debt will not exceed 60 percent of first-year wages for graduates of

Texas public institutions (Texas Higher Education Coordinating Board, 2015a). This student debt goal, coupled with the other plan goals, pressures higher education institutions to graduate more students without corresponding increases in costs. One way to accomplish this is to eliminate the need for developmental education courses for students entering college, which is the intent of the HB5 college preparatory courses at the heart of this study.

Texas Success Initiative Assessment

Over the past 30 years in Texas, there have been many legislative efforts to reform education (Sigala, 2016). Many of these reforms have implemented changes in the methods by which a student may demonstrate college readiness. Since the 1990's students have used the SAT, the American College Test (ACT), the State of Texas Assessments of Academic Readiness (STAAR), the Texas Academic Skill Program (TASP) and the Texas Higher Education Assessment (THEA) scores to indicate whether they meet college readiness standards.

Today, in Texas, the main method by which high school students demonstrate college readiness is via the Texas Success Initiative Assessment (TSIA). Since 2013, this statewide exam has replaced other college entrance exams. The minimum Passing College Readiness Benchmarks on the TSIA are 350 for math and 351 for reading. For writing, minimum passing scores are either a 340 with an essay score of 4 or less than a 340 with an adult basic education diagnostic score of 4 and an essay score of 5. Students not achieving these minimum scores are not eligible to take college level coursework in the relevant area(s) (Texas Higher Educations Coordinating Board, 2016c).

The scrutiny surrounding college readiness is so pervasive that in the Southwest region of Texas, several of the local Independent School Districts (ISDs) begin administering this exam to their students as early as the 8th grade. These districts then provide interventions designed to improve student performance where needed to help prepare students to pass the exam. This testing/intervention cycle may be performed several times while a student is in high school. Despite this, there remains a significant number of local high school seniors that have not passed one or more portions of the TSIA and are therefore deemed not college ready (Hahn et al., 2015). It is this group of students that drew the attention of the Texas 2013 Legislature.

TSIA Exemptions

There are several exemptions to the requirement for students to take the TSI assessment. Students taking the ACT, SAT and TAKS tests can be exempted by achieving certain scores on those tests. Students who have taken the ACT and achieved a composite score of 23 with at least a score of 19 on both the English and math portions do not have to take the TSI (Texas Higher Education Coordinating Board, 2016c). Students are also exempt if they achieved certain scores on the SAT. Because the SAT has changed, there are two different sets of scores by which a student may be exempted. Students taking the SAT before March of 2016 are exempt with a combined reading and math score of 1070 with a minimum of 500 on the verbal test and a minimum of 500 on the math test. Students taking the SAT after March 2016 are exempt with minimums of 530 on the math and 480 on the Evidence-Based Reading and Writing (EBRW) sections. Students may also be exempted via the Texas Assessment of Knowledge and Skills (TAKS) test by achieving a 2200 on the English and/or math sections with at least a score of 3 on the writing component of the 11th grade TAKS. TAKS scores may be used for a period of five years from the date the test was taken.

In addition to the exemptions based on exam scores, there are other exemptions from the TSIA. Students may be exempt from the requirement to take the TSIA and be deemed college ready through military service. Veterans, active duty and current reservists that have served at least three years are all exempt from the requirement to take the TSIA. Although military exemptions exist, some of those eligible for the exemption choose to take the TSIA anyway. Many military students have been out of school for several years and are hesitant to jump into college level coursework, especially in mathematics. Those opting to take the exam can follow the traditional developmental sequence to help them prepare for college level courses.

Students who enroll in one-year certificate programs of 42 hours or less at a community or technical college are also exempt from the TSIA. Such pathways include certificates in programs such as welding, cosmetology, culinary arts, and construction. These programs are intended to prepare student to directly enter the workforce and are not intended to transfer to a four-year university. These alternative pathways are becoming increasingly utilized for students that have not passed the TSIA. Finally, students who transfer a college level course from another college or university into a Texas institution of higher education are exempt from taking the TSIA (Texas Higher Education Coordinating Board, 2016c). Because of the broad nature of TSIA exemptions and the fact that some are not reflective of academic preparation, these students will be excluded from the data set for this study.

HB5 College Preparatory Courses

As indicated above, there are large numbers of Texas high school seniors that have not demonstrated college readiness by passing the various components of the TSIA. This excludes them from the possibility of taking advantage of dual credit courses and would require the completion of one or more developmental sequences upon entering college. During the 83rd Texas Legislative Session, lawmakers passed House Bill 5, which contained a significant change in the way these high school seniors can demonstrate college readiness. In this study, the researcher will examine the relevant mandates of the bill and seek to evaluate the effectiveness of these mandates. Specifically, the study will focus on Section 10 of the bill which requires the development of two college preparatory courses, one in math and one in English language arts, which high school seniors may take to demonstrate college readiness. The relevant section of the bill and its modifications can be found in Appendix A. To assist the reader with context, I include information regarding those involved with the development and implementation of the courses mandated by the bill and those affected by it.

Course Development

HB5, section ten requires each school district in the State to partner with at least one institution of higher education (IHE) to develop and provide courses in college preparatory mathematics and English language arts. These courses are designed for 12th graders whose performance on either an end-of-course high school exam or college entrance exam does not meet college readiness standards (Texas State Legislature, 2013). The bill specifically states that the courses are for high school seniors, effectively eliminating their use to serve as an alternative college readiness measure for lower grade levels.

The developed courses may be offered by faculty on site in the high school or through distance education taught by a faculty member at an IHE. At the discretion of the higher education institution, the course may also be offered as dual credit. By mandate, the courses had to be made available to students by the 2014-2015 academic year. In the local region, to date, none of the developed courses have been offered as dual credit or through distance learning. The collective agreement in the region was that students taking these courses were best served through face-to-face interactions with high school teachers.

With approximately 12 school districts in the southwest region, the proliferation of required courses could have easily escalated into 24 different course offerings. This would include 12 courses in math and 12 courses for English language arts. Additionally, this approach would have required establishing 12 separate school district/IHE teams to develop courses and conduct training. Maintaining that number of courses and ensuring they are aligned with college readiness standards would have been quite difficult to manage. Further, this approach would have required 12 separate interlocal agreements between the ISDs and the IHE and the accompanying cycle of reviews and updates associated with such documents. This would require the participation of ISD and IHE administration, legal counsel and boards on a regular basis.

Fortunately, the collective decision of the southwest region was to develop one common set of courses and common associated agreements. Under the umbrella of the local Education Service Center (ESC), a team comprised of representatives from the local school districts, the college and the ESC, worked collaboratively to develop an acceptable partnership agreement and common course objectives. This allowed the entire region to be served by the development of one set of courses.

Teacher Collaboration

Historically, there has been a gap between what high schools consider as a standard for graduation and what colleges consider as standards of college readiness for an entering student. Further, the perceptions of high school teachers in gauging the college readiness of their seniors and college faculty in gauging the college readiness of incoming freshmen varied markedly (Reed, 2014). High school teachers were much more likely to perceive their graduates as college ready than were the college faculty. Aligning high school graduation and college entrance requirements ensures that students are prepared for full participation in postsecondary education (Kirst & Venezia, 2004). In an attempt to address this college readiness gap, HB5 requires regular meetings between high school teachers offering these courses and their higher education counterparts. This requirement is to ensure that these courses are aligned with college readiness expectations (Texas State Legislature, 2013).

In his research, Reed (2014) found that it would be beneficial for school district and higher education partners to work collaboratively on college readiness issues. That is exactly what occurred in the development of the college preparatory courses. To develop the mandated courses, teams of high school and higher education faculty in both mathematics and in English language arts worked collaboratively to ensure the objectives of the courses would ultimately align with college readiness standards.

Between April of 2014 and August of 2014, numerous meetings were held between school district teachers and college faculty to develop the HB5 college preparatory courses. These meetings were divided between math and English groups and included participants from the college as well as the school districts in the region. In addition to the development of the courses, the participants developed a training protocol for high school teachers who would be teaching the courses. The first set of college preparatory courses were offered in fall 2014.

Course Description

The developed courses are intended to close the gap between knowledge and skills required for high school graduation and those required for completion of college level coursework. This knowledge gap is a long-standing issue that is discussed further in chapter 2. In an attempt to fill in the missing pieces between high school and college, these courses contain learning objectives encompassing the highest levels of traditional high school courses in the subject areas and entry level learning objectives for college level courses. An important characteristic of these courses is that they are each two semesters in length. This gives each enrolled student a yearlong exposure to the subject material resulting in more time on task for the content. Further, students must pass these courses with a score of 75 or higher in order to be deemed college ready in the subject and receive the exemption from taking the associated portions of the Texas Success Initiative Assessment.

For English, the course objectives include critical thinking and higher order skills such as the ability to draw complex inferences and analyze and evaluation information across multiple texts of varying lengths. A complete list of the college preparatory English course learning objectives can be found in Appendix B. For math, the course objectives include topics from geometry, algebra II and precalculus including factoring of polynomials, solving/graphing quadratic equations and solving a system of equations. A complete list of the college preparatory math course learning objectives can be found in Appendix C.

Intended Population

The following language is taken from the Memorandum of Understanding (MOU) developed between the regions ISDs, ESC and IHE. There is equivalent language for the math college preparatory course.

> This course is recommended for any 12th grade student whose performance on measures outlined in TEC §28.014 and the memorandum of understanding (MOU) with the partnering institution(s), indicates that the student is not on track to perform entry-level college coursework in English Language Arts. This course is designed to advance college and career readiness.

This mirrors the language in HB5 and means that the intended population for these courses are students who are in their final year of high school, who have not been able to meet college readiness standards in math or English (or both). College readiness for high school students in Texas is typically measured via the TSIA. As was mentioned above, many districts begin testing students on the TSIA as early as the eighth grade and most provide ongoing opportunities for interventions and retesting throughout high school. This suggests that there are characteristic of these students that preclude success on standardized exams such as the TSIA. Chapter 2 explores several such characteristics found in the literature. Regardless of the factors involved, the population for which these courses are intended are at a disadvantage compared to the population of students who succeed on the TSIA. These courses are established in an attempt to help level the field for these students.

Accountability

Educators and schools are under increasing pressures and scrutiny from legislators and businesses to ensure that students are successful in high school (Goldrick-Rab & Mazzeo, 2005). Legislators feel compelled to respond to constituent concerns regarding education and continue to pass state and federal regulations surrounding education and educational standards. Legislation such as No Child Left Behind (NCLB) provides punitive measures for schools failing to meet standards (No Child Left Behind, 2001).

Accountability for student success is the order of the day for educators and schools, with increased attention directed toward standardized testing and the need to produce a qualified workforce. In the State of Texas and in the southwest region, 60x30TX and regional 60x30 initiatives establish goals regarding college and career readiness as well as high school graduation and college degree attainment (Hahn, et al, 2015). Led by local businessmen, increased pressures and rhetoric have paved the way for a larger charter school presence in the local region.

Research shows that students engaged in college preparatory programs are more likely to participate in college (Goldrick-Rab & Mazzeo, 2005). In light of this and in response to the information presented above, the Texas Legislature passed legislation calling for a new way that students may demonstrate college readiness. In an effort to increase the numbers of high school graduates deemed college ready and to avoid the challenges associated with developmental education, the Texas Legislature passed HB5 in the 83rd Legislature in 2013. Section Ten of that bill called for the development of two college preparatory courses, one in English and one in Math. HB5 allows high school seniors that have not passed one or more portions of the TSIA to take these courses in order to demonstrate college readiness. Successful students are automatically deemed college ready and are exempt from the applicable portions of the TSIA.

To help ensure broad support, the bill called for the courses to be co-developed by school district and higher education entities. Faculty from both entities worked collaboratively to develop the curriculum and objectives of these courses. In addition, the higher education partners are responsible for training high school teachers who will teach these courses. Each of the school district instructors that teach the courses must complete this training.

Further, the educational administrators associated with the school district and higher education institute are required to develop a memorandum of understanding (MOU) that details the particulars of the acceptance of the college readiness standards of these courses. This would formalize the respective responsibilities of the school districts and the college and would articulate the methods and timing of teacher training, transcription of courses, course assessments and course revisions.

Such wide involvement of legislators, school district and college faculty, and educational administrators has allowed for broad involvement and input from the various constituents. HB5 also requires a cyclical review and regular reporting of the various components of the bill, ensuring continued collaboration among the partners and reinforcing the findings by Reed (2013).

If the goals of the bill are realized, students who successfully pass the preparatory courses will avoid the pitfalls associated with entering the traditional college developmental course sequence. As a result, their time to degree should be significantly decreased and their success rates should go up. Further, the taxpayer costs associated with teaching developmental education courses in college should be reduced. Businesses will also benefit due to a larger percentage of the workforce possessing a college credential.

State and Regional Degree Attainment Efforts

Both the state of Texas and the local southwest region have adopted goals and associated strategies surrounding the idea that 60 percent of the population between the ages of 25 and 34 will hold a degree or certificate by the year 2030 (Hahn et al., 2015). These initiatives are referred to as 60x30TX and 60x30 El Paso respectively. The goals associated with 60x30TX put additional pressure on State educational institutions to ensure high school students graduate and to adequately prepare them to enter and complete college. This point is further driven home by the fact that only 52.7% of Texas students that complete high school go to college (Texas Higher Education Coordinating Board, 2017). In order to meet their goals, the state and region must find ways to ensure that increasing numbers of high school students graduate college ready. One way the state has approached the issue is through the passing of HB5 in the 83rd legislative session (Texas Legislature, 2013).

Purpose of the Study

The purpose of this study was to examine the effectiveness of one of the latest Texas legislative efforts to increase the college readiness of Texas high school graduates. The study assessed whether students falling under this mandated measure of college readiness are as successful in their college level math and English courses as students who pass the TSIA. Further, the study examined the success of these two groups disaggregated by gender, ethnicity, socioeconomic status, high school GPA and first-generation status. This will shed light on any demographics positively or negatively effected through this alternative measure of college readiness and will help inform future revisions and iterations of the courses.

The HB5 courses were first offered in the fall of 2014 to a small number of high school seniors. Because the HB5 college preparatory courses are a relatively new college readiness measure, little has been researched on the college success of the students completing them. Further, because the definition of success for this research study requires students to graduate high school then enter college and successfully complete a college level course, the timeline for gathering adequate data for the study suggests that appropriate data is only now becoming available and meaningful. As a result, little research has been conducted regarding the efficacy of the HB5 college preparatory courses, especially with regards to developing a predictive model of student success. In order to develop such a model, there is also a need to identify those secondary school academic measures that may play a role in the predictive model.

The findings of this study will help higher education practitioners understand the effectiveness of the HB5 college preparatory courses as it pertains to student success in college level coursework. These findings will also assist higher education practitioners in supporting the needs of students completing these courses and will inform the curriculum for future versions of these math and English courses. Further, these findings may provide insights into the training needs of the high school teachers who have been tasked with teaching these college preparation courses.

Hypothesis

Based on the literature review and the regional implementation of the HB5 mandated college preparation courses in math and language arts, the hypothesis is that students demonstrating college readiness by the successful completion of these courses perform equally well to those students demonstrating college readiness by passing the relevant component(s) of the TSIA. Further, disaggregated demographic groups will show similar success rates to their counterpart groups that passed the TSIA as predicated by relevant academic and demographic measures.

Significance of the Problem

The issues surrounding college readiness are important to diverse, widespread constituencies. Students, educators, taxpayers, businesses, and legislators are all impacted when college readiness measures are not met by large percentages of students entering college. Students taking developmental coursework are delayed in their college graduation and are more likely to drop out (Bailey, 2009). Educators and schools are under increasing pressures and scrutiny from legislators and business to ensure that students are successful in high school and ready for college (Goldrick-Rab & Mazzeo, 2005).

With less than 40% of students entering college completing a degree or certificate in six years, there is a significant loss to the overall state and national economy (Bailey, Smith Jaggars & Jenkins, 2015; Martorell & McFarlin, 2011). Such narrative has prompted calls for significant gains in the number of individuals with a postsecondary credential. Legislators feel compelled to respond to constituent concerns regarding education and continue to pass state and federal regulations surrounding education and educational standards. Legislation such as No Child Left

Behind (NCLB) provides punitive measures for schools failing to meet standards (No Child Left Behind, 2001).

Accountability for student success is the mandate for educators and schools, with increased attention directed toward standardized testing and the need to produce a qualified workforce. In the State of Texas and in the El Paso region, 60x30TX and 60x30 Regional initiatives have established goals regarding college and career readiness as well as high school graduation and college degree attainment (Hahn, et al, 2015). Led by local businessmen, increased pressures and rhetoric have paved the way for increased secondary education competition and a larger charter school presence in the local region.

Research shows that students engaged in college preparatory programs are more likely to participate in college (Goldrick-Rab & Mazzeo, 2005). In light of this and in response to the information presented above, the 2013 Texas Legislature passed legislation calling for a new way that students may demonstrate college readiness. In an effort to increase the numbers of high school graduates deemed college ready and to avoid the challenges associated with developmental education, in 2013, the Texas Legislature passed HB5 in the 83rd Legislature (Texas Legislature, 2013). Section ten of that bill called for the development of two college preparatory courses, one in English and one in Math. HB5, section ten allows high school seniors that have not passed one or more portions of the TSIA to take these preparatory courses in order to demonstrate college readiness. Successful students are automatically deemed college ready and are exempt from the applicable portions of the TSIA.

Should these college preparatory courses prove effective, the implication for colleges is profound. The focus on standardized testing for college readiness may shift towards other measures of preparedness and a more holistic assessment of students' readiness for college.

Alternatively, should they not prove effective, it may call into question the fiscal and other resources being devoted to this mandate.

College Readiness Gap

As mentioned in the chapter introduction, there is a gap in what high schools define as college readiness and what colleges require of entering students. Kirst (2006) suggests that it would be important for K-12 and post-secondary educators to collaborate on college readiness issues. In that spirit, HB5 calls for the mandated college preparation courses to be co-developed by ISD and higher education entities. To develop the mandated courses, teams of high school and higher education faculty in both mathematics and in English language arts worked collaboratively to ensure the objectives of the courses would ultimately align with college readiness standards. In a further attempt to address the college readiness gap, HB5 requires regular meetings between high school teachers offering these courses and their higher education counterparts. This requirement is to ensure that these courses are aligned with college readiness expectations (Texas State Legislature, 2013). This study intends to determine whether students are being well served by the HB5 college preparatory courses.

In this study, I gauge the success of students who demonstrate college readiness by passing the TSIA versus those who complete the HB5 college readiness courses. This information will help school district and college administrators and teachers to understand more about the level of success of these courses and whether the new college preparation courses are serving students as planned. The findings from this study may ultimately help policy makers understand what the perceived impacts of their legislation are from those required to implement the legislation.

Delimitations of the Study

This study is an examination of the success of students in college level math and English courses in the local region at a Hispanic Serving Institution along the U.S./Mexico border. Further, the development and implementation of these college success courses, while collaborative in nature, involved 12 local independent school districts (ISDs). Each of these ISDs, may have nuances in their implementation that would preclude the extrapolation of the results of this study to other institutions or regions including other Hispanic serving institutions with similar student populations.

Researcher's Bias

The researcher has no preconceptions on the success rates of students taking HB5 college preparatory courses versus students passing the TSIA. Other than selecting the most relevant data elements to be included in the analysis, the researcher has no role in the acquisition or filtering of data records for the study. Having said that, there are several considerations that must be acknowledged in my positionality as a researcher. The researcher serves as Vice President of Instruction and Workforce Education at the institution at which the study is being conducted. Due to the nature of this role, the researcher has close ties to the local ISDs that have been charged with implementing the college preparatory courses as well as with the Region 19 Educational Service Center (ESC), which provided much of the data used in this research. Further, the faculty who worked to develop the courses and who work with local ISDs to assess and revise the courses as needed have an indirect reporting relationship to the researcher. The need to maintain good relationships with these entities and individuals as well as with State officials may unintentionally bias those involved to look for success in evaluating the data. As a quantitative study, this potential bias will be largely mitigated. In addition, in my role, I must admit to having concerns about possible grade inflation in the HB5 high school courses that may harm students upon entering college.

Assumptions

The researcher assumes that the data used contains an accurate, reliable and valid representation of student participation in and completion of the high school college preparatory courses resulting from HB5. It is assumed that due to the comprehensive, collaborative nature of the development of the HB5 courses as well as the associated training protocol implemented throughout the region that the courses were designed to be the most relevant in providing the content and knowledge to prepare the students to be successful in college level coursework.

As this study is focused on student success in college level math and English courses, it is also assumed that the dataset contains the most pertinent and relevant measures of student academic success in these areas. It is also assumed that these measures are valid and consistent across college level courses and faculty at the college in the study.

Further, there is an assumption of consistency in the delivery of the curriculum provided by the numerous high schools that offered these courses and that the determination of whether students successfully passed the courses or not were relatively uniform. While there is typically variety in course content and success measures in high school courses by teacher, school and district, the measures outlined in the course development section serve to minimize this variety for these courses. Specifically, the broad, region-wide participation and agreement in course content coupled with the training provided to ISD faculty by the higher education partner and the ongoing collaboration mandated by HB5 should work to mitigate any wide differences in course delivery and grading.

Limitations

One limitation of the proposed study is that the research was conducted at a single college site. While the site may be representative in many ways of other higher education institutions in Texas, it also differs in substantive characteristics such a geographical area and population demographics. The study site may also differ in the organizational structure and demographic makeup of the faculty and staff. These differences may also extend to the numerous school districts in the region. No two institutions or regions are exactly the same. As a result, the findings of this study may not be appropriate to generalize to other institutions or regions in the State.

HB5 also calls for regular assessment and revision of the mandated courses meaning that course content and corresponding instructional focus will likely shift over time. Because of the cycle of review, revision and retraining of high school faculty teaching the college preparatory courses, the success of students is intended to increase over time. As a result, replication of the study in the future may not yield similar results as those found in this study.

The use of a secondary data set may limit the type of pertinent or more relevant variables that are directly or indirectly related to the research questions in this study. Due to the nature of the data set available, there may be other key variables not present but may be important for the research questions. There are a number of well documented attributes that contribute to ultimate student success that are not captured in the data set. Such student characteristics include class attendance, self-awareness, self-management, social awareness, relationship skills, self-efficacy, academic discipline and responsible decision-making (Hein, Smerdon, & Sambolt, 2013; Komarraju, Ramsey & Rinella, 2013). Further, the reliability and validity of the study variables is assumed from other studies, some of which are referred to in the next chapter.

In researching the nature of the populations demonstrating college readiness through the TSIA and those demonstrating college readiness by completing a college preparatory course, it was evident that some form of selection bias may be at play. While exploring ways to account for this, the researcher found that there were multiple ways that students found themselves in one population or the other. It was originally thought that only seniors who had taken the TSIA but were unable to pass it would be the population taking the college preparatory course. However, that was not the case. Some schools elected to put their seniors into the college preparatory course(s) without testing the students on the TSIA. Doing this may have presented a cost savings to the schools. Other students had a successful TSIA score but were placed into the college preparatory course(s) anyway. Other students took the TSIA while enrolled in the college preparatory course(s) with some successfully completing the test and some who didn't. In the end, it was difficult to develop a strategy, given the data at hand, to account for possible selection bias.

Definition of Key Terms

Texas Success Initiative Assessment (TSIA) – The principal college readiness assessment exam in Texas. All students entering public Texas colleges who do not meet any of the exemption criteria for the assessment are required to take the TSIA (Overview: Texas Success Initiative, 2017). The assessment contains three components that gauge a student's ability in math, reading and writing.

House Bill 5 – For purposes of this study, House Bill 5 (HB5) refers to the 2013 Texas Legislative session's version of the bill. Specifically, this study examines section 10 of that bill which calls for the development of two college preparatory courses, one in math and one in English language arts (Texas State Legislature, 2013) These courses are planned for high school seniors who have not been able to demonstrate college readiness via a standardized college entrance exam such as the Texas Success Initiative Assessment (TSIA). The courses are intended as a last ditch effort for high school students to graduate college ready. See appendix A for the relevant language of the bill.

College Preparatory Courses – high school courses that are designed to provide curriculum and instruction that prepare high school seniors to be college ready. For purposes of this study, college preparatory courses refer to the two courses mandated by HB5, one in math and one in English language arts (Texas State Legislature, 2013).

College Readiness – There is no common definition of college readiness that is found in the literature (Porter & Polikoff, 2011). However, it is generally accepted that a student is college ready if they are prepared to take college level coursework without remediation. This is typically assessed through some sort of standardized testing such as the TSIA.

College Readiness Gap – The difference in knowledge and skills between what students need to graduate from high school and what students need to be ready for college level coursework.

Developmental Education – refers to the continuum of undergraduate courses and services ranging from tutoring and advising to remedial coursework and other instruction to prepare students for college level (and therefore work-ready) courses and continued academic success.

60X30TX - The State of Texas' education strategic plan developed in 2015. One of the plan's overarching goals is that 60 percent of the population between the ages of 25 and 34 will hold a degree or certificate by the year 2030 (Hahn, et al, 2015). The plan has significant legislative policy implications and has put significant pressure on educational institutions to graduate more students.

Chapter Summary

Many students in Texas continue to graduate high school without demonstrating college readiness. Numerous attempts to address this issue have occurred at local, state and national levels, with little impact on the problem. In 2013, via HB5, the Texas Legislature mandated a strategy to increase the college readiness rates of high school graduates by creating college preparatory courses for high school seniors that have not passed the TSIA. Students successfully completing these courses are automatically deemed college ready and eligible to take college level courses in math and/or English.

This study sought to gauge the efficacy of these courses in preparing students for college level coursework in English and math. This was done through the development of a predictive model of student success in their first college level math and/or English course(s) and an analysis of students completing the HB5 courses versus students passing the TSIA. This study will help inform ISD and higher education administrators and teachers about the level of success of these courses and whether they are serving students well and in the manner intended. The findings from this study may ultimately help policy makers understand what the perceived impacts of their legislation are from those required to implement the legislation.

Chapter 2: Literature Review

Because the legislative mandate in HB5 that attempts to address college readiness is relatively new, research into the historical context of college readiness and the theories that motivate such legislative action is required. In addition, if one is to attempt to develop a predictive model of college success for students taking HB5 college preparatory courses, research must be conducted on historically significant predictors of college success, such as high school GPA, SAT scores, gender, ethnicity and similar variables from the literature. Such inquiry allowed the researcher to make an informed decision about the most relevant variables to include in the predictive model.

In order to conduct an exhaustive review of the literature, numerous databases were searched for relevant books, articles and online sources. Primary keywords included college readiness, Texas HB5 2013 (and variants), developmental education, remedial education, college success, college success factors, standardized testing, human capital, college benefits, 60X30TX, Texas Success Initiative Assessment, college preparatory programs and college equity.

ERIC, ProQuest, SAGE databases were searched, and keywords were also entered into Google Scholar. The most relevant sources were derived based on the number of relevant citations and evaluation of the available abstracts. When relevant articles were found, keyword tagging and categorization of main points were catalogued using MaxQDA software. The reference sections of each relevant source was then analyzed for further sources. This chapter provides an overview of the existing literature dealing with the research topic and focuses on the most germane theoretical and relevant constructs dealing with student college success.

Human Capital Theory

Human Capital Theory (HCT) suggests that individuals and society derive economic benefits from investments in people (Sweetland, 1996; Weisbrod, 1962). While there are several types of such investments, including health and nutrition, education has emerged as one of the most researched aspects of HCT. This is due in part to the belief that increased education is a positive contributor to individual and societal wealth, health and nutrition (Schultz, 1963). Secondarily, the educational aspects of HCT are more easily studied due to the quantifiable nature of its costs and associated investment of time (Johnes, 1993). Becker (1993) reinforces this idea stating that educational HCT investments tend to respond rationally to benefits and costs, citing the rise of women workers and their shifting educational habits towards higher paying professions. Education has been found to benefit numerous entities including the student, their children, employers and society at large (Weisbrod, 1962).

There are numerous studies that show a significant personal benefit to individuals who graduate from high school and even greater benefits to those graduating from college. In the context of education, Human Capital Theory suggests that more education generally means higher lifetime earnings (Sidorkin, 2007). Even after accounting for other factors such as class rank and test scores, additional post high school education has been shown to increase median household income (Weisbrod, 1962). Indeed, post-secondary education has become a gateway for both social and economic mobility in U.S. society (Pustejovsky & Joshi, 2019). On average, a college graduate will earn in excess of` $1 million more over a lifetime than a high school dropout (Montecel, 2010). Even those students with a high school diploma, but no post-secondary education have seen a “near-continuous decline in their earning power” since the 1970’s (Heckman & Krueger, 2005). Reinforcing the importance of the educational aspect of

Human Capital Theory, Becker (1993), states that "Education and training are the most important investments in human capital" (p.17). As such, education is considered an investment that is expected to pay dividends at some future point. This is true not only for the individual, but also for the society to which they contribute. The investments described by Becker include the expenditure of such resources as time and money, but also the lost opportunity costs in the form of wages that could have been earned in lieu of attending classes. Indeed, formal education does build the capacity of individuals (Winkler, 1987, as cited in Sidorkin, 2007). Further, it creates significant value for individuals as well as in the larger society (Sidorkin, 2007).

At the heart of this study is the issue of the efficacy of a specific educational policy designed to decrease the need for remedial education and increase the number of college-ready students in Texas. Martorell & McFarlin (2013) indicate that in the context of human capitol theory, there is a debate about how college remediation fits into labor economic policies to improve the human capital of low-skilled individuals. Some feel that it is difficult to increase the human capital of individuals beyond a certain age and that to be successful, interventions must come at an early age (Carneiro & Heckman, 2003). Others, suggest that such efforts, especially those that target individuals from disadvantaged backgrounds, have proven effective even when the interventions occurred later in life (Heckman & Krueger, 2005). Post-secondary remediation and the policy at the center of this study are important examples of interventions that occur later in life. Understanding whether remediation and other educational policies actually helps students develop valuable skills that lead to positive economic outcomes will help inform the literature about which view of human capital formation is more accurate (Martorell & McFarlin, 2011).

Educational policies, such as those passed by the Texas Legislature in HB5 are intended to encourage high school graduation and subsequent entrance to college, thereby increasing the individual and societal human capital. Why then, are so many high school graduates unprepared for college-level coursework and why do so few pursue higher education?

College Readiness

Barnes (2010) states that "Given the need for highly educated college graduates in the 21st century economy, the issue of college-readiness is of serious concern at a national policy level" (p. 9). There is a large volume of research regarding the college readiness of high school graduates and the variables that may predict college success. Unfortunately, there is no common, universally accepted definition of college readiness (Porter & Polikoff, 2011). In the literature, college readiness is often defined using multiple aspects including both cognitive and non-cognitive measures. Examples of non-cognitive measures include items such as self-efficacy and academic discipline (Komarraju, Ramsey & Rinella, 2013). Although there is a substantial body of research around such non-cognitive measures, these traits are not scored and transcripted in any standard format that college admissions personnel can use as a straightforward measurement of potential student success. Instead, colleges and universities with selective admission criteria are left to infer such traits through student essays, interviews and documented student experiences or participation in extra-curricular activities.

At institutions with missions and mandates that support open admissions, such as the one at the heart of this study, non-cognitive measures lose their value as an admissions criterion, but gain importance when attempting to assess students' college readiness and course placement. These factors may come into consideration when determining whether a student entering college is in need of remediation and if so, the level of remediation required. In practice, the assessment and application of these measures is difficult to standardize and often comes down to the individual counselor or advisor making the determination of appropriate placement.

As a result of the difficulty in measuring and evaluating such non-cognitive traits in admitting and placing entering students into college level courses, they are not often standardized or even considered. When operationalized, academic performance is often prioritized in admission and placement decisions. Such academic performance standards include test scores, class rank and GPA. Conley (2007a) states that college readiness continues to be defined primarily in terms of scores on national tests, high school courses taken and grades received. Martorell & McFarlin (2011) also found that assignment to remediation is mainly determined by performance on a placement test. Even when multiple measures are used to determine college readiness, standards can be a challenge. As an example, one of the significant issues with using high school class rank and GPA is that there is no common metric or standard for these across high schools (Porter & Polikoff, 2011). Because of the lack of national college readiness standards, it is quite possible that a student placed into developmental education at one college may be placed into college-level courses at a different college (Bailey, 2009).

As stated earlier, there is no standard definition of college readiness. One definition expands on that proffered by Tierney & Duncheon (2015) by including the concept of remediation. In this definition, readiness is "the level of preparation a student needs in order to enroll and succeed—without remediation—in a credit-bearing general education course at a postsecondary institution that offers a baccalaureate degree or transfer to a baccalaureate program" (Conley, 2007a).

Many Americans go to college, but a large proportion of them are not ready in the sense that they take one or more remedial courses (Porter & Polikoff, 2011). Nationally, students entering college needing some form of remediation account for approximately twenty percent of incoming freshmen. In Texas, thirty-two percent of high school graduates need some form of remediation in either English or mathematics upon entering college (Texas Higher Education Coordinating Board, 2016a).

Negative Effects of Developmental Education

Students who do not demonstrate college readiness need additional coursework to bring their knowledge and skills up to the level needed for college coursework. This is typically through some form of developmental education sequence. At the college that is the focus of this study, students may need developmental coursework in one or more areas of reading, English or math. Students placed into these sequences face a number of challenges that adversely affect their potential to persist and graduate from college. In addition to the challenges faced by individual students described in the coming paragraphs, it is estimated that the annual aggregate cost of students taking developmental education courses is in excess of $1 billion (Martorell & McFarlin, 2011). In Texas, during each biennium the cost of post-secondary developmental education is estimated at $197 million (Martorell & McFarlin, 2011).

Bailey (2009) states that developmental education is one of the most difficult issues facing community colleges. Students that graduate from high school, but have not passed the TSIA, usually undergo some form of remediation when they enter college. There are numerous negative effects on students taking developmental education courses including higher stop-out rates, increased time to degree and exhaustion of financial aid availability. In examining the impact of remediation on subsequent labor market earnings, one study found no evidence that remediation confers long term economic benefits in the form of higher earnings (Martorell & McFarlin, 2011). Further, it was found that an examination of a wide range of academic outcomes, across a variety of subgroups, the effects of remediation are statistically insignificant. Another study found that while there is evidence that remediation improves fall-to-fall retention, it found little evidence that remediation increased the likelihood of completing college-level courses, transferring to a four-year college, or completing a degree (Calcagno & Long, 2008).

As indicated earlier, 32% of Texas high school graduates that go to college must take some form of developmental education classes (Texas Higher Education Coordinating Board, 2016a). Of college students identified as not being college ready, 87% attend community colleges. Locally, this can mean up to three semesters of developmental coursework before students begin taking college courses. Further, students needing remediation in math will often defer taking the needed developmental courses until the end of their college coursework. Analyzing data from a database compiled by Achieving the Dream, Bailey (2009) found that 21 percent of students placed in developmental math did not enroll in any remedial math course within three years of initial registration. For reading, that number is 33 percent. It is not unusual for a student to have completed all needed coursework for their degree with the exception of a necessary college level math course. One of the results of this is that students' time to degree may increase dramatically (Bailey, 2009; Martorell & McFarlin, 2011).

In addition, students needing a great deal of remediation in developmental coursework may find that their financial aid is in danger of being exhausted. Even if a student on financial aid finishes the developmental sequence and graduates with a two-year degree, they may have financial aid challenges when attempting to complete a baccalaureate. The State of Texas' educational strategic plan put it succinctly, "Excessive semester credit hours for degree completion in Texas contribute to student debt and less than timely completions" (Texas Higher Education Coordinating Board, 2015a).

Another, more serious outcome is that many students in developmental courses never complete their developmental sequence and the corresponding college level courses. Nationally, 16 percent of students in public 2-year colleges never complete any of the remedial courses taken and 35 percent complete some, but not all of their developmental courses (Chen, 2016). Bailey (2009) found that nationally, only 30 percent of students pass the developmental math courses in which they enroll.

Students in developmental courses also stop out in greater numbers than students who place directly into college level courses. Less than 25 percent of community college students that take developmental coursework complete a degree or certificate up to eight years after enrolling in college (Bailey, 2009). This compares poorly to community college students that do not take developmental education courses who complete at almost 40 percent over the same timeframe. The problem gets worse the longer a student is in a developmental sequence. Students enrolling in the lowest level versus the middle level of remedial math reduces the likelihood of earning a credential in 4 years by 9 to 15 percentage points (Xu & Dadgar, 2017). In short, the longer a student is in the developmental sequence, the more likely they are to drop out of college. These students spend time and resources attempting college without ever completing and attaining a degree or certificate.

It is the students that are most affected when they are underprepared for college level work. College readiness is a measure of a student's preparedness and ability to succeed in college coursework. While there are a multitude of factors that come into play when examining what it means to be college ready, studies have shown that race and socioeconomic status are major contributing factors to whether a student is more likely to be deemed college ready upon graduation from high school (Hahn, et al, 2015).

College Preparatory Courses and Programs

Research suggests that students who participate in college preparatory courses and/or programs are far more likely to get a bachelor's degree than students who do not, with mathematics courses being the strongest predictors (Porter & Polikoff, 2011). Hein, et al, (2013) also found that participating in college preparatory programming was also shown to be correlated with college success. Such interventions include boot camps, tutoring, group study session and college preparatory courses, such as those mandated by HB5. Boot camps provide targeted, intensive, short-term coursework in math, reading and writing. Tutoring provided just in time, individual learning and refresher opportunities targeted to students' immediate needs. Group study sessions allow students to learn from each other in a semi structured environment. Finally, college preparatory classes provide focused curriculum designed to fill in the gaps in knowledge between high school graduating requirements and college entrance requirements. In one of the few examinations of the math HB5 courses, Pustejovsky & Joshi, (2019) stated that participating in early college coursework positively impacts post-secondary persistence and degree completion.

Gap between College and HS college readiness standards

Central to the creation and intent of the HB5 college preparatory courses is the problem that students can graduate high school, but not be prepared to succeed in college level coursework. This results in students needing varying levels of developmental coursework before taking college level classes. This is highly detrimental to student success in college and brings with it all of the challenges described in the previous section.

The gap between college readiness standards in high schools and the standards set by colleges is significant and has been difficult to overcome. Barnes (2010) found that in 30 years of increasing state and national legislation regarding rigorous curriculum, accountability and standardized testing, there has been little improvement in college readiness rates. Complicating the issue is the fact that students can be deemed successful graduates from high school but lack sufficient knowledge to meet minimal college readiness standards or succeed on college entrance exams such as the TSIA. This gap between high school graduation criteria and college readiness standards is an ongoing topic of dialogue in education as well as with legislators and other constituents.

A disconnect contributing to the college readiness gap literature between many K-12 and postsecondary systems is due, in part, because secondary and higher education institutions "operate in separate professional worlds" (Kirst, 2006). Kirst suggests that at both the state and federal levels, these two systems operate under separate policies and as a result, they have differing funding, governance and assessment systems. How to understand and remedy this gap has become one of America's pressing policy concerns (Porter & Polikoff, 2011). In Texas, the college preparatory courses mandated by HB5 are an example of an attempt to address this gap through policymaking.

Socioeconomic impact on College Readiness and Success

Low socioeconomic status has proven to be a major barrier to education. Research also shows that there is a large, well established educational achievement gap between students from poor families and those from wealthy families. Data has shown that even provided similar access, college students from high income families are eight times more likely to complete a bachelor's degree by age 24 than are college students from poor families (Hacker & Marcus, 2015). More recent data shows similar patterns. Kolluri and Tierney (2019) found that nationally, fifty percent of children from high-income families earn a bachelor's degree by the age of 25 while less than ten percent of children from low-income families achieve similar success.

The problem is more significant in southern border regions of Texas, including the area in which the college in this study is found. These regions contain a disproportionately high percentage of citizens with low socioeconomic status. According to data derived from the 2000 census, the poverty rate in Texas counties along the U.S. – Mexico border is currently 29.1% (Strayhorn, 2003). This stands in stark contrast to the State poverty rate of 14.5%. Even more alarming is that the percent of school children in poverty in those same border counties is 35.3%, compared to the State percentage of 18.6%.

As stated previously, economic disadvantage is a major obstacle to education. In Texas border counties, the 2000 census showed that the percent of the population over 25 years of age without a high school diploma is 43.2%. This compares poorly with the State average of 24.3% (Strayhorn, 2003). The magnitude of the issue of undereducation is further demonstrated by the lack of college going students in the region. In Texas, only 65% of high school freshmen graduate and less than half of those that graduate enroll in some form of post-secondary education (Montecel, 2010).

In Texas, economic disadvantage is the leading indicator of whether a student will continue their education past high school (Hahn, et al, 2015). Some suggest that the educational system is purposefully set up to perpetuate the advantage of the privileged by denying lower-class students the same level of education (Bowles & Gintis, 1976). Anyon (1980) states there is a hidden curriculum in our schools that teaches social classes differently keeping the various classes in their given places. Even in longitudinal studies of a major university, it was found that university experience did little to change the class structure of the study participants (Armstrong

& Hamilton, 2013). Indeed, those without money and other class resources were likely to experience negative consequences.

Whether the education system is rigged to reinforce social structure intentionally or not, certain populations, specifically poor and minority students, show marked declines in educational access and degree attainment. Additionally, wealthy families are found to spend seven times more on their children's development than poor families (Neuman, 2013).

In its educational strategic plan, the Texas Higher Education Coordinating Board (2015a) states "Although Texas student debt has not reached national levels, it is on the rise at a rate of 8 to 9 percent annually. At this pace, student debt will become a deterrent to much larger numbers of Texans making decisions about pursuing higher education." Such rising debt will be particularly impactful for those students at a lower socioeconomic status. In addition, the state comptroller reports that one quarter of the students who borrow money leave college without a degree.

Gender, Race and Ethnicity impact on College Readiness and Success

As with poverty, minority race and ethnicity also correlate to lower educational attainment levels. According to national data, there are significant gaps in the percentages of students who graduate from high school and enroll and complete college across various ethnic groups (Montecel, 2010). For example, Hispanic males drop out of high school at rates exceeding 50 percent, while White dropout rates are well below those of Blacks and Hispanics. Similarly, the level of White males participating in college exceed Black college enrollment rates by 13 percent and Hispanic rates by over 40 percent. Nationally, the need for remediation for African-American students has tripled and the need for remediation has doubled for Latinx students when compared with their white counterparts (Kolluri & Tierney, 2019).

The issue of college readiness for students of color takes on even greater urgency when it is estimated that this growing demographic will represent over half of the U.S. public school enrollment within a decade (Welton & Martinez, 2013). The U.S. Census bureau projects that the “Hispanic school-age population will increase by 166% by 2050 (to 28 million from 11 million in 2006), while the non-Hispanic school-age population will grow by just 4% (to 45 million from 43 million) over this same period. In 2050, there will be more school-age Hispanic children than school-age non-Hispanic white children” (Fry & Gonzales, 2008).

Prior Research

There are few studies that have researched the Texas HB5 college preparation courses to date. Additionally, there were no similar studies found that researched the impact of these courses on minority and socioeconomically disadvantaged students such as those found in the region of the state in which this study takes place. Pustejovsky & Joshi (2019) looked at a cohort of Texas math students from the 2016-17 class seniors at 18 high schools in nine school districts in central Texas. They found that students who took the HB5 courses were less likely than students in their comparison group to pass college-level math courses by the end of their first semester after high school.

While similar in some respects, the Pustejovsky & Joshi (2019) study had several significant differences from this one. First, the districts in their study adopted a common version of the math college preparatory course called The Transition to College Mathematics Course (TCMC) that was developed by the Charles A. Dana Center at the University of Texas at Austin. This course may have significant differences to the one developed by the partners in the southwest region of Texas. In addition, the teacher training conducted by the Charles A. Dana Center was likely different that the training received by the high school teachers in the region in this study. Second, the study looked at only one senior cohort and only examined math student college attendance and success, with no attention given to the English language arts HB5 course. Third, while some of the variables in the two studies are similar, the Pustejovsky & Joshi (2019) study contained additional variables unavailable to this researcher. Finally, the strategy of comparison between the HB5 students and the comparison group differed significantly. This study focuses on a comparison group that successfully completed the TSIA whereas the Pustejovsky & Joshi (2019) study created comparison groups based on matching demographics, historical course taking patterns and State of Texas Assessments of Academic Readiness (STAAR) scores. It did not consider TSIA as a variable. As a result of these differences, the results of the two studies may not be applicable to the different groups or regions studied.

Chapter Summary

With studies showing that a college degree will pay dividends for individuals in the form of future earnings, better health and reduced crime, it is difficult to understand why so few high school graduates attend college and why those that do are largely unprepared for college level coursework. Human Capital Theory suggests that the benefits of additional education extend to both the individual as well as to society at large. Understanding this, national and state policy makers have created numerous educational policy changes over the last several decades designed to create a more educated populous. Despite these efforts, many students graduate high school without being college ready.

Students who are not college ready require remedial coursework upon entering college and face numerous negative effects including increased time to degree, higher stop out rates, lower degree attainment levels and increased debt. This debt can often come without the student having a college credential to show for their efforts. These issues are particularly evident for students of color and students with low socioeconomic status. More recently, there is an additional concern that gender is also a major factor with females attending college in greater numbers than their male counterparts.

These negative effects provide additional pressure and motivation for constituents, including legislators, to create structures and mandates to increase college readiness rates for high school graduates. Such mandates include the HB5 college preparatory courses that are the central factor in this study. With most of the current and future jobs requiring some education after high school, much focus is placed on getting students to be college ready upon graduation from high school.

In the context of Human Capital Theory, there is debate about whether interventions designed to increase the human capital of individuals is effective if done later in life. Remedial coursework and the college preparatory courses at the center of this study are examples of such interventions. While some human capital theorists state that to be successful, interventions must be done early in life. However, other human capital theorists suggest second-chance interventions can be successful despite being done later in life. This can be especially true for interventions targeting individuals who are from disadvantaged backgrounds. Understanding the success, or lack thereof, of the HB5 college preparatory courses may help inform such debate.

Chapter 3: Methodology

Chapters one and two presented the proposed research and purpose of the study. Those chapters introduced the research problem, the study purpose and described how the research findings could be used by practitioners in secondary school districts and in higher education. The proposed hypothesis will be used to guide the analysis of the data in this quantitative study. A review of relevant literature was described which provided a basis for the current state of research. This review included a list of key terms and definitions to assist readers with interpreting and understanding the study.

Various national, state, and regional pressures have resulted in legislative action directed at increasing the college readiness of students graduating from high school. These legislative mandates have introduced new ways for students to demonstrate college readiness through the use of college preparatory courses for high school seniors. This quantitative study is aimed at evaluating the efficacy of these courses and identify predictors of college success.

Setting

The study takes place at a 2-year, postsecondary Hispanic Serving Institution (HSI) in the southwest region of Texas. Situated on the border of the United States and Mexico, the multi-campus post-secondary institution serves just over 29,000 students as of the time of this study (Frescas, 2019). As a very large college with a student population that is 85% Hispanic, the location of the study allows for a rare opportunity to examine how state policies regarding college readiness affect minority populations. Like many colleges, the institution in this study has a population that is predominantly female. Although the region has a population that is equally split between males and females, the college has a student body comprised of 57%

female and 43% male. This makes the site a good setting to study the effects of college readiness initiatives on gender.

The site is also appropriate since the college falls under the Texas HB5 legislation described earlier and the region it serves has a large high school graduate population that is historically not deemed college ready. Being classified as a very large institution by the Texas Higher Education Coordinating Board, provides for a large faculty and student population. This will provide the researcher with a rich set of potential data records. The college is also located in a region of low socioeconomic status with 21% of the region's citizens falling below the poverty level (Frescas, 2019). While there are a multitude of factors that come into play when examining what it means to be college ready, studies have shown that race and socioeconomic status are major contributing factors to whether a student is more likely to be deemed college ready upon graduation from high school (Hahn et al. 2015). These characteristics make the selected institution an excellent location for this study.

Population and Sampling Plan

TSIA

In Texas, the main method by which high school students demonstrate college readiness is via the Texas Success Initiative Assessment (TSIA). Since 2013, this statewide exam has replaced other college entrance exams. Students passing the relevant portions of this assessment are eligible to take college level coursework in the associated content area(s) without remediation. Students may take this assessment at any point beyond eighth grade and may attempt the exam multiple times. There are several strategies for sampling, including probability, simple random, stratified and convenience (Creswell, 2008). For this study, the complete available data set will be used in the analysis. All regional students who successfully passed one or more areas of the TSIA and subsequently entered and attempted a college level Math or English course at the college in the study between fall 2014 and fall 2019 will be included in the data set for this study.

HB5 College Preparation Courses

Students who become high school seniors and have not demonstrated college readiness in math or English may take a college preparatory course as mandated in section 10 of HB5 from the 2013 Texas Legislature. The relevant section reads:

> Sec.28.014. COLLEGE PREPARATORY COURSES. (a) Each school district shall partner with at least one institution of higher education to develop and provide courses in college preparatory mathematics and English language arts. The courses must be designed:
>
> (1) for students at the 12th grade level whose performance on:
>
> (A) an end-of-course assessment instrument required under Section 39.023(c) does not meet college readiness standards; or
>
> (B) coursework, a college entrance examination, or an assessment instrument designated under Section 51.3062(c) indicates that the student is not ready to perform entry-level college coursework;

Students successfully completing these courses are deemed college ready in the relevant subject areas and may take college level coursework without remediation. There are several strategies for sampling, including probability, simple random, stratified and convenience (Creswell, 2008). For this study, the complete available data set will be used in the analysis. All regional students who successfully passed one or more of these college preparatory courses and subsequently entered and attempted a college level Math or English course at the college in the study between fall 2014 and fall 2019 will be included in the data set for this study.

Data

Student data was gathered on all students in the southwest region that have taken either of the two HB5 college preparation courses in their senior year of high school. Also included in the data set will be all students in the southwest region that passed either the math or Reading/English components of the TSIA. The final dataset used for the study will be limited to those students who subsequently went to college and attempted a college level course that corresponds to the area(s) for which they were deemed college ready. The date range for the dataset was from the fall 2014 semester through the fall 2019 semester. These dates represent the timeframe from when the course was first taught, through the predicted completion of this study.

There is no overlap of student data between the TSIA and HB5 Math students in that data set, nor is there overlap between the TSIA and HB5 English students in that data set. However, it is possible that a student is represented in both data sets due to the fact that taking math and English college level coursework and the two paths to college readiness in those areas are not mutually exclusive. This does not affect the ability to develop the separate predictive models of success for math or English.

As indicated in Chapter One, there are a variety of exemptions available to students that deem them college ready without taking either the HB5 college preparatory courses or taking the TSIA. Due to the wide variety of these exemptions, the fact that some exemptions do not measure academic preparedness and the fact that these exemptions represent a small percentage of student entering the college in this study, these records will not be considered for the study. The entire remaining useable data set was incorporated into the study.

Data was collected from two sources, the regional Educational Service Center (ESC) and the college's Institutional Research (IR) department. All required IRB permissions were obtained prior to data gathering. It was anticipated that data collection would be streamlined due to the robust data sharing agreements between the school districts, ESC and the postsecondary educational institutions in the southwest. However, the data collection proved difficult, taking over a year to gather with multiple requests and meetings needed.

The data from the regional ESC was provided to the college's IR department and consisted of school district records for every graduating senior between fall 2014 and fall 2019. The college's IR department matched records from this data set with the college's institutional records for students matriculating to the institution who have taken a college level math and/or English course. The combined data had student identity data stripped from each record and a single, encrypted identifier was attached to each record. As a result, the data was deidentified and the researcher does not have to ability to personally identify individual students. The resulting data sets, one for math and one for English, were provided to the researcher for analysis in this study. Standard statistical analysis was used to examine the data set for duplicates, outliers, and missing data elements.

Research Design

The intended study will be a cross-sectional relationship predictive design which allows for the examination of observational data typically collected at one point in time from variables gathered from a secondary data set. The specific selection of variables allows for the examination of how they may be related with each other and their potential as predictor variables related to the outcome variable (Johnson & Christensen, 2020). For this study, the relationship/predictive design compared the success of high school graduates in college level math and English courses. In this context, success is defined by achieving an A, B or C in the college level courses. Scores of D, F and W will indicate a lack of success for purposes of this study. This is consistent with how the college in the study reports student success internally.

The statistical analysis used observational/survey data and using a combination of academic and nonacademic variables. The variables were derived from a list of available records stored in a secondary data set. Using standard logistic regression techniques, a predictive model was derived for success factors pertaining to students taking college level courses. Separate models were developed for students taking college courses in English and for students taking college courses in mathematics. Identification of the model of best fit (best set of predictors) are reported for purposes of interpretation and application. Below, the variables proposed to comprise the models are described.

Data Collection

There is no consistent method of consolidating a complete dataset such as the one used in this study. Each entity in the data acquisition chain may add information or manipulate the data to meet its needs. Thus, some information is available to certain entities, but not readily accessible to others.

Each year, the ISDs gather and store high school level data that is subsequently parsed and provided to their district and to the ESC. The districts then report the data to the Texas Education Agency at the state level. Each high school is responsible for guaranteeing the accuracy of the data it provides. Some data, such as transcripts and SAT/ACT scores, from the high schools is also provided to the college when students apply for admissions.

Once the college in the study receives transcript information from high schools it is analyzed to ensure students meet admissions requirements. This includes examining the transcripts for college readiness exemptions such as those provided via the HB5 college preparatory courses. Students not receiving exemptions are required to take the TSIA college entrance exam. Once taken, those scores are made part of the student record. Other data gathered by the college that is not part of the high school record includes Pell eligibility, other need based financial aid and first generation status.

It is fortunate that the entities in the southwest region have robust data sharing agreements. While data sets such as the one used in this study are not regularly gathered and shared, it is relatively straight forward to request needed data and then to develop the data set for study.

Description of the Study Variables

The study utilized secondary data combined from the regional Education Service Center and the college Institutional Research department. This section provides a brief description of some of the key variables relevant to this study. The data stored in these variables of this secondary data set was used to perform relevant statistical analysis to answer the research questions of this study.

SAT

The three SAT values represent the scores achieved in Critical Reading, Math and the combined total of the two. The scores range from 400-1600. Studies regarding the predictive validity of the SAT show that the content and skills covered in the exam are those most critical for predicting student success and college readiness (College Board, 2018). However, one study suggests that college success for some subpopulations are less predictable by standardized tests such as the SAT (Aguinis, Culpepper & Pierce, 2016; Ransdell, 2001). When examined by gender, it was found that at 16 percent of the colleges in the study, the predictive value of the

SAT on college GPA was inaccurate. Likewise, ethnicity and race proved unreliable. When examining scores for white and Latino students on the mathematics section of the SAT there was found a lack of predictive accuracy at 19 percent of colleges. The researchers also found the predictive value of the reading portion of the SAT was unreliable at 20 percent of colleges when comparing black and white applicants' scores. In their report for the College Board, Kobrin and colleagues (2008) state that a student's SAT score and high school GPA measure different aspects of academic success and that both should be considered when predicting college success.

HS_GPA

HS_GPA represents the student's high school grade point average. It is derived by the number of points earned per semester credit hour completed divided by the number of semester credit hours attempted. It is represented by a one hundred point scale and is assumed to be an accurate representation of student achievement. Research suggests that GPA is highly correlated with student performance over time (Brookhart et al., 2015). Indeed, research has shown that HS_GPA is a stronger predictor than test scores such as those from the ACT and SAT of college outcomes (Bowen et al., 2009; Hiss & Franks, 2014; Kobrin et al., 2008; Ransdell, 2001). Strauss (2019) cites George Washington University President Thomas LeBlanc as stating "We know what the best predictor of college performance is high-school performance — not the SAT".

CPM

CPM represents whether the student's grade achieved in the college preparatory math course taken in the high school is sufficient to demonstrate college readiness. Students earning a 75 or higher in the high school course will receive a TSIA waiver and may enroll in college level mathematics courses without the need for developmental education. In the data set, this is a binary variable with a 1 indicating a passing score sufficient to receive the TSIA waiver for math.

CPE

CPE represents whether the student's grade achieved in the college preparatory English language arts course taken in the high school is sufficient to demonstrate college readiness. Students earning a 75 or higher in the high school course will receive a TSIA waiver and may enroll in college level English courses without the need for developmental education. In the data set, this is a binary variable with a 1 indicating a passing score sufficient to receive the TSIA waiver for English.

Gender

A variable representing the sex of a student. The field indicates whether a student is Male or Female. Alternately, the field holds a value of N for records that are not identified as male or female. For purposes of this study, records that did not clearly indicate whether a student was male or female were removed from the data set.

Encrypt_ID

This variable holds an encrypted identification number that is associated with each student record. As the gathered data set is derived from multiple data tables from two separate entities, this field holds the vital key to linking the student records together. The Encrypt_ID field was also used to identify duplicate records in the data set. Because the data set included a record of all of the college level math and/or English courses a student may have attempted, there were a large number of duplicate records. For example, a student who attempted their first college level course in fall 2014 may also have either reattempted the course or taken the next math course in sequence in subsequent semesters. Each of these courses would be represented in the data set as a duplicated Encrypt_ID record. As this study was only interested in students' success on their first attempted college level course, subsequent course records were eliminated from the data set resulting in a single record for each student.

Ethnicity

Ethnicity is a social science construct that describes a person's cultural identity, often based on geographic origin, heritage and cultural practices. Data in this field includes, but is not limited to white, Hispanic, black and undeclared. As indicated in chapter two, there are significant gaps in the percentages of students who graduate from high school and enroll and complete college across various ethnic groups (Montecel, 2010). This makes ethnicity an appropriate variable to include in potential predictive models of student success.

SES

Low socioeconomic status (SES) has a widely studied negative affect on college readiness and ultimately on college success. For this study, a student is identified as low SES if they are either the recipient of a federal Pell grant or another form of need-based assistance. As indicated in chapter one, data from the Texas strategic plan indicates that out of the 2013 8th grade cohort, economically disadvantaged students were 26% less likely to enroll in higher education and 20% less likely to earn a degree or certificate (Texas Higher Education Coordinating Board, 2015a). Further, in Texas, economic disadvantage is the leading indicator of whether a student will continue their education past high school (Hahn et al. 2015).

First Generation (FGEN)

Students are identified as first generation if neither of their parents have achieved a 4-year college degree. Prior research has shown that these students often underperform when compared to students whose parents completed college (Bailey, 2009). The college in this study has a large percentage of first generation students, making this valid variable for the study. In this study a score of one indicates that is student is a first generation student and a value of zero indicates they are not. This identifier is self-reported by students on the application and on the Free Application for Federal Student Aid (FAFSA).

College Readiness Method (CRM)

CRM is a binary indicator identifying whether students met the measure of college readiness through a successful score on the TSIA or through successful completion of a college preparatory course. It is derived based on the CPM and CPE variables described earlier. In this study, a score of one indicates a student demonstrated college readiness by completing a college preparatory course and a score of one indicates they demonstrated college readiness by passing the TSIA.

Summary of Variables/Constructs

This collection of variables consists of the most relevant set of variables that are part of the available secondary dataset. These are anticipated to play a significant role in the proposed predictive proposed model in the study. Note that for the most part the psychometric components of these variables is inferred from previous research (i.e., SAT, GPA, etc.) while others are assumed to be valid based on the self-reported description of the participants' personal characteristics as collected within the extant dataset. Such self-reported data includes first-generation status, ethnicity and socioeconomic status, all of which has been shown in the literature to be contributing factors to student success.

Proposed Analysis and Expected Findings

The data was uploaded into SPSS version 25.0 for Windows. The data was cleaned to account for duplicates, non-responses and outliers. Frequencies and percentages were derived to explore the nominal-level variables such as gender, ethnicity, SES, first generation and success in college level English and math courses. Means and standard deviations were utilized to analyze the trends in the continuous-level data such as GPA or SAT scores.

RQ1: Among students attempting their first college level math course, is there a significant predictive relationship between CRM, gender, ethnicity, SES, GPA, SAT, first generation status and success in first college-level math course?

H01: Among students demonstrating college readiness in math, there is not a significant predictive relationship between CRM, gender, ethnicity, SES, GPA, SAT, first generation status and success in first college-level math course.

HA1: Among students demonstrating college readiness in math, there is a significant predictive relationship between CRM, gender, ethnicity, SES, GPA, SAT, first generation status and success in first college-level math course.

RQ2: Among students attempting their first college level English course, is there a significant predictive relationship between CRM, gender, ethnicity, SES, GPA, SAT, first generation status and success in first college-level English course?

H02: Among students demonstrating college readiness in English, there is not a significant predictive relationship between CRM, gender, ethnicity, SES, GPA, SAT, first generation status and success in first college-level English course.

HA2: Among students demonstrating college readiness in English, there is a significant predictive relationship between CRM, gender, ethnicity, SES, GPA, SAT, and success in first college-level English course.

To address the research questions, a series of logistic regressions were conducted. A binary logistic regression is an appropriate statistical analysis when assessing the strength of the relationship between a group of predictors on a dichotomous outcome variable (Field, 2018; Hahs-Vaughn, 2017; O'Connell, 2006; Pallant, 2013). The predictor variables include CRM, gender, ethnicity, SES, GPA, SAT English, SAT Math and first-generation status. CRM, gender, ethnicity, SES and first-generation status are nominal-level variables and were coded prior to entry into the regression model. GPA, SAT English, and SAT Math are continuous-level variables. The dependent variable corresponds to success in a student's first college-level Math and/or English course. In this study, success is defined as the student achieving a grade of A, B or C in their first college level course. Grades of D, F, or W reflect an unsuccessful outcome in the course. This coding is consistent with how the college in the study reports student success.

Prior to analysis, the normal assumptions of a logistic regression were checked. The dependent variable needs to be a dichotomous measurement. Course success will be dichotomized into two categories: yes (A, B, or C) and no (D, F and W). The second assumption is that there are one or more independent variables. There are seven independent variables of interest. The third assumption is that there is independence of observations. This assumption is met due to each student being completely independent of one another. The complete assumption testing requirements and processes are detailed in chapter 4.

The models were examined for statistical significance through logistic regression analysis due to the nature of the independent variables and the dichotomous nature of the dependent variable (Tabachnick & Fidell, 2013). Significance at the generally accepted level, $\alpha = .05$, indicates that the independent variables collectively predict course success. Pseudo R^2 explains the amount of variance in course success that can be explained by the independent variables. If the predictor variables were significant, the odds ratios were further examined to identify how course success fluctuates based on variations in the independent variables. Success for two groups of participants, those demonstrating college readiness via the TSIA and those demonstrating college readiness via completions of HB5 college preparatory courses, were compared for similarities and differences. The efficacy of the HB5 college preparatory courses was examined based on success rates of that participant group compared with success rates of TSIA students.

Although the researcher had no preconceived expectations of the study, research suggests that students participating in college preparatory programs will have higher success rates than those using standardized measure scores such as the TSIA (Goldrick-Rab & Mazzeo, 2005). This could lead one to expect that students participating in the HB5 college preparatory courses will compare well with those not using college preparatory courses.

Chapter Summary

There is good research suggesting strong relationships between student success in college and variables such as high school GPA and scores on standardized exams such as the SAT. Socioeconomic status and ethnicity are also well researched variables as they relate to college success. This study attempts to examine a relatively new, legislatively mandated measure of college readiness through the lens of student success as defined by passing college level coursework. At the heart of the study is whether a high school senior deemed not ready for college can be made college ready by successful completion of HB5 college preparatory courses. By developing a predictive model of success for such students, this research may inform secondary and post-secondary educators about the efficacy of these courses and more importantly, the educational needs of students who become seniors without demonstrating college readiness.

Chapter 4: Results

This chapter presents the results of the data analysis performed and explores the research questions that guided it. To effectively answer these research questions, binary logistic regression, a quantitative research methodology, was employed in order to make predictions and measure relationships. The researcher will begin by reiterating the study's purpose. This is followed by relevant information on the secondary data sample set and a breakdown of the process followed for data screening. Descriptive statistics are provided for important points in the screening process as well as for the final data set. This chapter will cover in detail the research method, assumptions associated with the logistic regression procedures and development of the final predictive models. Finally, the chapter will present the results of the statistical analysis and interpret their meanings.

The purpose of this study is to examine the effectiveness of one of the latest Texas legislative efforts to increase the college readiness of Texas high school graduates. The study assesses whether students falling under this mandated measure of college readiness are as successful in their college level math and English courses as students who pass the TSIA. The study's intent was to develop a predictive model that identifies those available data elements that most contribute to student success on college level Math and English courses. To assist the reader, the screening, analysis and findings related to the math data set will be presented first, followed by the similar screening, analysis and findings related to the English data set.

Data

The data for this study was derived from two sources, the local regional Educational Service Center (ESC) and the college's Institutional Research (IR) department. This was needed because no known single source contains the data needed to conduct the study. The data from the regional ESC was provided to the college's IR department and consisted of school district records for every graduating senior between fall 2014 and fall 2019. The college's IR department matched records from this data set with institutional records for students matriculating to the college who have taken a college level math and/or English course. The combined data had student identity data stripped from each record and a single, encrypted identifier was attached to each record. As a result, student identifiable information was safeguarded and unavailable to the researcher. Finally, the data was separated into two different data sets, one for math and one for English. The resulting data sets were provided to the researcher in the form of Microsoft Excel spreadsheets for analysis in this study. The original data set for math consisted of 11,737 records. The original set for English consisted of 14,638 records. While these appear at first glance to be robust data sets, it is notable that the number of cases for students taking the TSIA are significantly higher than the number of cases for students completing the HB5 college success courses. Table 4.1 provides a breakdown of these cases by number and percentage.

Table 4.1

Initial Number of Cases by College Readiness Measure

	HB5 Course		TSIA	
Cases	N	%	N	%
Math	970	8.26%	10768	91.74%
English	516	3.53%	14122	96.417%

Relevant data elements for each record included Encrypt_ID, CRM (college readiness method), High School GPA, Gender, Ethnicity, First Generation Status, Need Based Assistance (SES), SATW, SATM, SATT, Term, Subject, Course, and Grade. Initial analysis of the data showed that due to the large number of missing data elements, significant data screening would be required to derive a working sample in order to perform a meaningful, statistically valid analysis. Ultimately, one of the anticipated predictive variables, SAT, had to be eliminated from consideration due to the large number of missing data elements. It should be noted that prior to removing SAT from consideration, a logistic regression was run on the small number of remaining cases for both the Math and English data sets and SAT was not found to be significant in the models.

Data Screening - Math

The purpose of data screening was to identify and account for potential data points that would preclude the performance of a quality, relevant analysis. This included conversion of string data to numeric, dichotomous coding of success data, standardizing GPA values to a 100 point scale, coding of gender, coding of SES, coding of first generation status, identifying and eliminating records that were missing data elements relevant to the study, identifying and eliminating outliers and eliminating duplicate records.

Missing Data - Math

The first step taken was to examine the records for missing data in the relevant variables for this study. It became evident early in the screening process that the data set provided was missing large numbers of data elements. This would ultimately prove problematic and would significantly impact the study's ability to derive a predictive model using all of the variables originally planned for the model. Table 4.2 details the missing data elements for the math data set.

Table 4.2

Missing Data Elements - Math

	College Prep Math	%	TSIA	%
Total Records	970		10768	
Missing HS_GPA	3	0.31%	365	3.39%
Missing Grade	367	37.84%	841	7.81%
Missing SAT	754	77.73%	9938	92.29%
Missing FGEN	374	38.56%	502	4.66%
Missing Gender	4	0.41%	0	0.00%
Missing SES	0	0.00%	0	0.00%
Missing Ethnicity	174	18.04%	210	1.95%

There are several items of note in table 4.2 that bear explanation. First, there are large numbers of missing grades. The data provided to the researcher contained all records for students who graduated from high school, matriculated to the college and took a college level math course. When investigating these missing grades, the researcher discovered that the data provided included students enrolled in the spring 2020 semester, which was still in progress at the time the data was gathered. As a result, these grades were not yet recorded. Since this study only analyzed data between the fall 2014 and fall 2019 semesters, the cases for in progress students were eliminated.

Second, there are very large numbers of missing SAT scores. Upon investigation, it became evident to the researcher that large numbers of students in the region included in the study are electing not to take the SAT. What is not clear is whether this is by student choice or due to some other factor such as cost. Indeed, at the college in this study, SAT and ACT scores are not a requirement. Further, since the state of Texas has mandated the use of TSIA scores, students and local school districts are largely focused on student success on that exam. Most of the districts in the region have become testing sites for administration of the TSIA exam. As the researcher investigate this further, it is apparent that many institutions in the nation are eliminating the SAT and/or ACT as requirements for admissions (Strauss, 2019).

This missing data is unfortunate as it was originally theorized that SAT scores would be a significant predictive variable for the success model as there is much literature on the contribution of standardized test scores to ultimate student success in college. However, as mentioned in the literature review, some have found SAT scores to have only a modest contribution in ultimate student success, especially among certain populations, such as socioeconomically disadvantaged and minority students. (Aguinis, Culpepper & Pierce, 2016; Ransdell, 2001). Both of these characteristics are prevalent among the students attending the college in this study.

As mentioned previously, prior to removing SAT from consideration, a logistic regression was run on the small number of remaining cases and SAT was not found to be significant in the model. Because of this and the desire to retain sufficient cases, especially for the college prep math sample, SAT was removed from consideration in the ultimate predictive model. Tabachnick and Fidell (2013) indicate this is a valid strategy when one is concerned about the ratio of cases to variables.

Additionally, there were numerous missing data elements for first generation status. It was somewhat fortunate that there was a large overlap in cases missing both SAT scores and first generation status. After eliminating the records with missing SAT scores, only 118 cases were missing first generation status for the college prep math cases and 218 for the TSIA cases. These cases were removed from the data set.

For each of the other categories of missing data elements, including HS_GPA, Gender, and Ethnicity, the number of missing cases was minimal. The researcher determined that removing these would not have a significant impact on the study. Therefore, cases missing these elements were also removed from the data set.

Remove Duplicates - Math

Because the provided data included cases spanning five years, there were occurrences where a student may have taken an initial college level course and subsequently taken one or more math courses in a series. Alternatively, a student may have been unsuccessful in their initial attempt at a college level math course and reattempted it one or more times. Each of these attempts and additional coursework were captured in the provided data resulting in duplicate cases for some students. Because this study is focused on student success in their first attempt at a college level course, other attempts, reattempts, or additional math courses taken were removed. In total, 5765 duplicate records were removed from the original data provided.

Outliers – Math

A cursory analysis of the remaining data showed a very small number of outliers, all within the HS_GPA field. Each of these had HS_GPA scores exceeding 800 on a scale of one to one hundred. In total, five cases were removed due to obvious outlying HS_GPA scores.

After data cleaning, a total of 4,261 cases were left to conduct the analysis. Table D1 shows the final number of cases with a breakdown by HB5 versus TSIA populations.

Conversion and Data Coding - Math

Several relevant elements in the data set consisted of string data, which needed to be converted or coded to facilitate the statistical analysis. These included the code which indicates the college readiness method (TSIA or HB5 course), HS_GPA, gender, first-generation status, socioeconomic status, and the grade received in the college level math course. Using a combination of MS Excel functions and IBM SPSS Transform commands, data was converted and/or coded into new variables in a format useful for analysis. Table 4.3 identifies the conversion and/or coding performed on the data.

Table 4.3

Math Data Conversion and Coding

Original	New	Description of conversion/coding
Code	CRM	Data consisted of either the string CPMA or PTSM. A new variable was created to indicate the College Readiness Method (CRM) with the number one assigned for CPMA and zero assigned for PTSM.
HS_GPA	HS_GPA	String data converted to numeric. Grades originally provided on a four point scale were converted to a 100 point scale for consistency. HS_GPAs in excess of 100 were set to 100.
Gender	Gender_Num	Data consisted of either the string Male or Female. A new variable was created with the number one assigned for Males and a zero assigned for Females.
Need_Based_FA Pell	SES	Data consisted of either the string Y or N. If either of these were coded Y, SES was assigned a one indicating low socioeconomic status. Otherwise, SES was assigned a zero indicating the student was not low socioeconomic status.
First_Generation	FGEN	Data consisted of either the string Y or N. If coded Y, FGEN was assigned a one indicating the student is a first generation student, otherwise FGEN was assigned a zero.
Grade	Success	Data consisted of a letter grade A, B, C, D, F or W. Success was assigned a one for A, B or C grades, otherwise success was assigned a zero.

Testing of Assumptions - Math

Logistic regression analysis uses maximum likelihood estimation to predict group membership. There are several assumptions associated with performing a logistic regression analysis, some of which have specific tests available in SPSS (Field, 2018; Hahs-Vaughn, 2017; Tabachnick & Fidell, 2013).

One Dichotomous Dependent Variable

This study seeks to assess the likelihood of student success in a college level math or English course based on a number of independent predictor variables. Success is based on the grade received in the college course. These grades can be A, B, C, D, F or W. For the purpose of the study, success was identified as the student receiving a grade of A, B or C. Grades of D, F or W were identified as unsuccessful. The success variable was coded with the value one for grades of A, B or C and with the value zero for grades of D, F or W. This coding resulted in a dichotomous dependent variable, meeting this assumption.

The Model Has One or More Independent Variables measured on either a continuous or Nominal scale

After the removal of SAT as a variable, this study examined six independent variables. HS_GPA is a continuous variable. CRM, Gender_NUM, Ethnicity, SES and FGEN are nominal variables. As there are more than one variable and the scales are continuous or nominal, this assumption is met.

Independence of Observations

The dichotomous dependent variable categories are mutually exclusive. In addition, each of the nominal independent variables are mutually exclusive. As indicated previously, duplicate records were removed leaving only one case for each Encrypt_ID. Therefore, the assumption of independence of observations is met.

Linearity in the Logit

In testing for linearity, the Box-Tidwell approach is considered appropriate and can be accomplished within SPSS (Field, 2018; Tabachnick & Fidell, 2013). Using the SPSS compute variable function, a new variable, LN_HS_GPA was created and computed as the natural log of HS_GPA. The interaction between these two variables was then added to the logistic regression model and was examined for significance. Table D2 shows the results. Because the interaction variable is significant ($p < 0.05$), the assumption of linearity fails for the continuous variable HS_GPA. The assumption failed even after applying a Bonferroni correction based on the number of terms in the model (Tabachnick & Fidell, 2013).

There are several strategies to attempt to linearize the data including eliminating the variable from the model (Field, 2018; Tabachnick & Fidell, 2013). These strategies include transforming the variable using a power transformation, acknowledging the failed assumption in the model analysis or categorizing the data in the variable. The researcher explored various transformations of HS_GPA including a squared transformation, a sqrt transformation and a cube transformation, however, in each case the interaction of the transformed variable with its natural log was found to be significant.

A second approach was to categorize the continuous variable. This effectively eliminates the test as the Box-Tidwell test is only applicable to continuous variables. It should be noted that the researcher did explore this approach but found that the resulting model did not differ significantly from the model which left the variable as continuous. Since HS_GPA is the only continuous variable in the model, the researcher ultimately chose to leave it untransformed and acknowledge the assumption failure.

Absence of Multicollinearity

Multicollinearity is present when model variables are highly correlated (Field, 2018). When present, it suggests that not all of the correlated variables are needed in the model because they are in essence measuring the same thing (Tabachnick & Fidell, 2018). When using logistic regression, the assumption is that there is not multicollinearity between the variables. Although SPSS does not have a function to test for multicollinearity under the logistic regression model, appropriate testing can be performed by running a linear regression with the model variables (Tabachnick & Fidell, 2013). Specifically, the collinearity statistics for tolerance and variance inflation factors (VIF) are available. Table D3 shows the results of the multicollinearity test for the math data set. Tolerance values below 0.1 or VIFs above 10 indicate a problem with multicollinearity (Field, 2018). Because all variables show a tolerance value over 0.1 and under 10, the assumption of absence of multicollinearity was met.

Descriptive Statistics - Math

After the data screening and assumption testing, descriptive statistics were run to provide a sense of the remaining 4,261 cases and examine the population sample more closely. A look at the frequencies of study variables is shown in table 4.4. Of note is that the overwhelming number of students demonstrated college readiness via the TSIA-math exam with 94.8% of the cases categorized as taking the TSIA versus 5.2% of the cases categorized as having taken the math college preparatory course. This was not unexpected as the college preparatory courses are relatively new. Further, the HB5 college preparatory courses have a small target population in that they are limited to seniors who have not demonstrated college readiness via another measure. Contrast this with the TSIA exam, which has been available for many years and is often administered to students multiple times during high school, giving many students a cycle of intervention and retesting for that assessment.

The gender distribution is in line with the overall population at the college in the study with females outnumbering males by approximately 6.6%. The percentage of students identified as first generation, 43.2%, is 13.6% lower than those not identified as first generation. This is only slightly lower than the college's overall population identifying as first generation at 46% (Frescas, 2019). Students in the study receiving some form of need-based financial aid is 11.5% lower than the institutional percentage of approximately 70%.

Table 4.4

Frequency Distributions of Other Relevant Study Variables - Math

Variable		Frequency	Percent	Cumulative Percent
CRM	TSIA	4040	94.8	94.8
	ColPrep	221	5.2	100
Gender	Female	2271	53.3	53.3
	Male	1990	46.7	100
First Gen	No	2419	56.8	56.8
	Yes	1842	43.2	100
Need Based FA	No	1770	41.5	41.5
	Yes	2491	58.5	100
Student Success	Failed	996	23.4	23.4
	Passed	3265	76.6	100

Because a major focus of this study is to develop a predictive model of student success, especially in light of differing college readiness methods, it was important to exam these variables separated by CRM. Table 4.5 allows for an examination of similarities and differences between student populations taking TSIA versus those taking college preparatory courses.

Table 4.5

Frequency Distributions of Study Variables by CRM - Math

Variable		Frequency	Percent	Cumulative Percent
Gender				
TSIA	Female	2130	52.7	52.7
	Male	1910	47.3	100
ColPrep	Female	141	63.8	63.8
	Male	80	36.2	100
First Gen				
TSIA	No	2305	57.1	57.1
	Yes	1735	42.9	100
ColPrep	No	114	51.6	51.6
	Yes	107	48.4	100
Need Based FA				
TSIA	No	1718	42.5	42.5
	Yes	2322	57.5	100
ColPrep	No	52	23.5	23.5
	Yes	169	76.5	100
Student Success				
TSIA	Failed	909	22.5	22.5
	Passed	3131	77.5	100
ColPrep	Failed	87	39.4	39.4
	Passed	134	60.6	100

Notable differences between the populations include the observation that the percentage of females taking the math college preparatory course is much higher than the TSIA population. In addition, the percentage of college preparatory students reported as first generation is 5.5% higher than the TSIA group. More notable was the large 19% difference for college preparatory students on some form of need-based assistance versus their TSIA counterparts. Finally, the percent of college preparation students passing their first college level math course was 16.9% lower than the TSIA group.

In addition, the researcher looked for variances in the HS_GPAs for the groups. Table 4.6 shows that the minimum HS_GPA for the college prep students is almost 2 points lower than that of the TSIA group. As importantly, the Mean HS_GPA for the college prep students was over three points lower than that of the TSIA group. This could help to partially explain this group's lower percentage of success on their first college level math course.

Table 4.6

GPA Descriptive Statistics by CRM - Math

Descriptive Statistics						
Type of program selected		N	Minimum	Maximum	Mean	Std. Deviation
TSIA	HS_GPA	4040	64.52	100.00	90.20	5.66
	Valid N	4040				
ColPrep	HS_GPA	221	62.60	100.00	86.96	5.714
	Valid N	221				

As a practitioner, these differences are not surprising. As a review of the literature showed, standardized tests often put some sub populations of students at a disadvantage, showing differences based on gender, socioeconomic status and first generation students (Aguinis, Culpepper, & Pierce, 2016; Ransdell, 2001). Such disadvantages may lead to lower scores for these groups, making them candidates for the college preparation courses. Indeed, the college preparation sample presents with lower overall socioeconomic status, a higher percentage first generation student status, a higher percentage of females and a lower mean GPAs. These observations also reflect that the target population taking the college preparation math course is in line with that which is intended by HB5. This course is intended as a last ditch opportunity for high school students who have become seniors without being able to pass the TSIA.

Logistic Regression Analysis - Math

It is a recommended practice in logistic regression to perform a cross-validation of the model (Hahs-Vaughn, 2017). This approach allows testing of the model on two different samples. This is accomplished by developing the predictive model using approximately 75% of the available cases and then using the remaining cases to help determine the accuracy of the derived model. If the classification accuracy of the validation sample is reasonably close to that of the reference sample, then this supports the validity of the model.

To accomplish this, the SPSS select cases function was used to create a new filter variable which included approximately 25% of the final data set. This allowed for a reference group made up of the majority of cases as well as a smaller validation sample with which the developed model can later be compare. This resulted in a reference sample consisting of 3167 cases and a validation sample consisting of 1094 cases. The SPSS split file command was then used to filter the analysis to only the reference sample for the logistic regression.

Research Question 1

RQ1: Among students attempting their first college level math course, is there a significant predictive relationship between CRM, gender, ethnicity, SES, GPA, first generation status and success in first college-level math course?

Running the SPSS binary logistic regression function including all remaining study variables, provided a baseline to begin a hierarchical approach to developing a predictive model (Field, 2018; Tabachnick & Fidell, 2013). Such an analysis will help determine which of the independent variables have a statistically significant ($p < .05$) association with the dependent variable and then allow an analysis of how predictive the regression model is on the dependent variable. The initial output provided data for a model consisting only of the intercept (baseline) and another consisting of all variables. The baseline output provided important comparative data including an initial -2 Log likelihood value of 3436.404 and a predicted percent correct value of 76.7%. These are shown in tables D4 and D5 respectively. The baseline model was also found to be significant ($p < .05$) as shown in table D6. These results allow the researcher to compare subsequently tested models for improvement.

When the full model with all of the variables present was run, none of the categories associated with ethnicity showed significance. This was not unexpected as 92.3%, the vast majority of cases, were classified as Hispanic. As a result, the hierarchical approach towards a predictive model excluded that variable and the analysis was run again with the remaining variables. This iteration improved the model somewhat with the -2 Log Likelihood changing from 3436.404 to 3018.533, a reduction of 417.871. In addition, the percentage correct increased from 76.7% to 78.2%, a small increase. As seen in Table 4.7, most of the model variables do not show significance towards student success. Those showing significance ($p < .05$) include Type of program selected and HS_GPA. This model showed a modest pseudo R^2 range between 12.2% and 18.4%, a rough indication of the variance explained by the model.

Table 4.7

Logistic Regression Analysis Math Performance as a Function of Proposed Predictors – All Variables Excluding Ethnicity

Variables in the Equation [a]

		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for EXP(B) Lower	95% C.I. for EXP(B) Upper
Step 1[b]	Type of program selected	-.454	.183	6.170	1	.013	.635	.444	.909
	HS_GPA	.157	.009	294.361	1	.000	1.169	1.149	1.191
	Gender_Num	-.072	.094	.580	1	.446	.931	.774	1.120
	FGEN	.092	.093	.973	1	.324	1.097	.913	1.317
	Student Financial Need reported	.118	.097	1.456	1	.228	1.125	.929	1.362
	Constant	-12.770	.836	233.338	1	.000	.000		

a. Sample Groups = Reference Sample

b. Variable(s) entered on step 1: Type of program selected, HS_GPA, Gender_Num, FGEN, Student Financial Need reported.

As another test of model discrimination, a receiver operating characteristic (ROC) analysis was performed on the model with all variables. A ROC analysis is a useful way to assess the accuracy of model predictions by plotting sensitivity versus specificity of a classification test.

Sensitivity is defined as the probability that a case coded as one for the dependent variable is classified correctly (Hahs-Vaughn, 2017). This is also referred to as the true positivity rate. Specificity is defined as the percent of correct predictions of zero coded cases for the dependent variable. This analysis provides a visual depiction of the correct classification of cases and a value for the "area under the curve" which gives a sense of the level of discrimination for the model. Running a ROC analysis for this model resulted in figure 4.1 and provided an area under the curve value of .739 which is classified as an “acceptable” level of discrimination (Hosmer el al., 2013). This value can later be used to compare with additional models as they are derived.

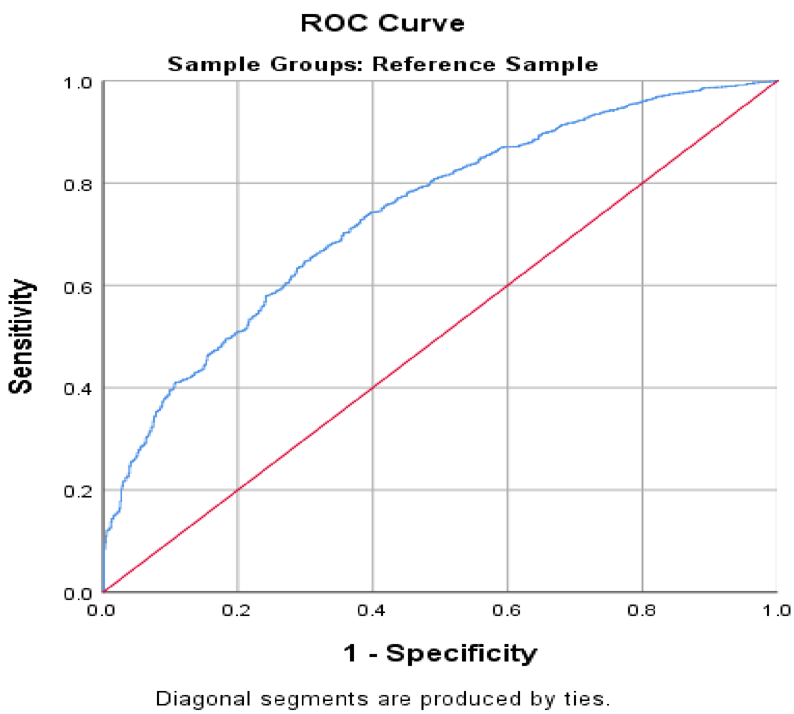

Figure 4.1

Initial ROC Analysis with All Variables – Math [a]

[a] Area under the curve = .739

Reduced Model

Removing the variables that did not show significance resulted in a final model which included the independent variables CRM (type of program) and HS_GPA. This is shown in table 4.8 which is interpreted below

Table 4.8

Math Final Model Analysis – Reference Sample

Variables in the Equation [a]

		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for EXP(B) Lower	95% C.I. for EXP(B) Upper
Step 1[b]	Type of program selected	-.415	.181	5.271	1	.022	.660	.464	.941
	HS_GPA	.156	.009	326.303	1	.000	1.168	1.149	1.188
	Constant	-12.602	.760	275.266	1	.000	.000		

a. Sample Groups = Reference Sample

b. Variable(s) entered on step 1: Type of program selected, HS_GPA.

As shown in table D7, this resulted in a very small reduction (.01%) in the resulting percentage correct. However, this model proved slightly better at predicting which students would pass the college level math course with an increase of (.01%). This model's pseudo R^2 range remained largely identical to the previous model and falls between 12.1% and 18.1%.

Performing a ROC analysis using the final model, shows the area under the curve remains largely unchanged at .737, a .001 decrease from the full model (see figure 4.2). This indicates that the new model is no better at discrimination than the full model. However, it also means that the removal of the insignificant variables does not harm the model's discrimination.

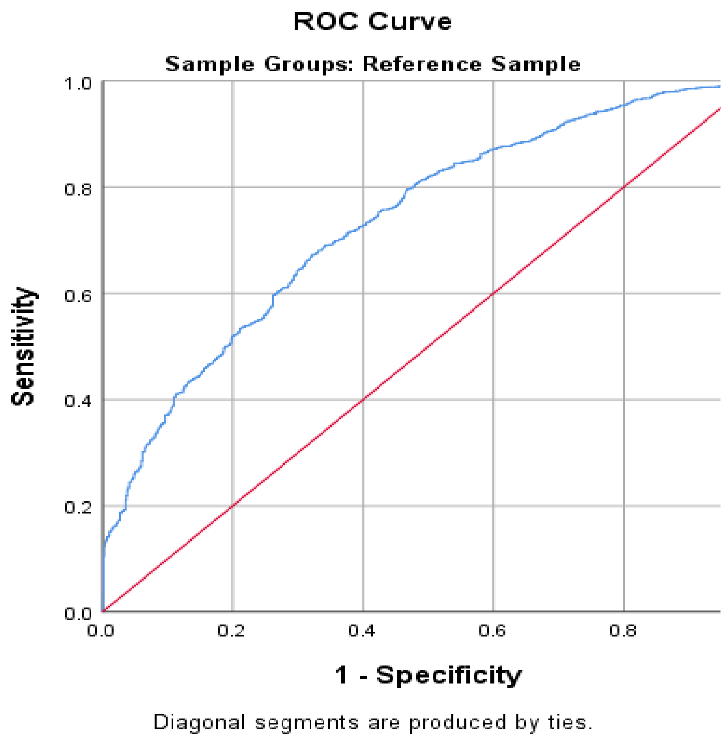

Figure 4.2

Final ROC Curve – Math[a]

[a]Area Under the Curve = .737

Math Validity Sample

As indicated, it is best practice to test the developed model against a validation group. It is generally accepted that if the classification results of the model with the validation sample falls within 10% of the reference sample, the model's validity is appropriate (Hahs-Vaughn, 2017). Running the final model against the validity sample resulted in table D8. The overall classification percentage correct for the reference sample was 78.2% and that of the validation sample is 77.2%, well within a margin of 10%. Since each of the other percentage correct figures fall within 10% of those of the reference sample, the model's validity is verified.

Math findings

Logistic regression analysis was done to determine whether there is a significant predictive relationship between the success of students in their first college level math course and the variables CRM, gender, ethnicity, SES, HS_GPA and first generation status. The dependent variable was coded 1 if the student achieved a grade of C or better in their first attempted college level math course. The total number of cases were n = 4261 and there were no missing cases. A hierarchical approach was used in the development of a final model. No significant contribution to the model was evident for gender, ethnicity, SES or first generation status. Two predictors were significant, including CRM (OR = .660, 95% CI [.464, .941] p = .022) and HS_GPA (OR = 1.168, 95% CI [1.149, 1.188] p = .000). The final model had only a small effect (Cox and Snell R2 = .121; Nagelkerke R2 = .181). The overall predictive percentage correct for the final model improved by 1.4% over the baseline, a minor improvement. The odds ratio for CRM indicates that the odds are 66% that a student taking the college preparation course will successfully complete their first college level math course compared with their TSIA counterpart. Additionally, the odds ratio for HS_GPA indicates that for every point increase in GPA, students are 16.8% more likely to successfully complete their college level math course.

As noted in table 4.6, the high school GPA for the HB5 sample was 3.24 points lower than the TSIA sample. Since high school GPA was the only significant variable in the model besides the college readiness method (CRM), the researcher was curious about the likelihood of success for students both adjusted and not adjusted for high school GPA. A model was run using only the variable CRM (OR = .447, 95% CI [.338, .592] p = .000), which remained significant. The odds ratio of .447 meaning that unadjusted for high school GPA, the students taking the HB5 college preparatory math courses are only 44.7% as likely to pass their college level math course compared with their TSIA counterparts. Stated another way, students in the TSIA sample are 2.24 times more likely to pass their college level math course compared with the college preparatory sample when unadjusted for high school GPA. This is understandable as the college preparatory sample had a mean GPA value that was 3.24 points lower than the TSIA sample and the final model in table 4.8 suggests that for every point reduction in GPA, students are 16.8% less likely to successfully complete their college level course. It is important to note that the model for the unadjusted high school GPA showed a reduction in the Nagelkerke R2 value from 18.1% in the final model to 10% in the unadjusted high school GPA model. This suggests that adjusting for high school GPA accounts for an additional 8% in the variance of the model.

It is important to note that the data did not pass one of the major assumptions of binary logistic regression, that of linearity in the logit associated with the variable HS_GPA. Despite several efforts by the researcher to transform the data to meet this assumption, these attempts did not result in linearity with the logit. This calls into question the validity of the overall model, so readers should take this into consideration when interpreting its results.

Data Screening - English

As with the math data set, the purpose of data screening was to identify and account for potential data points that would preclude the performance of a quality, relevant analysis. This included conversion of string data to numeric, dichotomous coding of success data, standardizing GPA values to a 100 point scale, coding of gender, coding of SES, coding of first generation status, identifying and eliminating records that were missing data elements relevant to the study, identifying and eliminating outliers and eliminating duplicate records.

Missing Data - English

The first step taken was to examine the records for missing data in the relevant variables for this study. became evident early in the screening process that the data set provided was missing large numbers of data elements. This would ultimately prove problematic and would significantly impact the study's ability to derive a predictive model using the variables originally planned for the model. Table 4.9 details the missing data elements for the English data set.

Table 4.9

Missing Data Elements - English

	College Prep English	%	TSIA	%
Total Records	516		14122	
Missing GPA	3	0.39%	513	3.63%
Missing Grade	175	33.91%	1232	8.72%
Missing SAT	364	70.54%	12935	91.59%
Missing FGEN	268	51.94%	1453	10.29%
Missing Gender	1	0.19%	1	0.01%
Missing SES	0	0.00%	0	0.00%
Missing Ethnicity	135	26.16%	323	2.29%

There are several items of note in table 4.9 that bear explanation. First, there are large numbers of missing grades. As with the math data set, the English data provided to the researcher contained all records for students who graduated from high school, matriculated to the college and took a college level English course. When investigating these missing grades, the researcher discovered that the data provided included students enrolled in the spring 2020 semester, which was still in progress at the time the data was gathered. As a result, these grades were not yet recorded. Since this study is only analyzing data between fall 2014 and fall 2019, these cases for in progress students were eliminated.

Second, as with the math data set, there are very large numbers of missing SAT scores. Upon investigation, it became evident to the researcher that large numbers of students in the region included in the study are electing not to take the SAT. What is not clear is whether this is by student choice or due to some other factor such as cost. Indeed, at the college in this study, SAT and ACT scores are not a requirement. Further, since the state of Texas has mandated the use of TSIA scores, students and local school districts are largely focused on student success on that exam. Most of the districts in the region have become testing sites for administration of the TSIA exam. As the researcher investigate this further, it is apparent that many institutions in the nation are eliminating the SAT and/or ACT as requirements for admissions (Strauss, 2019).

This missing data is unfortunate as it was originally theorized that SAT scores would be a significant predictive variable for the success model as there is much literature on the contribution of standardized test scores to ultimate student success in college. However, as mentioned in the literature review, some have found SAT scores to have only a modest contribution in ultimate student success, especially among certain populations, such as socioeconomically disadvantaged and minority students. (Aguinis, Culpepper & Pierce, 2016; Ransdell, 2001). Both of these characteristics are prevalent among the students attending the college in this study.

As mentioned previously, prior to removing SAT from consideration, a logistic regression was run on the small number of remaining cases and SAT was not found to be significant in the model. Because of this and the desire to retain sufficient cases, especially for the college prep English sample, SAT was removed from consideration in the ultimate predictive model. Tabachnick and Fidell (2013) indicate this is a valid strategy when one is concerned about the ratio of cases to variables.

Additionally, there were numerous missing data elements for first generation status. It was somewhat fortunate that there was a large overlap in cases missing both SAT scores and first generation status. After eliminating the records with missing SAT scores, 120 cases were missing first generation status for the college prep English cases and 981 for the TSIA cases. These cases were removed from the data set.

For each of the other categories of missing data elements, including HS_GPA, Gender, and Ethnicity, the number of missing cases was minimal. The researcher determined that removing these would not have a significant impact on the study. Therefore, cases missing these elements were removed from the data set.

Remove Duplicates - English

Because the provided data included cases spanning five years, there were occurrences where a student may have taken an initial college level course and subsequently taken one or more English courses in a series. Alternatively, a student may have been unsuccessful in their initial attempt at a college level English course and reattempted it one or more times. Each of these attempts and additional coursework were captured in the provided data resulting in duplicate cases for some students. Because this study is focused on student success in their first attempt at a college level course, other attempts, reattempts, or additional courses taken were removed. In total, 1,859 duplicate records were removed from the original data provided.

Outliers – English

An analysis of the remaining data showed a very small number of outliers, all within the HS_GPA field. Each of these had HS_GPA scores exceeding 700 on a scale of one to one hundred. In total, fourteen cases were removed due to obvious outlying HS_GPA scores. After data cleaning, a total of 9784 cases were left to conduct the analysis. Table E1 shows the final number of cases with a breakdown by HB5 versus TSIA populations.

Conversion and Data Coding – English

Several relevant elements in the data set consisted of string data, which needed to be converted or coded to facilitate the statistical analysis. These included the code which indicates the college readiness method (TSIA or HB5 course), HS_GPA, gender, first generation status, socioeconomic status and the grade received in the college level math course. Using a combination of MS Excel functions and IBM SPSS Transform commands, data was converted and coded into new variables in a format useful for analysis. Table 4.10 identifies the conversion and/or coding performed on the data.

Table 4.10

Conversion and Data Coding - English

Original	New	Description of conversion/coding
Code	CRM	Data consisted of either the string CPEL or PTSE. A new variable was created to indicate the College Readiness Method (CRM) with the number one assigned for CPEL and zero assigned for PTSE.
HS_GPA	HS_GPA	String data converted to numeric. Grades originally provided on a four point scale were converted to a 100 point scale for consistency. HS_GPAs in excess of 100 were set to 100.
Gender	Gender_Num	Data consisted of either the string Male or Female. A new variable was created with the number one assigned for Males and a zero assigned for Females.
Need_Based_FA Pell	SES	Data consisted of either the string Y or N. If either of these were coded Y, SES was assigned a one indicating low socioeconomic status. Otherwise SES was assigned a zero indicating the student was not low socioeconomic status.
First_Generation	FGEN	Data consisted of either the string Y or N. If coded Y, FGEN was assigned a one indicating the student is a first generation student, otherwise FGEN was assigned a zero.
Grade	Success	Data consisted of a letter grade A, B, C, D, F or W. Success was assigned a one for A, B or C grades, otherwise success was assigned a zero.

Testing of Assumptions – English

The same set of assumption tests done for the math group must also be done for the English data set. Logistic regression analysis uses maximum likelihood estimation to predict group membership. As such, there are several assumptions associated with performing a logistic regression analysis, some of which have specific tests available in SPSS (Field, 2018; Hahs-Vaughn, 2017; Tabachnick & Fidell, 2013).

One Dichotomous Dependent Variable

This study seeks to assess the likelihood of student success in a college level math or English course based on a number of independent predictor variables. Success is based on the grade received in the college course. These grades can be A, B, C, D, F or W. For the purpose of the study, success was identified as the student receiving a grade of A, B or C. Grades of D, F or W were identified as unsuccessful. The success variable was coded with the value one for grades of A, B or C and with the value zero for grades of D, F or W. This coding resulted in a dichotomous dependent variable, meeting this assumption.

The Model Has One or More Independent Variables measured on either a continuous or Nominal scale

After the removal of SAT as a variable, this study examined six independent variables. HS_GPA is a continuous variable. CRM, Gender_NUM, Ethnicity, SES and FGEN are nominal variables. As there are more than one variable and the scales are continuous or nominal, this assumption is met.

Independence of Observations

The dichotomous dependent variable categories are mutually exclusive. In addition, each of the nominal independent variables are mutually exclusive. As indicated previously, duplicate records were removed leaving only one case for each Encrypt_ID. Therefore, the assumption of independence of observations is met.

Linearity in the Logit

In testing for linearity, the Box-Tidwell approach is considered appropriate and can be accomplished within SPSS (Field, 2018; Tabachnick & Fidell, 2013). Using the SPSS compute variable function, a new variable, LN_HS_GPA was created and computed as the natural log of HS_GPA. The interaction between these two variables was then added to the logistic regression model and was examined for significance. Table E2 shows the results. Because the interaction variable is significant ($p < 0.05$), the assumption of linearity fails for the continuous variable HS_GPA. The assumption failed even after applying a Bonferroni correction based on the number of terms in the model (Tabachnick & Fidell, 2013)

There are several strategies to attempt to linearize the data including eliminating the variable from the model, transforming the variable using a power transformation, acknowledging the failed assumption in the model analysis or categorizing the data in the variable. The researcher explored various transformations of HS_GPA including a squared transformation, a sqrt transformation and a cube transformation, however, in each case the interaction of the transformed variable with its natural log was found to be significant. A second approach was to categorize the continuous variable. This effectively eliminates the need for testing the assumption as the Box-Tidwell test is only applicable to continuous variables. It should be noted that the researcher did explore this approach but found that the resulting model did not differ significantly from the model which left the variable as continuous. Since HS_GPA is the only continuous variable in the model, the researcher ultimately chose to leave it untransformed and acknowledge the assumption failure.

Absence of Multicollinearity

Multicollinearity is present when model variables are highly correlated. When present, it suggests that not all of the correlated variables are needed in the model because they are in essence measuring the same thing (Tabachnick & Fidell, 2018). When using logistic regression, the assumption is that there is not multicollinearity between the variables. Although SPSS does not have a function to test for multicollinearity under the logistic regression model, appropriate testing can be performed by running a linear regression with the model variables. Specifically, the collinearity statistics for tolerance and variance inflation factors (VIF) are available. Table E3 shows the results of the multicollinearity test for the English data set. Tolerance values below 0.1 or VIFs above 10 indicate a problem with multicollinearity (Field, 2018). Because all variables show a tolerance value over 0.1 and under 10, the assumption of absence of multicollinearity is met.

Descriptive Statistics - English

After the data screening and assumption testing, descriptive statistics were run to provide a sense of the remaining 9,784 cases and examine the population sample more closely. A look at the frequencies of study variables is shown in table 4.11. Of note is that the overwhelming number of students demonstrated college readiness via the TSIA-English exam with 98.2% of the cases categorized as taking the TSIA versus 1.8% of the cases categorized as having taken the math college preparatory course. This was not unexpected as the college preparatory courses are relatively new. Further, the HB5 college preparatory courses have a small target population in that they are limited to seniors who have not demonstrated college readiness via another measure. Contrast this with the TSIA exam, which has been available for many years and is often administered to students multiple times during high school, giving many students a cycle of intervention and retesting for that assessment.

The gender distribution is skewed slightly towards the females versus the overall population at the college in the study with females outnumbering males by approximately 16% (versus 6.6% for the math sample). The percentage of students identified as first generation, 43.1%, is almost identical to that of the math sample and is in line with the college's overall population. Students in the study receiving some form of need-based financial aid is almost 6% higher than the math sample and is 4.1% lower than the institutional percentage of approximately 70%.

In comparing the English population to that of math, the overall success rate is approximately 3% higher for the English group. Further, the percentage of TSIA students is 3.4% higher than the math sample. This is understandable as the English and reading portions of the TSIA are often considered easier that the math portion.

Table 4.11

Frequency Distributions of Other Relevant Study Variables - English

Variable		Frequency	Percent	Cumulative Percent
CRM	TSIA	9603	98.2	98.2
	ColPrep	181	1.8	100
Gender	Female	5670	58	58
	Male	4114	42	100
First Gen	No	5274	53.9	53.9
	Yes	4510	46.1	100
Need Based FA	No	3334	34.1	34.1
	Yes	6450	65.9	100
Student Success	Failed	2040	20.9	20.9
	Passed	7744	79.1	100

Because a major focus of this study is to develop a predictive model of student success, especially in light of differing college readiness methods, it was important to exam these variables separated by CRM. Table 4.12 allows for an examination of similarities and differences between student populations taking TSIA versus those taking college preparatory courses.

Table 4.12

Frequency Distributions of Study Variables by CRM - English

Variable		Frequency	Percent	Cumulative Percent
Gender				
TSIA	Female	5554	57.8	57.8
	Male	4049	42.2	100
ColPrep	Female	116	64.1	64.1
	Male	65	35.9	100
First Gen				
TSIA	No	5197	54.1	54.1
	Yes	4406	45.9	100
ColPrep	No	77	42.5	42.5
	Yes	104	57.5	100
Need Based FA				
TSIA	No	3295	34.3	34.3
	Yes	6308	65.7	100
ColPrep	No	44	24.3	24.3
	Yes	137	75.7	100
Student Success				
TSIA	Failed	1988	20.7	20.7
	Passed	7615	79.3	100
ColPrep	Failed	52	28.7	28.7
	Passed	129	71.3	100

Notable differences between the populations include the observation that the percentage of females taking the college preparation English course is 6.3% higher than those taking the TSIA. The first generation population is skewed even more than the math sample with an 11.6% higher rate for the college prep sample. College preparation students also have a 10% higher rate of need-based financial aid and their failure rate is 8% higher than their TSIA counterparts.

In addition, the researcher looked for variances in the HS_GPAs for the groups. Table 4.13 shows that the minimum HS_GPA for the college prep students is significantly lower than that of the TSIA group, however this is due to a small number of low HS_GPA scores in the sample. More interestingly, the mean HS_GPA for the college prep students was almost identical to the TSIA group. That is in contrast to the math group which had a mean over three points lower than that of the TSIA group. The academic preparedness for the English group seems more evenly matched based on HS_GPA, which may provide insight regarding this group's increased likelihood of success on their college level English course.

Table 4.13

GPA Descriptive Statistics by CRM - English

Descriptive Statistics						
Type of program selected		N	Minimum	Maximum	Mean	Std. Deviation
TSIA	HS_GPA	9603	55.24	100.00	87.47	6.03
	Valid N	9603				
ColPrep	HS_GPA	181	73.49	100.00	87.94	5.26
	Valid N	181				

As with the math sample, these differences are not surprising. As a review of the literature showed, standardized tests often put some sub populations of students at a disadvantage, showing differences based on gender, socioeconomic status and first generation students (Aguinis, Culpepper & Pierce, 2016; Ransdell, 2001). Such disadvantages may lead to lower scores for these groups, making them candidates for the college preparation courses. Similar to the math sample, the English college preparation sample presents with lower overall socioeconomic status, a higher percentage first generation student status and a higher percentage of females. These observations also reflect that the target population taking the college preparation math course is in line with that which is intended by HB5. This course is intended as a last ditch opportunity for high school students who have become seniors without being able to pass the TSIA

Logistic Regression Analysis – English

The researcher mirrored the analysis done for the previous math sample. It is a recommended practice in logistic regression to perform a cross-validation of the model (Hahs-Vaughn, 2017). This approach allows testing of the model on two different samples. This is accomplished by developing the predictive model using approximately 75% of the available cases and then using the remaining cases to help determine the accuracy of the derived model. If the classification accuracy of the validation sample is reasonably close to that of the reference sample, then this supports the validity of the model.

To accomplish this, the SPSS select cases function was used to create a new filter variable which included approximately 25% of the final data set. This allowed for a reference group made up of the majority of cases as well as a smaller validation sample with which the developed model can later be compare. This resulted in a reference sample consisting of 7317 cases and a validation sample consisting of 2467 cases. The SPSS split file command was then used to filter the analysis to only the reference sample for the logistic regression.

Research Question 2

RQ2: Among students attempting their first college level English course, is there a significant predictive relationship between CRM, gender, ethnicity, SES, GPA, first generation status and success in first college-level English course?

Running the SPSS binary logistic regression function including all remaining study variables, provided a baseline to begin a hierarchical approach to developing a predictive model

(Field, 2018; Tabachnick & Fidell, 2013). Such an analysis will help determine which of the independent variables have a statistically significant ($p < .05$) association with the dependent variable and then allow an analysis of how predictive the regression model is on the dependent variable. The initial output provided data for a model consisting only of the intercept (baseline) and another consisting of all variables. The baseline output provided important comparative data including an initial -2 Log likelihood value of 7447.557 and a predicted percent correct value of 79.4. These are shown in tables E4 and E5 respectively. The baseline model was also found to be significant ($p < .05$). These results allowed the researcher to compare subsequently tested models for improvement.

When the full model with all of the variables present was run, all of the categorical values associated with ethnicity did not show significance. This was not unexpected as 92.5%, the vast majority of cases, were classified as Hispanic. As a result, the hierarchical approach towards a predictive model excluded that variable and the analysis was run again with the remaining variables. This iteration improved the model somewhat with the -2 Log Likelihood changing from 7447.557 to 6902.707, a reduction of 544.85 as shown in the full model's Omnibus Test of model coefficients table of the SPSS output. However, the percentage correct decreased from 79.4% to 79.1%, a very small decrease. As seen in Table 4.14, one of the model variables, SES ($p = .238$), did not show significance towards student success. Those showing significance ($p < .05$) include CRM (type of program selected), HS_GPA, gender and SES. This model showed a modest pseudo R^2 range between 9.3% and 14.6%, a rough indication of the variance explained by the model.

Table 4.14

Logistic Regression Analysis of Student English Performance - All Variables Excluding Ethnicity

Variables in the Equation [a]

		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for EXP(B) Lower	95% C.I. for EXP(B) Upper
Step 1[b]	Program selected	-.422	.208	4.143	1	.042	.655	.436	.984
	HS_GPA	.122	.005	495.919	1	.000	1.129	1.117	1.142
	Student Gender	-.359	.062	33.642	1	.000	.699	.619	.789
	Student generational status	-.233	.062	13.942	1	.000	.792	.701	.895
	Student Financial Aid Status	-.081	.069	1.394	1	.238	.922	.806	1.055
	Constant	-8.805	.482	334.401	1	.000	.000		

a. Sample Groups = Reference Sample

b. Variable(s) entered on step 1: Program selected, HS_GPA, Student Gender, Student generational status, Student Financial Aid Status.

As another test of model discrimination, a ROC analysis was performed on the model with all variables, which provided an area under the curve value of .721 which is classified as an “acceptable” discrimination (Hosmer el al., 2013). This value can later be used to compare with additional models as they are derived.

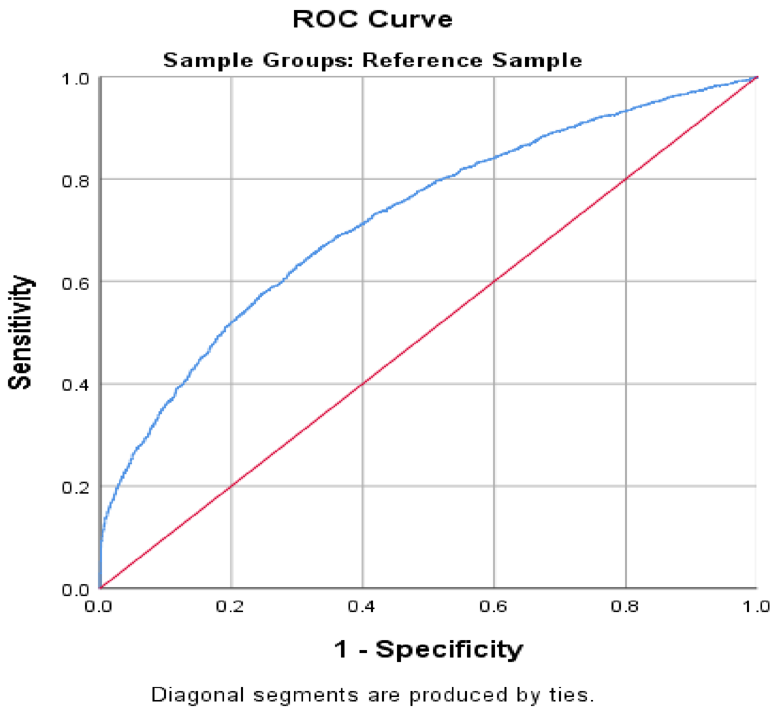

Figure 4.3

Initial ROC Analysis With All Variables – English [a]

[a] Area under the curve = .721

Removing SES resulted in the final model shown in table 4.15. This iteration improved the model somewhat with the -2 Log Likelihood changing from 6902.707 to 6734.907, a reduction of 167.8 from the previous model. However, the percentage correct remained at 79.1%. This model, however, was slightly better at correctly predicting failures on the college level English course by .02%. This final model showed a modest pseudo R^2 range between 9.3% and 14.5%, a rough indication of the variance explained by the model. No further iterations improved the predictive model.

Table 4.15

Logistic Regression Analysis of Student English Performance - English

Variables in the Equation [a]

		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for EXP(B) Lower	Upper
Step 1[b]	Program selected	-.430	.207	4.297	1	.038	.650	.433	.977
	HS_GPA	.122	.005	507.266	1	.000	1.130	1.118	1.142
	Student Gender	-.354	.062	32.898	1	.000	.702	.622	.792
	Student generational status	-.246	.061	16.136	1	.000	.782	.693	.882
	Constant	-8.914	.473	355.724	1	.000	.000		

a. Sample Groups = Reference Sample

b. Variable(s) entered on step 1: Program selected, HS_GPA, Student Gender, Student generational status.

Performing a ROC analysis using the final model, shows the area under the curve remains largely unchanged at .722. This indicates that the new model is no better at discrimination than the full model. However, it also means that the removal of the insignificant variables does not harm the model’s discrimination.

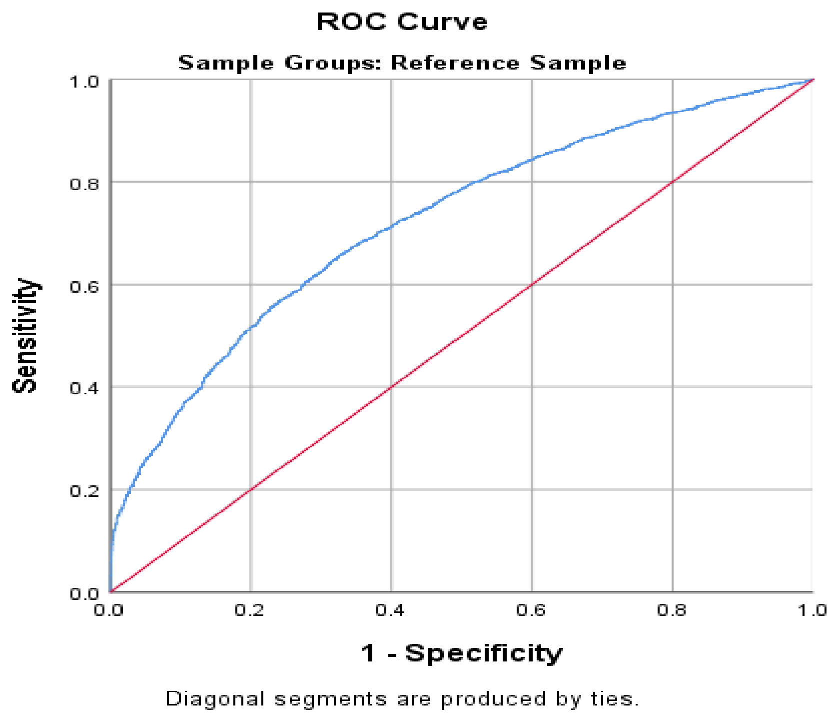

Figure 4.4

Final ROC Curve – English [a]

[a] Area Under the Curve = .722

English Validity Sample

In accordance with best practice, the developed model was run against a validation sample. It is generally accepted that if the classification results of the model with the validation sample falls within 10% of the reference sample, the model's validity is appropriate (Hahs-Vaughn, 2017). Running the final model against the validity sample resulted in table E6. The overall classification percentage correct for the reference sample was 79.1% and that of the validation sample is 78.3%, well within a margin of 10%. Since each of the other percentage correct figures fall within 10% of those of the reference sample, the model's validity is verified.

English findings

Logistic regression analysis was done to determine whether there is a significant predictive relationship between the success of students in their first college level English course and the variables CRM, gender, ethnicity, SES, GPA, first generation status. A hierarchical approach was used in the development of a final model. No significant contribution to the model was evident for ethnicity or SES. Four predictors were significant, including CRM (OR = .650, 95% CI [.433, .977], $p = .038$), HS_GPA (OR = 1.13, 95% CI [1.118, 1.142], $p = .000$), Gender (OR = .702, 95% CI [.622, .792], $p = .000$) and FGEN (OR = .782, 95% CI [.693, .882], $p = .000$). The final model had only a small effect (Cox and Snell R2 = .093; Nagelkerke R2 = .145). The overall predictive percentage correct for the final model decreased by less than 1%, but was better at predicting failures for the college level English course.

The odds ratio for CRM indicates that the odds are 65% that a student taking the college preparation course will successfully complete their first college level English course compared to their TSIA counterpart. The odds ratio for HS_GPA indicates that for every point increase in GPA, students are 13% more likely to successfully complete their college level English course. Additionally, the odds ratio for FGEN indicates the odds are 78% that a first generation student will be successful compared to non-first generation student. Finally, the odds ratio for gender indicates the odd are 70% that a male will be successful when compared to females.

It is important to note that the data did not pass one of the major assumptions of binary logistic regression, that of linearity in the logit associated with the variable HS_GPA. Despite several efforts by the researcher to transform the data to meet this assumption, these attempts fell short. This calls into question the validity of the overall model, so readers should take this into consideration when interpreting its results.

Chapter Summary

The purpose of this study was to examine the effectiveness of one of the latest Texas legislative efforts to increase the college readiness of Texas high school graduates. In this chapter, the findings of the data analyses were presented. Descriptive statistics were used to examine the relevant nature of the variables. Binary logistic regressions were run to address the two research questions.

For research question one (math), CRM and HS_GPA were found to be significant, but the overall model did not improve significantly from the baseline model. The developed model accounted for 12% - 18% of the variance and improved the predicted percentage correct over the baseline by a modest 1.4%. In examining the efficacy of the mandated math college readiness course, with an odds ratio of .66, the model does suggest that students taking those courses are less likely to succeed in college level math courses than their TSIA counterparts. This reinforces the findings by Pustejovsky and Joshi (2019). However, the failure of one of the assumptions associated with binary logistic regression, that of linearity of the logit, must be acknowledged.

For research question two (English), CRM, HS_GPA, Gender and FGEN (first generation status) were found to be significant. However, the final model did not improve the ability to predict success in college level English courses based on the variables available in the data set. In examining the efficacy of the mandated math college readiness course, with an odds ratio of .65, the model suggests that students taking those courses are less likely to succeed in college level English courses than their TSIA counterparts. Further, the failure of one of the assumptions associated with binary logistic regression, that of linearity of the logit, must be acknowledged.

In the next chapter, the findings will continue to be examined with connections to future research.

Chapter 5: Discussion and Conclusions

The purpose of this quantitative study was to examine the effectiveness of one of the latest Texas legislative efforts to increase the college readiness of Texas high school graduates. Section 10 of HB5 from the 2013 Texas Legislature called for the creation of two college preparatory courses, one in math and one in English language arts. Successful students in these courses would be deemed ready for college level coursework despite not passing the TSIA. This study assessed whether students falling under this mandated measure of college readiness are as likely to succeed in their college level math and English courses as are students who pass the TSIA. Specifically, the study focused on the following two research questions:

RQ1: Among students attempting their first college level math course, is there a significant predictive relationship between CRM, gender, ethnicity, SES, GPA, first generation status and success in first college-level math course?

RQ2: Among students attempting their first college level English course, is there a significant predictive relationship between CRM, gender, ethnicity, SES, GPA, first generation status and success in first college-level English course?

It was anticipated that predictive models would be found that would inform educational practice in the region in which the college in the study is located. The variables considered for the study included characteristics discovered in the literature that impact ultimate student success such as gender, socioeconomic status, high school performance, first-generation status and ethnicity. As with other studies, this study confirmed that some of these characteristics are significant (Bowen et al., 2009; Brookhart et al., 2015; Hiss & Franks, 2014). Indeed, as much of the literature showed, high school performance is one of the greatest predictors of college success and this long-term assessment of student academic progress variable was found to be significant in both models. The literature also uncovered other variables that may be predictive of student success in college such as class attendance, self-awareness, self-management, social awareness, relationship skills, self-efficacy, academic discipline, and responsible decision-making (Hein, Smerdon, & Sambolt, 2013; Komarraju, Ramsey, & Rinella, 2013). However, these variables were not available in the secondary data set used for the study.

Because of the relatively recent passage of the legislation which created these college preparation courses, there is very little research available on this topic. As such, even modest findings may prove valuable to researchers, practitioners, and policy makers. Although the courses were mandated to begin in the fall 2014 semester, sufficient cohorts of students were needed to work through the courses, matriculate to college, and enroll and complete a college level math or English course. Further, teachers had to be trained and awareness needed to be created surrounding the availability of the courses in the region. Initial offerings of the courses were few. After several semesters, course offerings and availability increased, creating additional cases for this study. Even with this passage of time, sufficient data for the local region was somewhat difficult to capture and complete student records were the minority of cases. In fact, one of the anticipated variables for the study, SAT score, was unable to be used due to the large number of missing data elements.

Course Efficacy

One of this study’s goals was to determine the efficacy of the two courses mandated by the Texas Legislature. Said another way, do these courses provide the intended outcomes for which they were created? As indicated previously, these courses were created as a last ditch effort for students to become college ready upon graduation from high school. If one examines the TSIA versus college preparation populations, we find the students going through the college preparatory courses succeeding at lower rates than the TSIA population for both math and English college level courses. Indeed, for the math population 77.5% (n = 3131) of the TSIA students successfully completed their college level math course versus 60.6% (n = 134) of the college preparation students. For English, the success rate was 79.3% (n = 7615) for the TSIA students and 71.3% (n = 129) for the college preparation students. While one can infer that the TSIA students are better prepared for college level coursework, we must also ask whether the students taking the college preparation courses have been well served by them.

To partially answer this question, we must examine what would typically happen to those students if they were not afforded an opportunity to take the HB5 courses. Most of these students would likely have graduated from high school without being deemed college ready. Assuming they chose to attend college, they would have been placed into some level of developmental coursework. As discussed in chapter two, there are a number of negative effects associated with this including higher dropout rates, longer time to degree and exhaustion of financial aid availability. At community colleges, the graduation rates for students enrolled in developmental courses are less than 25%, which is 15% lower than non-developmental students (Bailey, 2016). Over 16% of students enrolled in developmental courses never complete the course in which they are enrolled and 34% complete some of their developmental course, but never complete the sequence (Bailey, 2009; Chen, 2016). As such, these students never even reach the point where they can attempt college level coursework.

One could assert that for the 263 college preparation course students that successfully completed their first college level math or English course that they were very well served by these courses. Each of them has avoided the aforementioned pitfalls associated with enrollment in a developmental sequence. Further, successfully passing these college gateway courses has numerous positive outcomes; however, that is a topic beyond this study. In chapter two, I explored the theoretical framework of Human Capital Theory in the context of education and ultimate personal and societal benefit. There is some contention in the literature about the effectiveness of late interventions on a person's long-term economic benefit. It can be suggested that for the 263 college preparation students that successfully completed their gateway college courses that the likelihood of long-term economic benefit has improved.

Implications/Recommendations

The results of this study may be useful to those associated with the development, oversight and improvement of the HB5 courses. As stated in earlier chapters, the HB5 legislation calls for the regular review and update of course content as well as ongoing training for those teaching the courses in high school. It is unlikely that these teachers are aware of the success (or lack thereof) of their students in subsequent college-level work. Further, it is unlikely that the college faculty are aware of which of their students arrived in their classes via the successful completion of these courses.

It is recommended that this research be shared with those involved to help inform future iterations of these courses. Armed with such analysis and its accompanying descriptive statistics, it is possible that improvements in the courses may be able to be tailored to the demographics of students taking them. Both the math and English populations from the HB5 courses were more female, minority, socioeconomically disadvantaged, and first-generation than their TSIA counterparts. Such findings can inform not only the course content, but potentially the pedagogical approach to the content as well as modifications to the training provided to the teachers of the courses.

At a state level, similar research should be provided to education agencies and policy makers to help them understand the impact of their mandates. By examining the results of their efforts, they can potentially make better informed decision about future legislatively driven college readiness efforts. As described in the future research section below, this information could be coupled with a cost/benefit analysis to help legislators make fully informed future decisions regarding these mandates.

Another recommendation has to do with the disparate data systems, storage, sharing, and needs of each entity providing data sets. During the course of this study, it became apparent that the data provided for the research existed in multiple places with disparate IT systems. Each of the ISDs in the study reported their data to the local Educational Service Center (ESC). While these systems are relatively compatible, there exists multiple opportunities for data corruption or input errors to occur. The ESC therefore contains relevant high school student records, but contains no data associated with college coursework. As a result, the ESC data must be merged with college institutional data in order to derive an appropriate data set for this study. However, the final data from this process consists of only regional data and may not be reflective of data found in other areas of the state. One recommendation would be to develop a statewide data sharing site, available to researchers, that can host this data in a standardized way to facilitate future studies.

Due to the targeted nature of the HB5 course content, it could prove beneficial to analyze the data using prior performance in the content area rather than using an aggregate overall HS_GPA. It is a recommendation that to facilitate future analysis, GPAs for high school math courses and GPAs for high school English courses be gathered for inclusion in the predictive models. Reporting of these disaggregated GPAs should be an ongoing, annual occurrence. There are other sources of content specific data that could be incorporated in future iterations of this analysis. The State of Texas Assessments of Academic Readiness (STAAR) exam scores in English and math may prove useful as predictors of future student success. In addition, if student scores on the relevant TSIA components could be gathered on an ongoing basis, this could prove valuable in analyzing future models.

As explained in chapter two, Kirst (2006) suggests that secondary and higher education institutions operate in separate professional worlds. At both the state and federal levels, these two systems operate under separate policies and as a result, they have differing funding, governance, and assessment systems. As a result, the motivation, approach, and attitudes towards the HB5 college preparatory courses may be very different between secondary and post-secondary institutions. This could be a contributing factor to the difficulties the researcher encountered when trying to examine potential self-selection bias between the HB5 and TSIA populations. It is a recommendation that an annual meeting be held between those responsible for implementing the HB5 courses at the high school level and post-secondary educators to develop and understanding of each other's perspectives and motivations in offering the various pathways to students.

Although non-cognitive characteristics were not part of the available data set, there is a large volume of research associated with the predictive nature of these variables on student success. A final recommendation for practice would be to examine the HB5 course content, learning objectives, pedagogy and teacher training to determine ways to incorporate techniques to bolster characteristics such as self-efficacy and student motivation.

Future Research

Because of the relatively new nature of the college preparatory courses in Texas, there is rich ground for future study and for significant contributions to the literature on this topic. Very little research was found regarding the HB5 college preparation courses in Texas. While this research focused on follow-on student success in college-level coursework and the development of predictive models of student success, future researchers can provide meaningful contributions by examining these courses and the students that take them along numerous lines of study.

Long Term Outcomes

At the college in the study, the typical time to degree is 4.2 years. Given this, the time passage from the initial cohorts of students taking the college preparatory courses means that these students should be beginning to graduate from college. Future researchers could examine several long-term outcomes for these students compared with other populations; thus, extending the research far beyond their outcomes in their first college level courses.

Questions for consideration might include an examination of the graduation rates for these students. Do they complete college in similar percentages to other populations such as the students passing the TSIA? How did their performance compare to other populations in courses other than math and English? Was their college GPA comparable to other populations?

Reed (2014) studied the perceptions of high school teachers versus college professors regarding the college readiness of their students. He found a gap showing that a higher percentage of high school teachers believe their students are college ready versus the college professors. Have the co-developed college preparatory courses closed that perception gap?

In the previous section it was explained that there are positive effects for the students who took the HB5 courses and subsequently passed their college-level coursework. Future researchers could also examine the long-term outcomes of those who failed on their first attempt. Did these students ultimately succeed? Or did they experience the same detrimental effects that developmental education students experience?

Cost Benefit Analysis

As describe earlier, there are numerous entities involved in the creation and oversight of the HB5 courses, resulting in large amounts of resources being devoted to this mandate. However, there is no funding provided in the bill for the development, implementation, or maintenance of these courses. College and ISD faculty members from 12 districts collaborated on the development and improvement of the courses and training must be created, arranged, and conducted each year. Memorandums of understandings (MOUs) were developed and approved by legal teams and educational boards. IT systems and processes were developed to track and transcript the college success courses. Thus, there are a large number of expenses associated with these courses. On the other hand, there are significant costs associated with developmental education and its accompanying negative impacts. As mentioned in chapter 2, it is estimated that Texas spends $197 million on post-secondary developmental education each biennium (Martorell & McFarlin, 2011). Future researchers might want to examine these courses from a resource perspective to determine their viability from an economic and/or human resource perspective.

Course Objective Analysis

A brief description of the two HB5 college preparatory courses, their learning objectives and the population for which they are intended was presented in chapter one. A complete list of the learning objectives can be found in Appendices B and C. As the learning objectives are comprehensive, with some exceeding the requirements of traditional high school coursework, future research could be done to determine if there are specific objectives or topics in the college level courses where students struggle, causing them to ultimately fail the course. An analysis of this information may provide important insight into potential curricular changes for the courses as well as guide the training content for teachers teaching the courses in high schools. Further, identifying these sticking points may allow for the development and implementation of targeted interventions at specific points in the course to assist students to complete successfully.

Additional Data Elements

One of the limitations stated for this study is that the secondary data set may not include other relevant variables that would contribute to a predictive model of student success. Some of these missing elements are non-cognitive student characteristics that have been found to be significant when attempting to predict college outcomes (Ransdell, 2001). Examples of such non-cognitive measures include self-efficacy, motivation and academic discipline (Komarraju, Ramsey, & Rinella, 2013). However, these non-cognitive factors are not typically captured or considered in post-secondary systems (Conley, 2007a). Additionally, there were a great number of missing data elements in the data used for this research. This could be due to the differences in the data collected and stored by secondary versus post-secondary institutions. Future research that could find a way to capture more complete data, gather the data for important non-cognitive variables, and match them together might result in additional insights into the success of students in college-level coursework and may lead to the development of more predictive models.

Conclusion

Results of the study found two predictive models, one associated with each of the two research questions. For math, significance was found for high school GPA and CRM, which indicates whether a student passed a standardized college entrance exam. For English, significance was also found for those same two characteristics, but also for the characteristics of gender and the students’ first-generation status. While significance was found for both models, it is noted that their predictive value was relatively small. As noted in the findings, the models failed one of the assumptions of logistic regression – linearity in the logit. Readers and future researchers should therefore take this into account when assessing the overall predictive value of the models.

A comparison of the population of students who passed the TSIA and those who took the college preparation course reinforces the literature that indicates females, minorities, students of low socioeconomic status, and first-generation students are more highly represented in the population unable to pass the standardized college entrance exam. This proved true for both the math and English data sets. This population also proved less likely to pass their first college-level math or English course, which reflects some of the previous research on the math courses and population. This suggests that the region should continue to focus on preparing students to become college ready via the TSIA, as those students have a greater chance of success in college level coursework.

However, the majority of students taking the HB5 courses did successfully complete their college level math or English course on their first attempt. This provides a good indication that the courses are somewhat effective for certain populations. As a practitioner, this suggests that these courses are a viable strategy for high school students who become seniors and cannot pass the state mandated college entrance examination. As the cycle of course examination, revision, and teacher training continues, the region could see an increase in the percentage of successful students.

It is hoped that this dissertation expands on the limited available research on the topic of college success for students taking college preparatory courses mandated by HB5 during the 2013 Texas Legislative session. This research may serve as a jumping off point for future researcher to continue to contribute to the body of literature on the topic. This research may also inform regional policies and practice to facilitate the improvement of college readiness pathways available to regional students. Ultimately, it is hoped that this research leads to an improved understanding of overall college access and student success.

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Appendix A

Section 10 of House Bill 5 from the 2013 Texas Legislative Session with Edits

H.B. No. 5

AN ACT

relating to public school accountability, including assessment, and curriculum requirements; providing a criminal penalty.

BE IT ENACTED BY THE LEGISLATURE OF THE STATE OF TEXAS:

SECTION 10. (a) Section 28.014, Education Code, is amended to read as follows:

Sec. 28.014. COLLEGE PREPARATORY COURSES. (a) Each school district shall partner with at least one institution of higher education to develop and provide [~~The commissioner of education and the commissioner of higher education shall develop and recommend to the State Board of Education for adoption under Section 28.002 the essential knowledge and skills of~~] courses in college preparatory mathematics[~~, science, social studies,~~] and English language arts. The courses must be designed:

(1) for students at the 12th grade level whose performance on:

(A) [~~who do not meet college readiness standards on~~] an end-of-course assessment instrument required under Section 39.023(c) does not meet college readiness standards; or

(B) coursework, a college entrance examination, or an assessment instrument designated under Section 51.3062(c) indicates that the student is not ready to perform entry-level college coursework; and

(2) to prepare students for success in entry-level college courses.

(b) A course developed under this section must be provided:

(1) on the campus of the high school offering the course; or

(2) through distance learning or as an online course provided through an institution of higher education with which the school district partners as provided by Subsection (a).

(c) Appropriate faculty of each high school offering courses under this section and appropriate faculty of each institution of higher education with which the school district partners shall meet regularly as necessary to ensure that each course is aligned with college readiness expectations. The commissioner of education, in coordination with the commissioner of higher education, may adopt rules to administer this subsection.

(d) Each school district shall provide a notice to each district student to whom Subsection (a) applies and the student's parent or guardian regarding the benefits of enrolling in a course under this section.

(e) A student who successfully completes an English language arts [~~a~~] course developed under this section may use the credit earned in the course toward satisfying the advanced English language arts [~~applicable mathematics or science~~] curriculum requirement for the foundation [~~recommended or advanced~~] high school program under Section 28.025(b-1)(1) [~~28.025~~]. A student who successfully completes a mathematics course developed under this section may use the credit earned in the course toward satisfying an advanced mathematics curriculum requirement under Section 28.025 after completion of the mathematics curriculum requirements for the foundation high school program under Section 28.025(b-1)(2).

(f) A course provided under this section may be offered for dual credit at the discretion of the institution of higher education with which a school district partners under this section.

(g) Each school district, in consultation with each institution of higher education with which the district partners, shall develop or purchase [~~(c)~~ ~~The agency, in consultation with the Texas Higher Education Coordinating Board, shall adopt an end-of-course assessment instrument for each course developed under this section to ensure the rigor of the course.~~ ~~A school district shall, in accordance with State Board of Education rules, administer the end-of-course assessment instrument to a student enrolled in a course developed under this section.~~ ~~Each school district shall adopt a policy that requires a student's performance on the end-of-course assessment instrument to account for 15 percent of the student's final grade for the course.~~ ~~A student's performance on an end-of-course assessment instrument administered under this subsection may be used, on a scale of 0-40, in calculating whether the student satisfies the graduation requirements established under Section 39.025.~~

[~~(d)~~ ~~The agency, in coordination with the Texas Higher Education Coordinating Board, shall adopt a series of questions to be included in an end-of-course assessment instrument administered under Subsection (c) to be used for purposes of Section 51.3062.~~ ~~The questions must be developed in a manner consistent with any college readiness standards adopted under Sections 39.233 and 51.3062.~~

[~~(e) The State Board of Education shall adopt~~] instructional materials for a course developed under this section consistent [~~in accordance~~] with Chapter 31. The instructional materials must include technology resources that enhance the effectiveness of the course and draw on established best practices.

(h) [~~(f)~~] To the extent applicable, a district [~~the commissioner~~] shall draw from curricula and instructional materials developed under Section [~~Sections~~] 28.008 [~~and 61.0763~~] in developing a course and related instructional materials under this section. A [~~Not later than September 1, 2010, the State Board of Education shall adopt essential knowledge and skills for each course developed under this section.~~ ~~The State Board of Education shall make each~~] course developed under this section and the related instructional materials shall be made available to students [~~school districts~~] not later than the 2014-2015 school year. [~~As required by Subsection (c), a school district shall adopt a policy requiring a student's performance on an end-of-course assessment instrument administered under that subsection to account for 15 percent of the student's grade for a course developed under this section not later than the 2014-2015 school year.~~] This subsection expires September 1, 2015.

(b) This section applies beginning with the 2013-2014 school year.

Appendix B

Learning Objectives – College Preparatory English

Upon successful completion of this course, students will be able to:

1. Locate explicit textual information, draw complex inferences, and describe, analyze, and evaluate the information within and across multiple texts of varying lengths.
2. Set individual learning goals, and self-monitor during the learning process by articulating difficulties, identifying solutions, and asking for assistance when appropriate.
3. Determine the meaning of unfamiliar vocabulary within text by analyzing context and using appropriate resources; incorporate expanded vocabulary into oral and written communication.
4. Describe, communicate, and apply insights gained from reading and writing a variety of texts through reflection.
5. Interact with text to discover evidence of author's purpose, intended audience, tone/voice, and message across a variety of texts.
6. Compose a variety of texts that demonstrate reading comprehension, clear focus, logical development of ideas, and use of appropriate language that advance the writer's purpose.
7. Determine and use effective approaches and rhetorical strategies for given reading and writing situations.
8. Discuss ideas in a variety of formal and informal contexts, contribute to group dialogue, and incorporate others' ideas into individual work and learning approach when appropriate.
9. Generate ideas and collect credible information relevant to the topic and purpose, incorporating the ideas and words of other writers in college-level writing using established strategies.
10. Evaluate relevance and quality of ideas and information in recognizing, formulating, and developing a claim.
11. Recognize and apply the conventions of Standard English in reading and writing.
12. Collaborate with peers throughout the reading and writing process to build upon ideas, investigate a problem, explore complexities of issues, and improve writing.
13. Revise writing to increase continuity of ideas, academic tone, accuracy of communication, and clarity of purpose.

Appendix C

Learning Objectives – College Preparatory Math

Course Student Learning Outcomes & Learning Objectives:

STUDENT LEARNING OUTCOMES	LEARNING OBJECTIVES	High School Equivalent
THE STUDENT WILL:		Algebra I & Geometry
1. Identify and apply properties of real numbers and perform accurate arithmetic operations with numbers in various formats and number systems. Apply basic geometric theorems and formulas.	1.1 Add, subtract, multiply and divide, using order of operations, real numbers and manipulate certain expressions including exponential operations.	
	1.2 Find square roots of perfect square numbers.	
	1.3 Solve problems involving calculations with percentages and interpret the results.	
	1.4 Use estimation skills, and know why, and when to estimate results.	
	1.5 Find the perimeter and area of rectangles, squares, parallelograms, triangles, trapezoids and circles; volume and surface area, relations between angle measures, congruent and similar triangles, and properties of parallelograms.	
2. Demonstrate the ability to graph and solve liner equations and inequalities.	2.1 Solve problems using equations and inequalities, absolute value equalities and inequalities.	Algebra I & Algebra II
	2.2 Solving linear equations.	
	2.3 Plot ordered pairs on a rectangular coordinate system and graph linear equations.	
	2.4 Graph linear equations & linear inequalities in two variables.	
	2.5 Finding intercepts graphically and algebraically.	
	2.6 Find the slope of a line & write its equation.	Algebra I & Algebra II
	3.1 Solve systems of linear equations in two variables by graphing.	

3. Solve systems of equations using a variety of techniques.	3.2 Solve systems of linear equations in two variables by substitution.	
	3.3 Solve systems of linear equations in two variables by addition.	
4. Understand operations of polynomial functions and solve problems using scientific notation.	4.1 Exponents	Algebra I & Algebra II
	4.2 Operations of polynomial functions to include addition, subtraction, multiplication, and division.	
	4.3 Solving problems using scientific notation.	
5. Understand, interpret, and make decisions based on financial information commonly presented to consumers.	5.1 Demonstrate understanding of common types of consumer debt and explain how different factors affect the amount that the consumer pays.	Mathematical Models with Applications; Algebra I & Algebra II
	5.2 Demonstrate understanding of compound interest and how it relates to saving money.	
	5.3 Use quantitative information to explore the impact of policies or behaviors on a population.	
	5.4 Factor polynomials using the techniques of the greatest common factor and grouping.	

STUDENT LEARNING OUTCOMES	**LEARNING OBJECTIVES**	**High School Equivalent**
THE STUDENT WILL:		
1. Use and interpret function notation in both algebraic and graphical contexts.	1.1 Recognize functional notation and evaluate functions.	Algebra I & Algebra II
2. Solve algebraic equations and inequalities involving rational expressions, radicals, quadratics, or linear expressions.	2.1 Factoring polynomials using the greatest common factor, grouping, trinomials of the form $xx^2+bbxx+cc$ and $aaxx^2+bbxx+cc$, difference of two squares, and special trinomials.	Algebra I, Geometry, Algebra II, & Pre-Calculus
	2.2 Solve quadratic equations by factoring.	
	2.3 Add, subtract, multiply and divide rational expressions.	
	2.4 Simplify complex fractions.	
	2.5 Solving equations involving rational expressions.	

	2.6 Simplify equations involving rational exponents and simplify radicals.	
	2.7 Add, subtract, multiply, divide expressions involving radicals and solve radical equations. 2.8 Add, subtract, multiply and divide complex numbers. 2.9 Solve quadratic equations by completing the square, quadratic formula, and square root property. 2.10 Graph quadratic functions and inequalities.	
3. Examine, solve, and interpret the quadratic graphs of equations and inequalities.	3.1 Add, subtract, multiply, and divide complex numbers. 3.2 Solve quadratic equations by completing the square, quadratic formula, and square root property. 3.3 Graph quadratic functions and inequalities.	Algebra I & Algebra II
4. Solve application problems.	4.1 Applications of functions.	all courses
5. Use counting principles and probability to quantify uncertainty in a variety of real-world contexts.	5.1 Build a finite sample space and interpret statements about probability (including terms like unlikely, rare, and impossible). 5.2 Compute and interpret the probability of an event and its complement. 5.3 Computer and interpret the probability of compound and conditional events. 5.4 Interpret two-way tables.	Advanced Quantitative Reasoning & Statistics

Appendix D

Reference Tables - Math

Table D1

Final Math Cases by College Readiness Measure

	HB5 Course		TSIA	
Cases	N	%	N	%
Math	221	5.20%	4040	94.8%

Table D2

Box-Tidwell Test of Linearity in the Logit - Math

Variables in the Equation

	B	S.E.	Wald	df	Sig.	Exp(B)
Type of program selected	-0.453	0.154	8.623	1	0.00	0.636
HS_GPA	-4.484	0.862	27.088	1	0.00	0.011
Gender_Num	-0.146	0.081	3.254	1	0.07	0.864
FGEN	0.018	0.08	0.049	1	0.83	1.018
Student Financial Need reported	0.13	0.084	2.397	1	0.12	1.139
HS_GPA by LnGPA	0.849	0.158	28.933	1	$\boxed{0.00}$	2.338
Constant	60.913	13.592	20.084	1	0.00	2.85E+26

a. Variable(s) entered on step 1: Type of program selected, HS_GPA, Gender_Num, FGEN, Student Financial Need reported, HS_GPA * LnGPA .

Table D3

Multicollinearity Test - Math

Variable	Collinearity Statistics Tolerance	VIF
HS_GPA	0.851	1.175
Type of program selected	0.972	1.028
Gender_Num	0.918	1.089
FGEN	0.938	1.066
Student Financial Need reported	0.897	1.114

a. Dependent Variable: Student pass/fail outcome

Table D4

Initial Log Likelihood - Math

Iteration History[a,b,c,d]

Iteration		-2 Log likelihood	Coefficients Constant
Step 0	1	3445.277	1.069
	2	3436.412	1.189
	3	3436.404	1.193
	4	3436.404	1.193

a. Sample Groups = Reference Sample

b. Constant is included in the model.

c. Initial -2 Log Likelihood: 3436.404

d. Estimation terminated at iteration number 4 because parameter estimates changed by less than .001.

Table D5

Baseline Classification Table - Math

Classification Table[a,b,c]

Observed			Predicted: Student pass/fail result: Failed course	Predicted: Student pass/fail result: Passed course	Percentage Correct
Step 0	Student pass/fail result	Failed course	0	737	0
		Passed course	0	2430	100
	Overall Percentage				76.7

a. Sample Groups = Reference Sample

b. Constant is included in the model.

c. The cut value is .500

Table D6

Baseline Model - Math

Variables in the Equation[a]

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 0	Constant	1.193	.042	804.914	1	.000	3.297

a. Sample Groups = Reference Sample

Table D7

Math Final Model Classification – Reference Sample

Classification Table[a,b]					
			Predicted		
			Student pass/fail result		Percentage
	Observed		Failed course	Passed course	Correct
Step 1	Student pass/fail result	Failed course	141	596	19.1
		Passed course	95	2335	96.1
	Overall Percentage				78.2

a. Sample Groups = Reference Sample

b. The cut value is .500

Table D8

Math Final Model Classification – Validation Sample

Classification Table[a,b]					
			Predicted		
			Student pass/fail result		Percentage
	Observed		Failed course	Passed course	Correct
Step 1	Student pass/fail result	Failed course	52	207	20.1
		Passed course	42	793	95.0
	Overall Percentage				77.2

a. Sample Groups = Validation Sample

b. The cut value is .500

Appendix E

Reference Tables – English

Table E1

Final Cases by College Readiness Measure - English

	HB5 Course		TSIA	
Cases	N	%	N	%
English	181	1.85	9603	98.15

Table E2

Box-Tidwell Test of Linearity in the Logit - English

Variables in the Equation

	B	S.E.	Wald	df	Sig.	Exp(B)
Program selected	-0.566	0.176	9.926	1	0.002	0.574
HS_GPA	-4.819	.572	71.049	1	0.000	0.008
Student Gender	-0.355	0.053	44.608	1	0.000	0.701
Student generational status	-0.157	0.054	8.531	1	0.003	0.855
Student Financial Aid Status	-0.008	0.059	0.018	1	0.893	0.992
HS_GPA by LN_HS_GPA	0.910	0.105	74.688	1	0.000	2.484
Constant	67.309	8.823	58.206	1	0.000	1.707E+29

a Variable(s) entered on step 1: Program selected, HS_GPA, Student Gender, Student generational status, Student Financial Aid Status, HS_GPA * LN_HS_GPA .

Table E3

Multicollinearity Test - English

	Collinearity Statistics	
Variable	Tolerance	VIF
Program selected	0.998	1.002
HS_GPA	0.919	1.088
Student Gender	0.965	1.036
Student generational status	0.944	1.060
Student Financial Aid Status	0.919	1.089

a Dependent Variable: Course performance

Table E4

English Baseline -2 Log Likelihood

Iteration History[a,b,c,d]			
Iteration		-2 Log likelihood	Coefficients Constant
Step 0	1	7484.497	1.175
	2	7447.632	1.340
	3	7447.557	1.348
	4	7447.557	1.348

a. Sample Groups = Reference Sample

b. Constant is included in the model.

c. Initial -2 Log Likelihood: 7447.557

d. Estimation terminated at iteration number 4 because parameter estimates changed by less than .001.

Table E5

Base Classification - English

Classification Table[a,b,c]			Predicted		
			Course performance		Percentage Correct
	Observed		Failed English course	Passed English course	
Step 0	Course performance	Failed English course	0	1509	0
		Passed English course	0	5808	100
	Overall Percentage				79.4

a Sample Groups = Reference Sample

b Constant is included in the model.

c The cut value is .500

Table E6

English Final Model Classification – Validation Sample

Classification Table[a,b]

			Predicted		
			Student pass/fail result		Percentage
	Observed		Failed course	Passed course	Correct
Step 1	Student pass/fail	Failed course	52	479	9.8
	result	Passed course	57	1879	97.1
	Overall Percentage				78.3

a. Sample Groups = Validation Sample

b. The cut value is .500

Vita

Steve Smith graduated from UTEP with a Bachelor of Business Administration in Computer Information Systems and from Webster University with a Masters of Arts in Computer Resource Management. He began his Doctor of Education in Educational Leadership and Administration in 2017.

Steve Smith currently serves as the Vice President of Instruction and workforce Education at El Paso Community College (EPCC). In this capacity, he oversees the instructional programs at EPCC's five campuses. He has district-wide responsibility for the College's credit transfer, career and technical and developmental education programs, Counseling Services and Libraries. Mr. Smith oversees 1,500 employees and a $47 million budget.

Prior to his current role, he served as the Instructional Dean for Math, Science and Career & Technical Education Division at EPCC's Transmountain Campus. In this position, he managed the daily operation of more than 21 diverse disciplines. He is also a tenured professor in the IT Department. As a faculty member, he has been recognized with several awards including the El Paso Energy Foundation Faculty Achievement Award, the Aristotle Award for creative classroom techniques and the NISOD Excellence Award.

In 2015, he was the recipient of the Chief Academic Officer Emerging Leader Award by the National Council of Instructional Administrators. In 2017 he was named as an Aspen Presidential Fellow and in 2018 he was presented the Carl M. "Cheesie" Nelson Administrative Leadership Award by the Texas Association of Community Colleges (TACC) for his outstanding leadership qualities and impact on higher education in Texas.