KEY TO SUCCESS? RELATIONSHIP BETWEEN TEXAS SUCCESS INITIATIVE

ASSESSMENTS AND COURSE PERFORMANCE IN FIRST-YEAR, CREDIT-BEARING

ENGLISH AND MATH CLASSES

by

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Abstract

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The University of Texas at Arlington, 2019

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The purpose of this study is to examine the relationship between the Texas Success

Initiative Assessment (TSIA) exams and student performance in associated content-area courses

in postsecondary education. While the number of students attending college is projected to

increase (Digest of Education Statistics, 2017; National Center for Education Statistics, 2018),

many of them may not be prepared for a college education (Greene & Winters, 2005; Porter &

Polikoff, 2012; Royster, Gross, & Hochbein, 2015) and are therefore obligated to enroll in

developmental education classes (Bailey, Jeong, & Cho, 2010; Scott-Clayton, Costa, & Belfield,

2014). These courses are meant to provide students with the basic skills and content knowledge

they should have received in high school (The Alliance for Excellent Education, 2006).

However, developmental classes come with several potential consequences, including incorrect

placement (Bailey, Jeong, & Cho, 2010; Scott-Clayton, 2012), lengthening the time to degree

completion (Alliance for Excellent Education, 2006), inflating the overall cost of college

(Alliance for Excellent Education, 2006; Strong American Schools, 2008), and increasing the

dropout rate (Bailey, Jeong, & Cho, 2010; NCES, 2004). Course appointments are typically

made based on placement exams (Chen & Simone, 2016; College Board, n.d.a). Texas utilizes

the TSIA exams, which were mandatory beginning with the fall 2013 cohort (Tex Leg Code §51.333).

In this study, I analyze the relationship between the TSIA exams in reading and mathematics and student performance in for-credit freshmen English and math classes. I begin by creating a cross-tabulation table and running a chi-squared analysis to determine if there is a statistically significant relationship between the variables, both measured as binary pass/fail. I follow this with a Pearson r correlation test to examine the strength and direction of the relationship between the variables. For the correlation, I use raw TSIA scores as one continuous variable and course grades, converted into points with $A = 4$ and $F = 0$ as the second variable. Finally, if a statistically significant relationship is found in either the chi-squared or Pearson r correlation analyses between exam score and course outcome, I build logistic regression models to determine if the relationship holds in the presence of other factors shown to affect academic performance, including race/ethnicity, gender, parent income, level of parent education, and standardized admission exam scores.

Results from these analyses indicate that there is no relationship between student performance on their TSIA reading exam and their results in their for-credit English class. However, there is a small, positive correlation between TSIA math score and grade in credited math. The regression analyses show that the standardized TSIA math score is a significant predictor of performance in for-credit math, although the logistic regression models are not a substantial improvement over the null model and do not account for much of the variance in student course outcomes.

Dedication

To begin, I dedicate this dissertation to my daughter. Jordan, without your support, encouragement, and conviction I would not have been able to survive this journey. You are my inspiration and my strength. I do not believe that this dissertation would be what it is without your willingness to let me read all of the sections aloud to you to help me catch all my mistakes!

I would also like to dedicate this work to my parents, Renée and David. You never let me settle for anything less than my best; you have always believed in me and provided me the ability to chase my dreams. Thank you for listening to hours of my worries, frustrations, and uncertainties. The two of you are my anchor and my safe haven. Mom, I am especially grateful for the time and effort you spent helping take care of Jordan so that I would be able to attend my classes and complete my work.

This achievement belongs to you three, as well. I love you.

July 26, 2019

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Chapter 1

Key to Success? Relationship Between Texas Success Initiative Assessments and Course

Performance in First-Year, Credit-Bearing English and Math Classes

The number of students graduating from high school and enrolling in some form of

postsecondary education is projected to increase over the next decade (Digest of Education

Statistics, 2017; National Center for Education Statistics, 2018). According to the U.S.

Department of Education (2015), 81% of U.S. students graduated from high school in four years

in 2012-2013. In addition, 69.2% of high school graduates from the class of 2015 were enrolled

in colleges or universities in October 2015 (Bureau of Labor Statistics, 2016). The National

Center for Education Statistics projects that approximately 21.3 million students will matriculate

colleges and universities in the United States in fall 2020, an increase of 6.9% from the 19.9

million who attended in fall 2015 (Digest of Education Statistics, 2017).

However, Porter and Polikoff (2012) point out that many students enrolling in college are

not ready for college-level work. Conley (2012) defines *college readiness* as being prepared to

"qualify for and succeed in entry-level, credit-bearing college courses leading to a baccalaureate

or certificate, or career pathway-oriented training programs without the need for remedial or

developmental coursework" (p. 1). Greene and Winters (2005) state that approximately two-

thirds of college-bound graduates may not be ready for a postsecondary education. Greene and

Winters compared the college-readiness rates for students in all 50 states to determine an overall

national rate of 34%. They defined college readiness as having graduated from high school with

the knowledge and skills necessary for a collegiate education. In 2015, Royster, Gross, and

Hochbein stated that nationally, only 19% of high school students progressed to college or

university prepared for the rigors of postsecondary work.

Bailey, Jeong, and Cho (2010) explain that students who are not equipped for college-level work are usually enrolled in *developmental classes* to get them ready to enroll in first-year courses. These developmental sequences are designed to prepare students, in a stepwise fashion, for their first college sessions. The Alliance for Excellent Education (2006) explicates that most students taking these remedial classes are required to do so in order to gain basic skills, like study habits and the ability to analyze material, and content knowledge they should have received in high school. These skills and knowledge are indispensable for them to be successful in college-level courses. Scott-Clayton, Costa, and Belfield (2014) assert that 50% of undergraduates will take at least one developmental course while enrolled in college, and Horn and Neville (2006) claim that 43% of first and second-year students in public two-year colleges enroll in at least one remedial class. These findings were echoed in 2018 by the Center for the Analysis of Postsecondary Readiness (CAPR) (Ganga, Mazzariello, & Edgecombe, 2018), who stated that over two-thirds of community college students and 40% of four-year college students enroll in at least one foundational course.

The need to take developmental coursework has several consequences, including incorrect placement into either remedial or for-credit classes (Bailey, Jeong, & Cho, 2010; Scott-Clayton, 2012), inflating the time to degree completion (Alliance for Excellent Education, 2006), increasing the odds of dropping out (Bailey, Jeong, & Cho, 2010; NCES, 2004), and adding to the overall cost of postsecondary education (Alliance for Excellent Education, 2006; Strong American Schools, 2008). These concerns add focus to the need for ensuring that students are appropriately placed into needed courses that will provide them with the ability and credits they require to successfully complete a postsecondary degree or certificate. Colleges and universities generally employ *placement exams* to determine the readiness level of new students and to select

which classes students need to enroll in (Chen & Simone, 2016; College Board, n.d.a). Students who are deemed ready for a postsecondary education are allowed to enroll directly into credit-bearing coursework, while students considered underprepared as a result of their placement exam results are assigned to developmental education classes (College Board, n.d.a).

The Texas Higher Education Coordinating Board (THECB) has set a 15-year strategic plan which declares that by 2030, 60% of Texans ages 25-34 will hold a postsecondary degree or certificate (Texas Higher Education Coordinating Board, 2015). To reach this goal, the THECB recommends evaluating student readiness for postsecondary education and reducing coursework duplication to decrease the time-to-degree (Texas Higher Education Coordinating Board, 2018b). The Texas Education Code (TEC) defines college readiness as the ability for a student to enroll and succeed in an entry-level course in the same content area without remediation (Tex. Leg. Code §39.024, 2018). Texas utilizes the Texas Success Initiative Assessments (TSIA) to determine preparedness for college and postsecondary student placement into English and mathematics courses (Tex Leg Code §51.333), whether credit-bearing or developmental. These exams are developed by College Board as part of a partnership with the THECB (Texas Higher Education Coordinating Board, 2016). State mandate requires that all college students be assessed in reading, writing, and mathematics before starting their postsecondary schooling at Texas institutes of higher education (IHEs) (College Board, 2014). The multiple choice questions on the TSIA-math, TSIA-reading, and TSIA-writing assessments are aligned to the Texas College and Career Readiness Standards and provide students with a numeric score between 310 and 390 (College Board, 2014). Cut scores, which Zieky and Perie (2006) define as "points on the score scale of a test… used to determine whether a particular test score is sufficient…" (p. 2), provide three categories for student results on TSIA exams. Students whose results place them

into the college-ready category can enroll in for-credit classes. Students in the diagnostic or adult basic education (ABE) categories must register for developmental coursework.

Table 1.1

TSIA Categories and Cut Scores

Level/Category	Math	Reading	Writing
College-Ready	350 – 390	351 – 390	340 – 390 with an essay score of 4+ OR < 340 with an essay score of 5 – 8
Diagnostic	336 – 349	342 – 350	350 – 362 and an essay score of 0 – 4
Adult Basic Education	310 – 335	310 – 341	310 – 349 and an essay score of 0 – 4

Note: Adapted from College Board, 2014; College Board, 2018; Tex. Leg, Code §4.57

There are a variety of ways that students may be exempt from completing the TSIA assessments: 1) they receive high scores on one of several other assessment exams, such as the Scholastic Aptitude Test (SAT), American College Testing (ACT), or State of Texas Assessments of Academic Readiness (STAAR) end-of-course exams in Algebra II and/or English III, 2) successful completion of a college preparatory course, as outlined in House Bill Five (Texas Association of School Administrators, 2013), 3) enrollment in a certificate program lasting one year or less at a public community or technical college, 4) transfer of necessary college credits from another postsecondary institution, including dual-credit programs completed in high school, or 5) status as a member of the armed services, whether that be veteran, active-duty, or Reservist during the three years prior to postsecondary enrollment (Texas Higher Education Coordinating Board, 2017a).

A validity study for the TSIA exams was conducted by College Board to determine the correlation between exam scores and course results, as well as the predictability of the TSIA for appropriate placement into developmental or credit-bearing coursework (Cui & Bay, 2016). After examining more than 20,000 entering college freshmen in Texas from the 2013 and 2014 cohorts, Cui and Bay determined that the college-ready cut-score for math (350) was associated with a 64% chance of receiving a passing grade (C- or higher) in the corresponding class. The college-ready cut-score for reading (351) was linked to a 68% chance of earning a C- or better in the corresponding class. The college-ready cut-score for the multiple choice section of the writing exam (363) plus a score of five or higher on the essay component was correlated to a 75% chance of making a C- or higher in the matching class. The authors also reported that students who received a higher TSIA score were more likely to successfully complete the course than students with lower results. However, when Cui and Bay analyzed the percentage of students who were correctly placed (earned a C- or higher) into for-credit courses based on TSIA exam scores, they found that only 62.55% of students were appropriately placed for math, 68.59% for reading, and 74.87% for writing; meaning that between approximately 25 – 40% of students were not enrolled into the appropriate class based on their placement exam results.

Since the Cui and Bay study was conducted, there has been a major policy change affecting the TSIA exams. House Bill Five, passed by the 83rd Texas Legislature, removed the requirement for students to complete the Algebra II and English III STAAR end-of-course exams for high school graduation (Texas Association of School Administrators, 2013), which narrowed the options for TSIA exemption. This change decreased the overall percentage of students meeting TSIA minimum requirements from 72.7% in 2014 to 58.2% in 2015 (Texas Higher Education Coordinating Board, 2018a). In addition to this policy change, the College Board

study mostly examined students at two-year institutions (Cui & Bay, 2016). There have not yet been any studies solely examining students attending four-year universities or any studies examining student populations since the policy change outlined above.

Statement of the Problem

The number of students seeking a postsecondary education is increasing (Digest of Education Statistics, 2017; National Center for Education Statistics, 2018); however many studies have concluded that a large portion of these students are not prepared to successfully complete their college courses (Greene & Winters, 2005; Porter & Polikoff, 2012; Royster, Gross, & Hochbein, 2015). Any students who are not prepared for the rigors of a college education must complete developmental, sometimes called remedial or basic-skills, classes to prepare them to complete credit-bearing coursework (Alliance for Excellent Education, 2006; Bailey, Jeong, & Cho, 2010; Horn & Neville, 2006; Scott-Clayton, Costa, & Belfield, 2014). These developmental classes can be accompanied by a myriad of problems (Alliance for Excellent Education, 2006; Bailey, Jeong, & Cho, 2010; NCES, 2004; Strong American Schools, 2008), but they remain an essential component of college course offerings to strengthen the readiness of postsecondary students (Chen & Simone, 2016). In most cases, students are enrolled in developmental education courses based on their performance on placement exams (Bailey, Jeong, & Cho, 2010). However, studies show that the placement exams used to determine which classes students should enroll in often display low predictability and only weak correlations between the results of the exam and the passing rates and course grades in the associated classes (Belfield & Crosta, 2012; Jenkins, Jaggars, & Roksa, 2009; Medhanie, Dupuis, LeBeau, Harwell, & Post 2012; Scott-Clayton, 2012).

The state of Texas has declared that their goal is to "become one of the top ten states for graduating college-ready students by the 2019-2020 school year" (Texas Education Agency, 2010a, p. I-47) and that by 2030, 60% of Texans ages 25-34 will hold a postsecondary degree or certificate (Texas Higher Education Coordinating Board, 2015). To facilitate these goals, institutes of higher education in Texas utilize the Texas Success Initiative Assessments (TSIAs) in mathematics, reading, and writing to govern placement decisions (Tex Leg Code §51.333). However, there have been no studies examining the relationship between performance on TSIA exams and student performance in college courses focused completely on undergraduates at four-year institutions. Nor have any studies been conducted since House Bill Five was implemented, which removed two of the TSIA exemption tests as a high school graduation requirement for Texas students (Texas Higher Education Coordinating Board, 2018a). In addition, there has been no study that takes into account the length of time between when students take their TSIA exams and when they enroll in their postsecondary coursework.

This study is critical given the wide-spread use of the TSIA exams and the fact that a college-ready score is not necessarily a guarantee of success in the affiliated content area college course. Nor is a failing grade on a TSIA exam automatically indicative that a student would not pass the course. Placement testing has been found to cost thousands of dollars annually to postsecondary institutions and students (Rodriguez, Bowden, Belfield, & Scott-Clayton, 2015), which provides another reason to examine the correlation between exam results and course success.

Purpose of the Study

The purpose of this quantitative study is to examine the relationship between the various Texas Success Initiative Assessment (TSIA) tests and associated content-area course

performance in postsecondary education. I aim to provide data that can help determine whether the current implementation of Texas higher education placement exam policy (minimum scores required to demonstrate college-readiness) is linked with correct placement into credit-bearing college classes, as defined by earning a passing grade. Students are required to perform at the college-readiness level of the TSIA exams, or hold one of the allowable exemptions, in order to enroll directly into credit-bearing English and mathematics courses at their postsecondary institution (Tex Leg Code §51.333). It is important to know if TSIA exam results are correlated to performance in first-year, for-credit coursework. And, if so, do those correlations hold true even when accounting for other factors that have been shown to be associated with academic achievement – for example, race/ethnicity (Ross et al, 2012; Sirin, 2005; Smith, 2012), gender (National Center for Education Statistics, 2018; Ross et al., 2012), socioeconomic status (Kohn, 2000; Reardon, 2011; Sirin, 2015), and parent education level (Hooker & Brand, 2009; Ivanovic et al., 2019; Ross et al., 2012).

Research Questions

This study addresses the following broad research questions:

(1) How does student performance on TSIA exams correspond with associated content-area, postsecondary course results?

(2) Does the relationship between TSIA exams and course results, if found, persist in the presence of other factors shown to affect academic performance?

In pursuit of these research questions, I will examine the association between TSIA exam performance, using cut scores set by College Board to determine student readiness for enrollment in credit-bearing college courses, and postsecondary course results, as determined by final class grade. Analyses will be performed for both content areas, mathematics and reading. Math and

reading enrollment is determined by results on a multiple-choice test. (College Board, 2014; College Board, 2018; Tex. Leg, Code §4.57).

Overview of Method

I intend to use descriptive and correlational statistics to investigate the research questions identified in this study by performing a secondary analysis of administrative data from The University of Texas at Arlington, a large, Texas, public, Research I institution. This will allow me to examine the relationship between results on the Texas Success Initiative Assessments and postsecondary course outcomes. My data will include first-time-in-college (FTIC) students who took TSIA examinations for course placement at the institution. These assessments are in line with the Texas College and Career Readiness Standards (College Board, 2014) and the content covered in developmental coursework (Jagger & Stacey, 2014; Kurlaender & Howell, 2012).

After I have received the anonymous student data from the university, I will analyze the data using Statistical Package for Social Sciences (SPSS) software, version 25 (IBM Corp., 2017) and will run descriptive statistics and chi-squared analyses on each of the TSIA examinations and course results for freshman-level mathematics and English classes to determine if there is a statistically significant relationship between the variables. Then I will perform Pearson *r* correlations to measure the relationship between each TSIA test results and associated course performance. Guided by Creswell (2012), each association will be analyzed for direction (positive or negative), form (linear or nonlinear) and strength (effect size). Finally, I will run a logistic regression to examine if the relationship of TSIA tests to course performance holds true in the presence of other factors shown to affect postsecondary course performance, including race/ethnicity (Ross et al, 2012; Sirin, 2005; Smith, 2012), gender (National Center for Education Statistics, 2018; Ross et al., 2012), socioeconomic status (Kohn, 2000; Reardon, 2011;

Sirin, 2015), and parent education level (Hooker & Brand, 2009; Ivanovic et al., 2019; Ross et al., 2012).

Significance of the Study

I will examine the correlation between results on the TSIA exams in mathematics and reading, and class performance in introductory English and mathematics classes in postsecondary education. The results of this study can provide specific evidence for educators and policy-makers to utilize when making decisions about the implementation of Texas' standardized-assessment requirement for postsecondary course placement. Current policy implementation designates the TSIA exams as the method that Texas institutes of higher education (IHE) must use when determining into which classes to place their incoming undergraduate students (Tex Leg Code §51.333). Exemptions to completing this testing are outlined in the Texas Education Code (Tex Leg Code §51.338) and include 1) achieving a high enough score on other standardized assessment measures such as the SAT, ACT, or end-of-course exams, 2) successfully completing a college preparatory course, 3) transferring college-level credit from another institution such as a community college or dual credit high school course, 4) showing enrollment in a certificate program lasting one year or less at a public community or technical college, or 5) having status as a member of the armed services, whether that be veteran, active-duty, or Reservist during the three years prior to postsecondary enrollment (Texas Higher Education Coordinating Board, 2017a). Discovering if TSIA test scores for reading and/or mathematics have a relationship with student performance in entry-level freshman classes could assist Texas postsecondary institutions and the test developers, College Board (College Board, 2014), align their definitions and expectations for college readiness, shape the requirements employed for ensuring collegiate institutions are accurately placing students into the appropriate

classes, and increase the number of students graduating with a postsecondary degree or certificate.

As part of the College Board arrangement with the Texas Higher Education Coordinating Board (THECB) to develop the TSIA exams, Cui and Bay (2016) conducted a validity study to examine the correlation between TSIA scores and course results as well as the predictability of the tests for class placement. However, there have been two significant policy changes enacted since the time of that study – the elimination of two of the high-school exit exams that were allowable exemptions for TSIA (Texas Association of School Administrators, 2013) and the lowering of the minimum score on the multiple-choice section of the writing exam to demonstrate college-readiness (Morales-Vale & Humphries, 2017; Texas Higher Education Coordinating Board, 2018a). Therefore, it is important that these relationships be reexamined to determine if the TSIA is still well aligned to expected outcomes; namely, correct placement and class success. Additionally, this single study into TSIA validity, conducted by the creator of the exam, did not take into account the length of time between when students completed their TSIA tests and when they enrolled in their college coursework. It is important to add independent research into TSIA exam validity to the available literature and to try and account for factors that could affect the relationship between exam results and course performance, like a significant period of time elapsing between exam completion and course-taking.

Having college placement exams properly aligned with expectations for college readiness can help IHEs accurately place students into the classes they need to successfully complete their degree. One of the approaches suggested by the THECB to help reach the goals of the 60x30 strategic plan is to decrease the amount of extra classes taken by students in order to shorten their time-to-degree and streamline their educational pipeline (Texas Higher Education Coordinating

Board, 2015). College Board (n.d.b) printed average yearly costs for tuition and fees at public two- and four-year colleges, as well as private four-year universities in the U.S., which run from a low of $3,440 to a high of $32,410. College Board (n.d.c) also reported that approximately two-thirds of full-time students in 2014-2015 utilized financial aid to help cover the costs for a postsecondary education, and the National Center for Education Statistics (2017) published that 83% of full-time undergraduate students in 2015-2016 were awarded financial aid. Unfortunately, many of these students discover that they must complete remedial coursework before being allowed to progress to for-credit classes. The Alliance for Excellent Education (2006) explains that the leading predictor that a student will drop out of college without completing a degree, is the requirement to take remedial reading when they get to college.

The more developmental courses a student is obligated to take, the more likely it is that they will drop out (Jaggers & Stacey, 2014). Cooper (2017) used data from National Student Clearinghouse and conveyed that 45% of undergraduate students who began college in 2011 obtained a degree at their beginning institution and another 12% received a degree at another collegiate establishment within six years, giving an overall completion rate of 57%. Another 12% of students were designated as being enrolled but not holding a degree; almost one-third, 31%, completely dropped out. Dropping out without completing a degree makes students vulnerable to unemployment and decreases the likelihood that they will earn a livable wage (Arzoumanidis, 2016; Hooker & Brand, 2009; Warburton, Bugarin, & Nunez, 2001), and therefore can make it challenging for students to pay back their loans. In 2010, 19% of U.S. households owed student debt that averaged to $26,682 (Fry, 2012). Nova (2018) reported that greater than one million people default on their student education loans each day. Currently, more than eight million Americans are in default (Sattelmeyer & Williams, 2018) and 40% of

borrowers are expected to be by 2023 (Nova, 2018). The current outstanding education debt in the United States is in excess of $1 trillion (Cilluffo, 2017; Nova, 2018; Stolba, 2019). If students and their college institutions could use the information in placement exams to make correct decisions about their readiness for a collegiate education and their need to enroll in developmental classes, then perhaps the dropout rate and the amount of education loan default can be lowered. Therefore, this study will act, in part, as a cost-benefit analysis of the usefulness of the TSIA exams in determining student preparation for successful completion of freshman-level, credit-bearing coursework.

Limitations and Delimitations of the Study

While there are no definitive limitations for this study, as that term is generally understood, there are several things to keep in mind. First is that all students in this study come from a single institution which restricts generalizability of the findings and limits the sample size. While the study site is one of the most diverse in the country (Gregor Aisch, 2017; Sullivan, 2013; University of Texas at Arlington, n.d.a), it is possible that there are factors at play at this particular institution that are causing some of the variations in class performance. Future research could focus on replicating this study at other institutions, both within and outside of Texas. Not all four-year institutions provide developmental education classes for their students; some refer those pupils to community colleges if they demonstrate the need for remedial coursework (Shields, 2005). It would be interesting to compare the course performance in first-year English and mathematics courses at institutions that provide developmental classes and those that do not.

While Texas' standardized placement exam policy requires the use of the TSIA examinations in reading, writing, and mathematics (Tex Leg Code §51.333), there are several exemptions from testing (Tex Leg Code §51.338), meaning students may have scores for all

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sections, some of the sections, or none of the sections. However, the study still holds value in that it provides a look at if, and how, scores on TSIA exams align with course grade outcomes in the associated freshmen-level English and math classes. In addition, the dataset from the institution used in this study may not include grades for students who completed freshmen English or first-year Algebra as dual credit courses in high school and therefore were not required to take those classes once on campus. These students may or may not have TSIA performance results reported to the college, since successful dual credit completion can be utilized as a TSIA exemption. Finally, as is the case with correlational research, it must be noted that correlation is not causality. Any results from this study cannot be used to explain *why* the association between variables exists (Gravetter & Wallnau, 2013).

Summary

Many students enrolling in postsecondary institutions are not prepared for college-level work. Therefore, they must enroll in developmental education classes designed to teach them the content and skills they need to know in order to be successful in their college classes (Alliance for Excellent Education, 2006; Bailey, Jeong, & Cho, 2010). There are several potential concerns regarding developmental class requirements, including incorrect placement (Bailey, Jeong, & Cho, 2010; Scott-Clayton, 2012), inflating the time to degree completion (Alliance for Excellent Education, 2006), increasing the odds that students will drop out (Bailey, Jeong, & Cho, 2010; NCES, 2004), and adding to the overall cost of postsecondary education (Alliance for Excellent Education, 2006; Strong American Schools, 2008). Decisions about placement into developmental courses is generally determined via placement exams (Chen & Simone, 2016; College Board, n.d.a).

In Texas, postsecondary institutions are bound by law to employ the Texas Success Initiative Assessments (TSIA) in reading, writing, and mathematics to placement students into appropriate classes (Tex Leg Code §51.333) unless they meet one of the published exemptions to the exam (Tex Leg Code §51.338). College Board conducted a validity study as part of their agreement with the Texas Higher Education Coordinating Board to develop and provide the TSIA tests (Cui & Bay, 2016). The authors utilized data from more than 20,000 students in Texas from the fall 2013 to fall 2014 and determined that the cut scores on the math, reading, and writing sections of the test were correlated with a 64%, 68%, and 75% chance of receiving a passing grade in the associated credit-bearing course, respectively. Students who received higher TSIA scores were shown to be more likely to successfully complete the course successfully, and students were correctly placed between approximately 62 and 75% of the time.

Two policy changes have occurred since the time of the College Board validity study that have impacted the TSIA exams. House Bill Five, passed by the 83rd Texas Legislature, removed the requirement for students to complete the Algebra II and English III STAAR end-of-course exams for high school graduation, which decreased that pathways towards TSIA exemption (Texas Higher Education Coordinating Board, 2018a). This changed decreased the overall percentage of students meeting TSIA minimum requirements from 72.7% in 2014 to 58.2% in 2015. The second change was that the minimum standard for meeting college readiness on the Writing portion of the TSIA was decreased effective fall of 2017 (Texas Higher Education Coordinating Board, 2018a). This change increased the percentage of students meeting TSIA minimum requirements from 58.0% in 2016 to 61.3% in 2017. However, there have not been any studies conducted that examine the relationship between TSIA tests and course performance since those policy changes were enacted. I aim to fill that gap with this study.

In the following chapter, I will provide a review of the literature associated with college readiness, developmental education, and postsecondary placement testing. Each major sub-section begins with an introduction to the research and then presents the chief findings. After the literature review, chapter three presents the methods I will employ in this study, including information about my research design, participants, data collection, and statistical procedures. The penultimate chapter presents the major statistical findings, tables, and graphical representations. Chapter five concludes with a summary of the study, implications for policy and practice, and recommendations for future research.

Chapter Two

Literature Review

The purpose of this research study is to determine whether the current implementation of Texas Success Initiative exams for developmental class placement is adequate for determining student readiness for college-level work. Analyzing the correlation between the Texas Success Initiative Assessment (TSIA) results and course performance in college can provide specific evidence for educators and policymakers to utilize when making decisions about the application of this policy. To do this, it is important to have a good understanding of what is meant by college readiness and what it looks like, the role developmental coursework plays in a student's education and the problems inherent in having to take these classes, the purposes behind state-mandated placement policies and the difficulties students face when completing these assessments, and the alignment between these various facets of this study. I will use Furhman's Coherence and Alignment Theory to explain the importance of this research – investigating the alignment between performance on placement exams and enrollment in college courses. I will also use this theory as a lens through which to examine my findings – if there is good alignment between exam results and associated course performance, then the current policy is a valid one. If alignment is lacking, then this theory can help guide next steps. Therefore, this review of the literature examines relevant research concerning college readiness, developmental education, placement testing, and Fuhrman's Coherence and Alignment Theory.

College Readiness

In 2010, President Obama insisted that the United States set a national priority on leading the world in the number of college graduates by the end of the decade. To that end, he stated that every student completing high school needed to be equipped for college and a career (U.S.

Department of Education, 2010). To ensure that entering students are prepared, institutes of

higher education employ placement exams to determine student readiness and enroll students in

the courses they need to successfully complete their college education (Ganga et al., 2018).

Because the overarching goal is college readiness, it is vital to understand what college readiness

is, how it is defined by various educational entities and stakeholders, and why it is a significant

topic of discussion. In this section of the literature review, I will survey pertinent research

regarding college readiness, including the importance of students being prepared for a collegiate

education as well as information regarding college readiness in Texas, including the *Closing the

Gaps* strategic plan from 2000-2015, the 2009 college and career readiness standards developed

by the Texas Education Agency and the Texas Higher Education Coordinating Board, and the

current 60x30 strategic plan.

Importance of College Readiness

Postsecondary degree completion provides significant benefits, including enhanced

earning potential, which allows for improved economic mobility and increases the chances of

receiving a livable wage (Hooker & Brand, 2009; Abel & Deitz, 2014). Wiley, Wyatt, and

Camara (2010) explain that college completion is also associated with increased citizenship,

political involvement, life and career satisfaction, and lawful behavior. The higher a person's

educational attainment, the more likely they are to report a positive health status (Hooker &

Brand, 2009). In addition, higher education attainment potentially touches future generations, as

parental education level is positively associated with increases in achievement, college-going

rates, and future income for their children (Hooker & Brand, 2009).

Individuals who do not continue their education past high school run the risk of leaving

themselves at a substantial disadvantage in the current labor market and vulnerable to

unemployment (Arzoumanidis, 2016; Hooker & Brand, 2009; Warburton, Bugarin, & Nunez, 2001). To ensure that U.S. students remain competitive in the world labor market, ESSA highlights the need for all students to be college and career ready upon graduation from high school (U.S. Department of Education, 2010). To facilitate this goal, states began implementing more rigorous standards in mathematics and English language arts while simultaneously developing comprehensive assessment systems aligned with college (and career) readiness criteria to determine if high school graduates have the skills necessary to be successful in postsecondary education (U.S. Department of Education, 2010). Former President Obama explained his determination to see considerable improvements in college completion rates by 2020 when he stated:

> We must do better. Together, we must achieve a new goal, that by 2020, the United States will once again lead the world in college completion. We must raise the expectations for our students, for our schools, and for ourselves – this must be a national priority. (U.S. Department of Education, 2010, p.1).

Much research has been conducted concerning skills necessary for students to achieve success in postsecondary education (e.g., Brown & Conley, 2007; Gore, 2006; Wachen, Pretlow, & Dixon, 2016), and many studies have shown that math, reading, and writing skills are critical to postsecondary success (e.g., Duncan et al., 2007; Harris & Graham, 2009; Matsumura, Wang, & Correnti, 2016; Murphy, Wilkinson, Soter, Hennessey, & Alexander, 2009). Wiley et al. (2010) explain that an increasing number of education initiatives have "focused on defining, measuring, and improving the college readiness of high school students" (pg. 2) since preparation during high school is a key determinant for student success in postsecondary education (Jackson and Kurlaender, 2014). Through their quantitative study of students at the 23

campuses in the California State University system, Jackson and Kurlaender (2014) found that, when compared to students who were not ready for college, prepared students averaged a GPA 0.2 grade points higher, were 6.1 percentage points more likely to persist to their second year, were 8.7 percentage points more likely to complete college, and 12.8 percentage points more likely to complete college on time (within four years of first-time enrollment). Bromberg and Theokas (2016) report that less than a third of high school graduates complete a college-ready course of study, which they define as a 15-course sequence required for entry at most public colleges. An additional eight percent complete a course of study that is both college- and career-ready, which includes the 15-course sequence and three or more credits in a broad career field like business or health sciences.

Conley (2003) proclaimed that lack of preparation for postsecondary education was due to misaligned standards between high school and college. To address this, he explicated that more rigorous coursework and higher expectations in high school would improve student access to credit-bearing courses in college. Similarly, Gallard, Albritton, and Morgan (2010) stated that the most critical indicator of student postsecondary success is student preparedness for college coursework. It is, therefore, important to examine and understand how college readiness is defined and determined, so as to support students towards postsecondary degree completion.

Factors Associated with Academic Achievement

Many studies have been conducted regarding factors that affect the academic achievement of students. Promoting equity between scholars means closing achievement gaps, which the National Center for Education Statistics (2015) defines as a disparity in student academic performance across various student groups that is statistically significant. It is important, in any study examining student achievement, to take these factors into account to

obtain as complete a picture as possible. This study will focus on the factors of race/ethnicity, gender, socioeconomic status, and parent education level in regards to their influence on student success in education.

Race/ethnicity. Sirin (2005) stated that race is an essential factor in the academic achievement of American students. To take this into account, testing results typically break student results down by various races and/or ethnicities to allow for comparison. These can include students who identify as Asian, Black/African-American, Hispanic/Latino, White, or two or more races. However, the vast majority of the research centers on the gaps specifically between Black and White students and between Hispanic and White students. Bailey, Jenkins, and Leinback (2005) found that students of color, specifically Black and Hispanic students, are underrepresented in postsecondary undergraduate education. In a report for the National Center for Education Statistics, Ross et al. (2012) found that White students were approximately 10 percentage points more likely to enroll in postsecondary education than their Black peers, and about 15 percentage points more likely to enroll than Hispanic students. More recently, Musu-Gillette et al. (2017) reported that African American and Hispanic students have enrollment rates under the national average of 40%, while White and Asian students have enrollment rates above the national average – 35% for African American students, 37% for Hispanic students, 42% for White students, and 63% for Asian students. Camara and Schmidt (1999) explain that one of the reasons for this could be due to results on standardized college admissions tests like the SAT and ACT, with White and Asian students consistently performing at the top, and Black and Hispanic students at the bottom. Smith (2012) reported that only 42% of Hispanic students meet college-readiness standards in both English and Math as compared to 66% of White students.

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White students make up three times as much of the national undergraduate enrollment than Hispanic students and more than four times that of Black students (McFarland et al., 2018). Ross et al. (2012) found that the percentage of Black and Hispanic students who earned a bachelor's degree at a four-year institution within 6 years were roughly equivalent, but approximately 20 percentage points below their White classmates. Overall, Ross et al. (2012) determined that, when compared to White students, Black students were 43% less likely to earn an associate's or bachelor's degree and Hispanic students were 25% less likely to earn same.

It has been argued that the educational environment encountered by students of color is not equivalent to the educational environment experienced by majority students (Bowen and Bok, 1998). A large portion of the students enrolled in developmental classes are from low socioeconomic backgrounds and/or are minorities (Attewell, Lavin, Domina, & Levey, 2006). Castro (2013) discovered that overall, an average of 76% of Black students and 78% of Hispanic students at community colleges enroll in at least one remedial class, as compared to 55% of White students. There were larger differences in developmental course enrollment between racial/ethnic groups for students in four-year institutions than there were for those enrolled in two-year institutions (Bailey, Jenkins, & Leinbach, 2005), highlighting the need to examine developmental class placement policies at four-year colleges. Specifically, Bailey, Jenkins, and Leinbach (2005) reported that 24% of White students, 26% of African American students, and 30% of Hispanic students were enrolled in developmental coursework in two-year establishments. By comparison, only 14% of White students at four-year institutions were enrolled, while 29% of African American students and 28% of Hispanic students were registered. More current studies show that 35% of White students, 45% of Hispanic students, and

56% of African American students enroll in developmental courses nationally (Jimenez, Sargrad, Morales, & Thompson, 2016).

Gender. Results from the 2012 National Assessment of Educational Progress (NAEP) showed that there has been no statistically significant change in the gender gap for either reading or mathematics in any elementary, middle, or high school grade level since 2008 (National Center for Education Statistics, 2013). The Center on Education Policy (CEP) published a report in 2010 examining state test score trends to determine if there were differences in testing achievement between males and females between 2002 and 2008. They found that the gender gap, when looking at standardized test scores, widened as often as it narrowed (Chudowsky & Chudowsky, 2010).

The differences between the genders persist into postsecondary education. Ross et al. (2012) found that males are 6% more likely to achieve all four ACT college readiness benchmarks. However, in 2010 they were 8% less likely to be enrolled in college and 7% less likely to enroll immediately following their high school graduation. In the National Center for Education Statistics *Condition of Education 2018*, female students were found to make up 56% of the total undergraduate enrollment as compared to the 44% of men. Following that, males were 6% more likely to report enrolling in developmental education classes and 5% less likely to have obtained a certificate, associate's, or bachelor's degree within 6 years. Overall, after taking other student, family, and school characteristics into account, men were 32% less likely to obtain an associate's or bachelor's degree than women (Ross et al., 2012).

There are many who argue that the gap between genders is a product of the different ways that males and females are treated by their teachers. Sadker and Sadker (1984) performed a study which concluded that teachers tend to give boys more attention and well-defined feedback

than they give girls. Sadker and Zittleman (2006) add that girls are more likely than boys to receive admonishments for speaking out of turn in the classroom. This is an issue because attention, especially positive attention, from teachers displays to students that they are valued and are meeting the expectations of a classroom, which in turn makes them more likely to be positive about schooling and learning in general (Good & Brophy, 2003). This gap in educational achievement corresponds to the gender gap in wages and earnings, as men are more likely to pursue careers in lucrative industries such as science, engineering, and computer technology (Correl, 2001). This, in turn, can affect the long-term socioeconomic status of students.

Socioeconomic status. Sirin (2005) declared that socioeconomic status is "probably the most widely used contextual variable in education research" (p. 417). However, Kohn (2000) asserted that critics have complained for decades that standardized tests are biased in that students from privileged backgrounds are more likely to have the knowledge and skills necessary to experience success on those tests. Furthermore, he argues that those from high-SES families and/or districts have the means to afford test preparation products and programs that allow them to have better scores on standardized tests. Sacks (2007) points out that a culture of elite advantage can continue to exist, in part, because of the belief held by many people that America is a land of equal opportunity, and that anyone can be successful if they simply put in enough effort. This belief belies the fact that some students simply have more resources to help them be successful and that this difference in advantage begins at birth.

Reardon (2011) performed a study in which he examined the trends in the income-achievement gap using data from 19 different nationally representative studies that provided data on mathematics and/or reading skills. He found that this gap between students from high and low income families is approximately 30-40% larger for children born in 2001 than it was for

children born in 1976. Reardon (2013) explained that the income gap between the top and bottom 10% of family income distribution has increased: families in the top 10% earns 11 times more than families in the bottom 10%, in comparison to the 5 times difference that existed between the two groups in 1970. He also noted that upward class mobility is more difficult than it was in the mid-twentieth century due to waning economic growth and the middle class disappearing as it is diverged into a low-wage service group and a high-wage information group. These increases for the high-income families have meant that they are better able to provide the tools to ensure student success on the standardized tests that play a key role in college admissions (Reardon, 2013).

The effects of this disparity between high-income and low-income students does not stop in elementary and secondary classrooms, but continues to affect students in their post-secondary education and in their lives after schooling. A higher percentage of students who obtained an associate's or bachelor's degree came from the highest income quartile, as compared to those who did not receive a degree (Ross et al., 2012). Bailey and Dynarski (2011) reported that while college completion rates for students from high-income families have increased, the rates for low-income students have not changed appreciably. They also point out that high-income students make up a larger percentage of undergraduates at selective universities when compared to low-income students with similar test scores. Sacks (2007) concurs, stating that wealthy, low-achieving students are more likely to attend a four-year university than lower-income, high-achieving students. Sirin's (2005) meta-analysis revealed a medium effect size between socioeconomic status and student academic achievement. He did, however, point out that SES is a combination of parental income and education level.

Parent education level. Parental education level is positively associated with increases in academic achievement, college-going rates, and degree completion (Hodgkinson, 1993; Hooker & Brand, 2009; Terenzini, Springer, Yaeher, Pascarella, & Nora, 1996). Fortunately, Sirin (2005) pointed out that children in 2000 were living with parents who were better educated than those in 1980. He also explained that the education level of the parent is part of the overall socioeconomic status. Further, it is likely to be the most constant feature "because it is typically established at an early age and tends to remain the same over time" (Sirin, 2005, p. 419). According to Ross et al. (2012), in 2010 only 11% of children between the ages of 6 and eighteen lived with parents who had not received a high school diploma. They also found that students who lived with parents who held at least a bachelor's degree were more likely to attain an associate's or bachelor's degree within 6 years. Ivanovic et al. (2019) reported significant correlations between student academic achievement and the schooling level of both fathers and mothers. Additionally, both paternal and maternal schooling were found to be one of the most relevant variables in predicting performance on Chilean mathematics and reading exams for school-age children. The authors concluded by stating that "maternal schooling is the strongest predictor of long-term SA [student achievement]" (Ivanovic et al., 2019, p. 17).

Admission exams. Given the prolific use of entrance exams for college admissions, it is not surprising that there have been many studies examining the relationship between admissions exams and student academic success in postsecondary education. A substantial number of these studies have examined the use of Scholastic Aptitude Test (SAT) scores and high school GPA as predictors of either freshman GPA or cumulative GPA in college. For example, both Wilson (1983) and Ramist (1984) found that SAT verbal and math scores, when taken together, gave a correlation coefficient of 0.42, with cumulative GPA and freshman GPA, respectively.

In 1993, Ramist, Lewis, and McCamley-Jenkins examined SAT scores for over 46,000 students from 38 different colleges in the mid-1980s. They utilized corrections for the range restrictions and criterion unreliability inherent in examining attending students only, as opposed to all students in the college applicant pool, and for examining students who take classes with variances in difficulty level. They found a validity coefficient of 0.36 if corrections were not made, but a value of 0.65 with statistical corrections taken into account. Overall, they found that 54% of the prediction of freshmen GPA was based on SAT scores (Ramist, Lewis, & McCamley-Jenkins, 1993). Bridgeman, McCamley-Jenkins, and Ervin (2000) examined over 48,000 students from 23 colleges in the mid-1990s, and reported that overall redesigned SAT scores gave a correlation coefficient of 0.56 with freshman GPA, when corrections were used. If this correlation is higher than what can be found with placement exams used for determining college readiness, then it calls into question the need to have students completing both types of exams.

However, authors of more recent publications have argued that entrance examinations are not as valuable as student's high school grades as high school GPA is more highly correlated to college GPA than admissions tests (Huh & Huang, 2016; Soares, 2012). In fact, many postsecondary institutions are now offering policies that have a range of available options for admission including, but not limited to, traditional entrance exams (National Association for College Admission Counseling, 2008). Syverson, Franks, and Hiss (2018) explained that one of the major goals with adopting test-optional admissions policies was to increase the number of underrepresented applicants and enrollees. The authors found that two-thirds of the colleges in their study that utilized test-optional policies had higher underrepresented growth than their test-required peer institutions.

College Readiness in Texas

Readiness in Texas took off when the state began a wave of education reforms in the 1990s (Barksdale-Ladd & Thomas, 2000; Texas Education Agency, 2010b). These reforms reflected changes in what Texas educators and policymakers thought students should be able to know and do by the end of their secondary education, and transformed how pupils were assessed concerning that knowledge. Texas shifted from testing minimal skills for graduation in the 1980s to assessing the knowledge and skills necessary for college readiness beginning in 2012 (House Research Organization, 1990; Texas Education Agency, 2010b; Texas Education Agency, 2014a; Texas Legislative Council, 2009). Jackson and Kurlaender (2014) asserted that many states around the U. S. have created policies aimed at better aligning high school curriculum to college expectations, most by adopting the federal Common Core Standards. However, Texas is one of nine states that has not adopted Common Core State Standards (Common Core State Standards Initiative, 2018), but instead has elected to refine its own curriculum, the Texas Essential Knowledge and Skills, otherwise known as TEKS (Williams, 2013). The work towards increasing targets for college readiness in the state began with the Texas Higher Education Coordinating Board's adoption of the 2000 plan *Closing the Gaps by 2015*, was continued with their collaboration with the Texas Education Agency to develop the College and Career Readiness Standards in 2009, and has culminated with the current 60x30 plan. The 60x30 strategic plan defines college readiness as a "70% likelihood of achieving a grade of A, B, or C in an entry-level college-credit course" (Morales-Vale & Montognese, 2017. p.3). Since this study is centered on measurements of college readiness in Texas, I will discuss the details of the *Closing the Gaps* strategic plan, the College and Career Readiness Standards, and the 60x30 strategic plan.

Closing the Gaps by 2015. Given the importance of a collegiate education to future success (Hooker & Brand, 2009; Wiley, Wyatt, and Camara, 2010), the Texas Higher Education Coordinating Board unveiled their 15-year strategic plan titled *Closing the Gaps* in October of 2000 (Texas Higher Education Coordinating Board, 2000). This strategic plan focused on four key challenges experienced by Texas postsecondary institutions: participation, success, excellence, and research. Fueled by the fact that large gaps existed among racial groups, and that the groups with the lowest enrollments were growing in relative size for the state, the THECB felt that "Texas must take bold steps for the future success of its people" (Texas Higher Education Coordinating Board, 2000, p.4). In the following subsections, I will give details about the first two goals – participation and success – as they are aligned with the overarching purpose of this study, examining if the implementation of Texas higher education placement exam policy lead to student success in entry-level postsecondary courses.

Goal 1: Close the gaps in participation. This plan called for the addition of 500,000 more students (for a total of approximately 630,000) participating in postsecondary education by 2015. The THECB (2000) outlined several strategies that Texas could utilize to ensure this goal, including using the Recommended High School program as the standard curriculum for Texas public high schools and the minimum requirement for admission to all Texas institutes of higher education (IHE) by 2008. The recommended plan was one of three plans towards graduation available to students from the 1997-1998 school year to the 2012-2013 school year, and included a total of 26 credits including four credits for each of the core content subjects of English language arts, math, science, and social studies, two credits in a language other than English, and more than five credits in electives (Texas Education Agency, 2014b). Since many postsecondary institutions required the elements found in the recommended plan, this become the default for all

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Texas students with the passage of house bill 1144 by the 77th Texas Legislature (Texas Higher Education Coordinating Board, 2001).

In addition, the THECB also suggested employing and retaining highly-qualified teachers for elementary and secondary schools, ensuring students and their families understand the benefit of a collegiate education, and creating an affordability policy that allows all students to participate in a postsecondary education (Texas Higher Education Coordinating Board, 2000). This goal was supported by the 2006 passage of House Bill 1, which provided 11 million dollars towards increasing student postsecondary participation and success by facilitating the creation of college readiness standards (Texas Higher Education Coordinating Board, 2008). The final progress report for Closing the Gaps, published by the THECB (2016a), conveyed that the state reached approximately 96% of this goal and increased student enrollment in IHEs statewide by 605,114 students.

Goal 2: Close the gaps in success. By 2015, Texas was to increase the number of degrees and/or certificates by 50%, up to 210,000. Strategies outlined to help achieve this goal included (a) aligning postsecondary demographics with the general Texas population, (b) rewarding high quality programs that were increasing retention and completion of their students, and (c) smoothing transitions between high school, community colleges, and four-year universities, among others (Texas Higher Education Coordinating Board, 2000). The final progress report published by the THECB (2016a) stated that Texas met this goal during the 2011 fiscal year and that the number of degrees and certificates awarded continued to grow each year after.

College and career readiness standards. In 2009, the Texas Education Agency (TEA) joined the Texas Higher Education Coordinating Board (THECB) to begin collaborating on the development of College and Career Readiness Standards (CCRS). This was an attempt at

aligning secondary and postsecondary understandings of college readiness to ensure that Texas

high school students were graduating prepared for entry-level courses at community college and

four-year universities (Education Policy Improvement Council, 2009). Texas was the first state

to have secondary and postsecondary stakeholders working together to align expectations

(Chapa, Galvan, Solis, Mundy, 2014). These standards "specify what students must know and be

able to do to succeed in entry-level courses at postsecondary institutions in Texas" (Educational

Policy Improvement Center, 2009, p.1). The standards are organized into four levels of

specificity. These levels are key content areas, organizing components, performance

expectations, and examples of performance indicators. According to Conley, Hiatt, McGaughy,

Seburn, and Venezia (2010), the key content are "keystone ideas" (p. 10) that can be found

throughout the curriculum. The organizing components highlight the knowledge and skills

students should be able to use and apply to new situations, the performance expectations are the

important concepts and the contexts in which they can be found. Finally, the performance

indicators explain how these proficiencies could be demonstrated and assessed. It is important to

understand these proficiencies, as this study seeks to discover whether the current assessment of

student knowledge and skills is adequate for determining accurate course placement.

     These CCR standards are not just structured into levels that denote increasing specificity,

but are also arranged by content type – English language arts, mathematics, science, social

studies, and interdisciplinary. Due to the nature of the content assessed on placement exams, this

study focuses only on English language arts and mathematics contents. The English language

arts standards are built on the understanding that "listening, speaking, writing, and reading are

vehicles for communications" (Education Policy Improvement Council, 2009, p.2) and are

broken down into those four components and an additional research element, all meant to

enhance the critical thinking ability of students. The Education Policy Improvement Council (2009) sees mathematics as critical to the ability of Americans becoming productive citizens in today's society. There are 10 math standards, including reasoning within numbers, algebra, geometry, measurement, probability, and statistics, as well as functions, problem-solving, communication, and connections.

The college and career readiness standards were also written to recognize the importance of students' ability to link all the standards together and to use the skills seamlessly across all content areas. To that end, TEA and THECB developed the cross-disciplinary standards that included key cognitive skills of intellectual curiosity, problem solving, academic behaviors, work habits, and academic integrity. In addition, they also highlighted foundational skills of reading, writing, and research across curriculum, and the ability to use data and technology (Educational Policy Improvement Center, 2009).

Texas 60x30 plan. The current 60x30 strategic plan aims to position Texas among the highest achieving states in the country in order to maintain its global competitiveness (Texas Higher Education Coordinating Board, 2018b). It is comprised of a primary goal supported by three secondary goals. The principal objective of the 60x30 plan is that 60% of Texans ages 25-34 will hold a postsecondary degree or certificate by the year 2030. This plan also includes areas of college completion, marketable skills, and student debt load as additional targets to help ensure that 60% of young Texans will successfully complete some kind of postsecondary programs by 2030 (Texas Higher Education Coordinating Board, 2015). In the following subsections, I will give details about the goals around 60x30, college completion, and student debt load. While the goal of marketable skills is important, it is outside the focus of this investigation.

Goal 1: 60x30. Of the more than 25 million Texas residents in 2010, approximately 14%, or 3.6 million, were in the 25-34 age bracket (US Census Bureau, 2019). Since this goal takes into account both graduates from Texas institutes of higher education (IHEs) and degree-holders that migrate into the state, it is critical for Texas to both retain their own graduates as well as attract graduates from IHEs across the nation (Texas Higher Education Coordinating Board, 2015). To help scaffold to 60% by 2030, the THECB has placed interim goals for the state to meet along the way, as a way of continuously assessing the state's movement toward the overarching target. In 2013, 38.3% of young Texans held a degree or certificate. The THECB hopes to see that number grow to 48% by 2020 and 54% by 2020 (Texas Higher Education Coordinating Board, 2015). However, the 2018 Texas Public Higher Education Almanac reported that in 2016, only 37.9% of the state's 25-34 year-olds held an associate degree or higher (Texas Higher Education Coordinating Board, 2018b), a decrease from 2013.

Goal 2: Completion. While the principal target of the 60x30 plan takes into account individuals with certificates and/or degrees from any location, the completion goal is focused solely on the students who graduate from Texas postsecondary institutions. Over the 15 years of the 60x30 strategic plan, the state is expected to award 6.4 million certificates and/or degrees (Texas Higher Education Coordinating Board, 2018b). This particular objective challenges Texas IHEs to educate students from all backgrounds in proportion to their share of the Texas population, similar to part of the success goal from the prior Closing the Gaps 15-year strategic plan (Texas Higher Education Coordinating Board, 2000). According to the 60x30 plan, more than 60% of the elementary and secondary pipeline is made up of students from racial minorities, specifically African American students and students of Hispanic origin. In addition, more than 60% of high school graduates in Texas are from economically disadvantaged families (Texas

Education Agency, 2018; Texas Higher Education Coordinating Board, 2018b). These numbers are projected to increase or remain steady over the course of the strategic plan, with the Hispanic population expected to grow from 43% of the 25-34 population in 2015 to 52% of the same population by 2030, and the African American population projected to remain at approximately 11-12% of the 25-34 population (Texas Higher Education Coordinating Board, 2018d). The population of students who are economically disadvantaged is projected to increase (Texas Education Agency, 2018).

This goal also targets other populations of students who are currently lagging behind but could have a great impact on the completion goal as well as the principal objective of 60x30. This includes female science, technology, engineering, and mathematics (STEM) majors, as they typically comprise less than one quarter of the positions in engineering and computer-related arenas; these are fields that are projected to have the largest increases in workforce needs in the coming years (Hill, Corbett, & St. Rose, 2010; National Science Board, 2010). And while the number of women in STEM fields is lower than desired, the overall number of women enrolling in and completing a postsecondary education has increased, and the number of men is not keeping pace (Texas Higher Education Coordinating Board, 2018b). Therefore, it is important to monitor the number of degrees awarded to male students in the interest of gender parity. Like they did for the primary goal, the THECB has also placed interim goals for the monitoring of the completion goal, which can be found in Table 2.1.

Table 2.1

Interim Goals for 60x30 Completion Goal

Population/Year	2014	2020	2025	2030
Hispanic	89,355	138,000	198,000	285,000

African American	37,658	48,000	59,000	76,000
Men	122,744	168,000	215,000	275,000
Economically Disadvantaged	107,419	146,000	190,000	246,000
Public HS Students enrolling in IHE first fall after graduation	54.2%	58%	61%	65%

Note: Data from Texas Higher Education Coordinating Board (2018b)

The THECB has offered several strategies to help support the achievement of both the interim goals as well as the final target. One strategy is using evaluations like the Texas Success Initiative Assessment (TSIA) to enable institutions to accurately establish the academic strengths and weaknesses of their students so that counselors can provide better guidance. A second approach is creating co-requisite opportunities that allow students to make progress towards college completion as they are receiving support in areas of academic need, and developing electronic degree plans to assist students with narrowing their focus and not wasting time with superfluous classes. Collaborating with K-12 institutions to improve college and career readiness and increase student participation in college-level courses during high school offer further procedures to support postsecondary success. Finally, building credentials at all levels to reduce duplication of coursework and decrease time-to-degree (Texas Higher Education Coordinating Board, 2018b). Knowing whether TSIA exams determine accurate placement in order to reduce superfluous classes would help Texas reach the completion goal and highlights the significance of this study.

Goal 4: Student debt. Student loan debt has become a critical problem in the United States in general (Fry, 2012; Sattelmeyer & Williams, 2018) and Texas in particular (Institute for College Access and Success, 2017; Stolba, 2019). Across the U.S., 37% of adults ages 18-29

report outstanding educational loans; more than any other age group (Cilluffo, 2017). In 2016, 56% of Texans graduated with debt averaging $26,292 (Institute for College Access and Success, 2017), and the average debt owed by Texas borrowers has risen 153% since 2008 (Stolba, 2019). Of the Texas institutions that provided usable data to the Institute for College Access and Success (2017), 91% of their graduates possessed some kind of educational debt. The worries about taking on an unmanageable debt load may deter many students from seeking a postsecondary education (U.S. Department of Education, n.d.a). In order to address this issue, the 60x30 plan calls for a maintenance of a debt load of 60% or less of first-year wages for all graduates of Texas public IHEs. Since more than half the Texas education budget comes from local property taxes (Swaby, 2019; Texas Comptroller, n.d.), it is critically important to have a population capable of contributing to the tax base (Texas Higher Education Coordinating Board, 2018b). For the 2016-2017 school year, Texas ranked 17th in the United States in state funding (College Board, 2017a) with students receiving an average of approximately $5,300 per full-time student equivalent, on par with the national average (Texas Higher Education Coordinating Board, 2018b). This is significant, since Texas is ranked 14th in percentage of undergraduate students designated as economically disadvantaged (Fernandez, Fletcher, & Klepfer, 2017). The current average debt load carried by Texas students is projected to rise approximately eight to nine percent annually (Texas Higher Education Coordinating Board, 2018b). Texas comptroller data shows that one-fourth of Texas students borrow less than $5,000 and leave college without a degree. Of these students, one in four will default on their loan (Texas Higher Education Coordinating Board, 2018b).

The 60x30 plan identifies several strategies to ensure that Texas students do not graduate with an unmanageable debt load. IHEs should steer students into a degree pathway early in their

college career in order to help students avoid taking excessive semester credit hours (SCH) they do not need, as taking superfluous classes lead to increased cost and debt. In 2014, Texas Guaranteed found that students completing a two-year degree only needed 60 SCHs, but were completing an average of 98 SCHs. Likewise, students at four-year institutions needed 120 SCHs to complete their degree, but averaged 145 SCHs. The average number of excess SCHs was 21 in 2014; interim goals are set at decreasing excess SCHs to 12 in 2020, six in 2025, and three in 2030 (Texas Higher Education Coordinating Board, 2018b). In addition, IHEs should work to make sure that no more than 50% of their graduates leave their education with loan debt. Therefore, it is important that placement exams accurately assess student's college readiness levels in order to help IHEs enroll students into the correct coursework – either developmental or credit-bearing – so they do not accumulate extra classes.

Readiness Rates. The differences between the percentage of Texas high school students who graduate from high school and those who are deemed "college ready" in English language arts (ELA) and mathematics have improved for the most current reported cohort of students; however, the gap is still significant. The Texas Academic Performance Report (Texas Education Agency, n.d.) published information regarding the percentages of their high school graduates that were deemed "college ready" upon graduation. For the 2015-2016 school year, 50.6% of graduates were considered college-ready in English language arts, 44.6% in mathematics, and 38.7% were ready for both subjects. This designation is based on the percentage of students who meet college-ready measures on the Texas Success Initiative Assessment (TSIA), the SAT test, or the ACT exam. Therefore, only 50.4% of the students who graduated during the 2015-2016 school year were also rated as prepared to begin a postsecondary education according to the State of Texas. The Texas Higher Education Coordinating Board reported that the college-readiness

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rates of first-time-in-college (FTIC) students has been on a steady decline since 2014 for reading, writing, and mathematics. The 2018 Texas Public Higher Education Almanac (Texas Higher Education Coordinating Board, 2018b) published that, overall, 42.6% of first-time higher education students were not college ready. According to the Texas Higher Education Coordinating Board, only 38.7% of all students enrolled in Texas IHEs were not ready to take first-year English and/or math courses, as determined by their TSIA results (Texas Higher Education Coordinating Board, 2018a).

The figures put forward by agencies outside the state are even worse. The American College Test (2016) profile for the Texas graduating class of 2016 shows that only 26% of student met the ACT college readiness benchmark scores. In addition, of the 62% of graduates who took the SAT during high school, only 63% met the readiness benchmark score for reading and writing and only 41% met the score for math. Of these students, 35% did not meet either benchmark score (College Board, 2017b). Students deemed unprepared for the rigors of a college education, generally measured via standardized assessments, are typically required to complete developmental education classes to ready them for postsecondary coursework.

Developmental Education

It is projected that by the year 2020, at least two-thirds of all jobs in the United States will require some form of postsecondary education (Georgetown Public Policy Institute, 2013). While 25 years ago, the U. S. led the world in both high school and graduation rates, Mabus (2012) found that America is now ranked 20th for high school and 16th for college graduation rates. The Texas Higher Education Coordinating Board (THECB) explains that "creating pathways for students into higher education and through completion to the workforce will require higher levels of cooperation among higher education, K-12 education, and workforce

leadership" (THECB, 2015, p. 11). Developmental courses are an essential element of postsecondary education, as they are used by institutions to make sure that their students are capable of completing their college classes in order to receive their degree. In this section of the literature review, I will survey pertinent research regarding developmental education, including a description and explanation of developmental education classes, the problems students face when they are required to complete remedial classes, and studies regarding developmental education in Texas. Since this study is examining the assessment that is used to determine student placement into developmental classes, it is important to understand what these classes entail and the effects that they can have on student success in postsecondary education.

Developmental Education Description

If states are successful in implementing rigorous high school standards in mathematics and English language arts and developing comprehensive assessment systems aligned with college and career readiness standards (U.S. Department of Education, 2010), then high school graduates should be ready for their postsecondary coursework. However, studies show that students enrolling in higher education are largely unprepared (Greene & Winters, 2005; Royster, Gross, & Hochbein, 2015) and are therefore obliged to enroll in developmental education courses (Bailey, Jeong, & Cho, 2010). Developmental education refers to classes designed for students deemed unprepared for credit-bearing college coursework (Chen & Simone, 2016). While this is the currently used term, there are several others that can also be utilized, including remedial, foundational, transitional, guided, and basic-skills studies (Arendale, 2005, p. 72). These content sequences are intended to help strengthen students' abilities so that they can be successful in their for-credit coursework (Alliance for Excellent Education, 2006; Bailey, Jeong, & Cho, 2010; Bettinger, Boatman, & Long, 2013).

Lack of preparedness for college work affects many entering college freshmen (Greene & Winters, 2005; Kuh, 2007; Porter & Polikoff, 2012; Royster, Gross, & Hochbein, 2015), who find themselves ill-prepared for the rigors of college classes and in need of foundational courses (Bailey, Jeong, & Cho, 2010; Bettinger & Long, 2005). Scott-Clayton, Costa, and Belfield (2014) stated that 50% of undergraduate students will be required to complete at least one remedial class. The Center for the Analysis of Postsecondary Readiness (CAPR) declared that 40% of students in four-year institutions and more than 67% of students attending community colleges enroll in at least one foundational course (Ganga et al., 2018). Texas Higher Education Coordinating Board (2014) reported that 49% of students enrolled in public community and technical colleges and 11% of students enrolled in public universities for the fall 2013 cohort required developmental education. However, there is "not a standardized or nationally-accepted construct used to evaluate these programs" (Goldwasser, Martin, & Harris, 2017, p.10).

Problems with Developmental Education

In most cases, students are enrolled in developmental education courses based on their performance on placement exams (Bailey, Jeong, & Cho, 2010) such as the Texas Success Initiative (TSI) assessment (College Board, 2014). These tests serve as gatekeepers to credited college classes in order to ensure students are prepared for the rigors of undergraduate programs and can succeed once there (Bailey, Jeong, & Cho, 2010). However, these developmental courses also come with potentially serious consequences for enrolled students, including incorrect placement, influencing time to degree completion, increasing dropout rates, and cost burdens. Additionally, these difficulties may not be the same across various demographic categories.

Incorrect placement. One of the first challenges with developmental education classes is to accurately determine which students should be placed into them. Most institutions use some form of standardized testing to determine which incoming students are unprepared and need to be placed into these basic-skills courses (Ganga et al., 2018). However, studies have found that these placement exams are often inaccurate. For example, Scott-Clayton (2012) found that approximately 18% of students placed in foundational math and 29% of the students enrolled in remedial English had the potential to earn a 'B' or better if placed directly into the credit-bearing course. In fact, students who skipped enrolling in developmental classes and went directly into credit-bearing coursework were more likely to pass than students who started with the foundational sequence (Bailey, Jeong, & Cho, 2010). Martorell and McFarlin (2011) reported that students enrolled in Texas public community colleges who participate in remediation do not display an increased chance of passing a college-level math course, transferring to a four-year institution, or completing their degree over students who did not complete remediation. After controlling for academic abilities and demographics, Attewell, Lavin, Domina, and Levey (2006) found that students who complete developmental coursework do just as well in for-credit courses as students who were not required to remediate. This research calls into question the usefulness of placement exams for determining developmental and credit-bearing class placement.

It may be that the manner of delivery in these courses contributes to the lack of success for students. Grubb (2010) found that the predominant pedagogy in foundational classes was skill-and-drill practice and basic memorization, which did not provide students with the relevant skills and overarching conceptual understandings necessary for continuing success as they moved into collegiate coursework. Lack of positive outcomes when comparing students on either side of the academic proficiency cutoff for developmental coursework could imply that the

assessments used to determine placement may not be adequately sensitive or aligned (Scott-Clayton, 2012).

Time to degree completion. Regardless of the reason for student placement, developmental classes add to the amount of time it takes for students to graduate and earn their degree (Chen & Simone, 2016; Lewis & Farris, 1996). According to the Alliance for Excellent Education (2006), many colleges do not offer credit for developmental courses, so students must spend their time and energy completing these sessions to become prepared for college before they can begin taking classes to receive credit towards an associate or bachelor's degree. The U.S. Department of Education (2003) reported that 63% of public two-year institutions enroll students taking an average of more than a year's worth of remedial courses. Students who need numerous developmental classes may be required to spend up to three extra years after transferring to a four-year university in order to complete their degree (Melguizo, Hagedorn, and Cypers, 2008).

Dropout rates. Discovering the requirement for remedial work just to be ready for college-level courses can be so discouraging to students that many do not complete their foundational sequences and can wind up dropping out of college and never achieving a degree (Deil-Amen & Rosenbaum, 2002; Quint, Jaggars, Byndloss, & Magazinnik, 2013; Wambach, Brothen, & Dikel, 2000). The Alliance for Excellent Education (2006) explains that the leading predictor that a student will drop out of college without completing a degree is the need to take remedial reading when they get to college. In fact, only 17% of students enrolled in remedial reading courses will go on to receive their bachelor's degree within eight years, compared to the 58% of students who are not enrolled in remedial courses (National Center of Education Statistics, 2004). NCES (Chen & Simone, 2016) published a statistical analysis report

concerning remedial course-taking at both two-year and four-year public postsecondary institutions for the 2003-2004 cohort of students and found that only 49% of students at two-year schools and 59% at four-year schools completed all of their remedial sequences. Further, Strong American Schools (2008) reported that only 19% of those enrolled in remedial courses who started college in 1992 received a bachelor's degree by 2000. The THECB (2016b) reported that only 9.4% of unprepared students in community colleges and 54% of unprepared students entering universities progress to graduation within three and six years, respectively. Bailey, Jeong, and Cho (2010) found that of all U.S. students enrolled in developmental coursework, fewer than 50% managed to complete their foundational sequences. The more remedial courses a student is obligated to take, the more likely it is that they will drop out (Jaggers & Stacey, 2014). Specifically, the 2016 NCES statistical analysis (Chen & Simone) discovered that 73% of students assigned to a single remedial course completed that class while only 25% completed their remedial courses if assigned to four or more. Students in foundational education courses explained to Van Ora (2012) that lack of access to credit-bearing classes, along with demands on their time and poor teaching, constituted obstacles to their completion of a degree. It is possible that more students could earn a postsecondary certificate or degree if they were not required to complete developmental courses based on placement exam results, especially in light of research that shows many are capable of passing the credit-bearing coursework regardless (Attewell, Lavin, Domina, & Levey, 2006; Bailey, Jeong, & Cho, 2010).
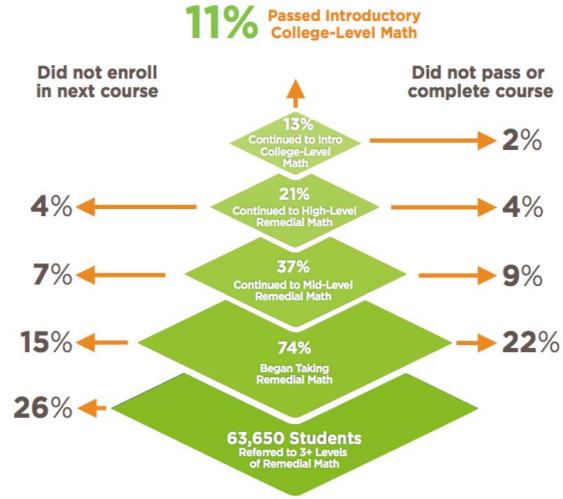
Figure 2.1

Progression Through Developmental Sequences

Student Progression Through the Developmental Reading Sequence

28% Passed Introductory College-Level English

Did not enroll in next course		Did not pass or complete course
	30% Continued to Introductory College-Level English	→ 2%
5% ←	37% Continued to High-Level Remedial English	→ 2%
4% ←	45% Continued to Mid-Level Remedial English	→ 4%
9% ←	71% Began Taking Remedial English	→ 17%
29% ←	11,210 Students Referred to 3+ Levels of Remedial English	
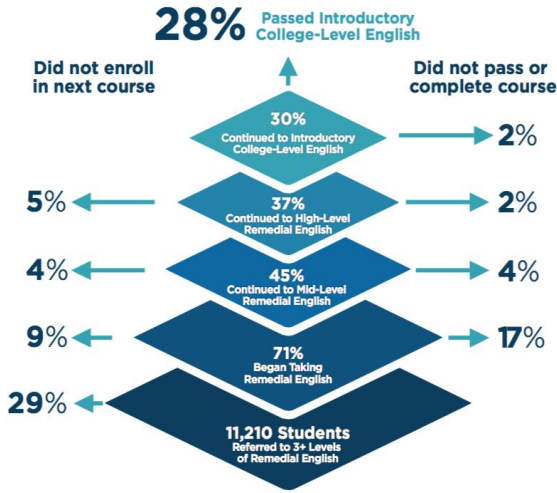
Student Progression Through the Developmental Math Sequence

11% Passed Introductory College-Level Math

Did not enroll in next course		Did not pass or complete course
	13% Continued to Intro College-Level Math	→ 2%
4% ←	21% Continued to High-Level Remedial Math	→ 4%
7% ←	37% Continued to Mid-Level Remedial Math	→ 9%
15% ←	74% Began Taking Remedial Math	→ 22%
26% ←	63,650 Students Referred to 3+ Levels of Remedial Math	

Source: Reprinted from Ganga et al., 2018

Cost burdens. Whether or not students remain in college and complete their degree, the extra time they spend in developmental education classes has serious cost burdens. These courses generally do not confer college credit; therefore, students pay the tuition and fees for the classes without earning hours towards their degree (Levin & Calcagno, 2008). According to Melguizo, Hagedorn, and Cypers (2008), who looked at community college students in California, the cost of tuition and fees for students who enrolled in at least one remedial class was approximately $3,000 more than students who did not have to enroll in developmental classes. Nationwide, Strong American Schools (2008) estimates that the average community college student pays between $1,607 and $2,008 for their remedial classes.

Scott-Clayton, Crosta, and Belfield (2014) performed calculations based on first-time degree-seeking fall-entry student data from Snyder and Dillow (2012, Table 207) to evaluate the national cost of providing remedial education to all college students. Assuming that each course is approximately 1/8 of a full-time college year, and working with an average of 1.3 remedial courses per student and the university tuition schedule, they calculated that the United States

spends roughly $6.7 billion annually on developmental education. The Alliance for Excellent Education (2006) explains that taxpayers provide at least one billion dollars a year to help cover the cost of developmental coursework at community colleges and an additional $500 million a year at four-year colleges and universities (Saxon, 2017; Strong American Schools, 2008). Approximately 55-70% of the funding for community college comes from the state and federal government (i.e. through taxes), while 20% is covered by the cost of tuition (which is shared between the students and their families through tuition payments and financial aid), and 11% from other sources (Alliance for Excellent Education, 2006; Center for Community College Policy, 2000; National Education Association, n.d.).

Strong American Schools (2008) further declares that the nation would be able to receive an additional $3.7 billion a year if more students were deemed ready for college and were not required to complete developmental coursework (thus saving approximately $1 billion spent for that purpose). Also, if these better-prepared students would not drop out and continue to earn a bachelor's degree at the same rate as students who do not take remedial courses, they would have more earning potential, which would create more tax revenue for the government (Strong American Schools, 2008). Challengers to developmental education argue that these classes are an unnecessary burden and that college should not have to make up for the academic preparation students should have received in secondary school (Bahr, 2008). If students are required to complete multiple exams, some for high school graduation requirements, some for admission to postsecondary schools, and still others for class placement once enrolled in college, then it is important to ensure that they are all performing their function adequately. It is possible that some of these exams could perform multiple functions, and decrease the need to excessive testing and the costs associated with these assessments. Kingston and Anderson (2013) point out that state

assessment scores are a potential alternative to currently used placement exams for college course placement since they are readily available and confer no additional cost to students or the postsecondary institutions.

Differences in demographics. However, not all schools and not all students are created equal. Various demographic factors have been shown to be closely associated with a student's likelihood of having to take a remedial class, including income level, race/ethnicity, and parental education (Chen & Simone, 2016; Ganga et al., 2018). This is unsurprising in light of the fact that offering these courses allows colleges and universities to accept students that might otherwise be unable to receive a postsecondary education (Ganga et al., 2018). If the only students who could be admitted to college were those deemed "ready" based on placement exam scores, then those who failed their placement assessments would be left with a high school diploma as their terminal degree. A 2004 NCES study examined developmental education along socioeconomic lines and stated that 63% of students in the lowest SES quintile enrolled in a remedial course as compared to only 24.8% of students in the highest SES quintile. This study also reviewed rates of remedial course enrollment in terms of race and ethnicity and found that 61.7% of African American students and 63.2% of Hispanic students were enrolled in a developmental class compared to 34.6% of White students. Predictably, first-generation college students, or those who are the first in their family to attend college, are more likely than their non-first generation peers to enroll in a foundational course (Wiley, Wyatt, & Camara, 2010). Ganga et al. (2018) explained that while more African American and Hispanic first-generation students are placed in basic-skills courses, fewer of them graduate within six years as compared to their White and Asian peers.

Developmental Education in Texas

Because there is no agreement concerning the definition of college readiness and no single method for assessing students, placement policies for developmental education courses vary across states and institutions (Bettinger & Long, 2005; National Center on Education and the Economy, 2013; Roderick, Nagaoka, & Coca, 2009). However, remedial education remains an essential component of college course offerings to strengthen the readiness of postsecondary students (Chen & Simone, 2016). The fact that a large number of incoming college freshmen are required to complete developmental education courses (Bailey, Jeong, & Cho, 2010; Chen & Simone, 2016) and that many do not complete the sequences and therefore do not earn a degree (Deil-Amen & Rosenbaum, 2002; Jaggers & Stacey, 2014; Quint et al., 2013; Wambach et al., 2000), coupled with the high cost of these programs (Alliance for Excellent Education, 2006; Scott-Clayton et al., 2014; Strong American Schools, 2008), has numerous policymakers call for developmental education reform.

In 2015, Governor Greg Abbott unveiled the new Texas Higher Education Coordinating Board (THECB) 60x30 Plan, the goal of which is for at least 60% of Texans ages 25-34 to hold a degree or certificate by the year 2030 (THECB, 2015). The 60x30 plan states that this goal is a signal of the economic prospects of Texas and its ability to remain competitive on a worldwide platform. Texas is the largest state by size in America and the second largest by population (World Population Review, 2019), and rivals the size of many countries ranked by the Organization for Economic Cooperation and Development (OECD). The Texas 60x30 plan explicates that one generation ago, the state's 25-34 year-old group ranked between the 3rd and 4th highest ranking OECD countries, making them among the most educated in the world. However, the 2013 OECD report placed this same age group in Texas between the 23rd and 24th highest ranking OECD nations.
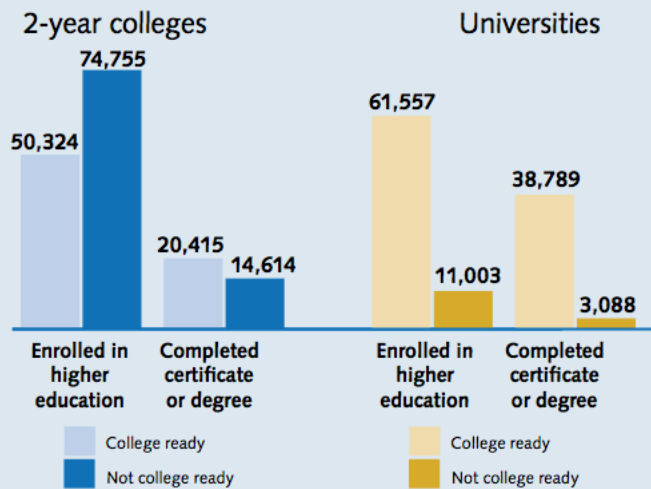
Texas currently employs the Texas Success Initiative in order to assess a student's level of academic skills to determine course enrollment for incoming freshmen (19 Tex. Admin. Code § 4.55). The results assist in developing an individual plan for the academic achievement of each undergraduate student that does not meet the necessary standard for college readiness (19 Tex. Admin. Code § 4.58). The Texas Higher Education Coordinating Board (THECB) defines college readiness as possessing the skills necessary to have a 70% likelihood of achieving a passing grade (C- or higher) in an entry-level, credit-bearing college course (Morgan & Morales-Vale, 2018). In 2018, THECB reported that overall, only 57.4% of entering Texas freshmen were college ready. This number encompassed both the 61% of underprepared students at two-year colleges and the 17.7% of scholars at four-year universities (THECB, 2018c). This report also conveyed that the lack of preparation affects these students' ability to complete a degree within six years – for the fall 2011 cohort, 40.6% of college-ready students at two-year and 63% at four-year institutions completed their degree within six years as compared to 19.5% of underprepared students at two-year and 28% at four-year institutions.

Figure 2.2

Student Completion within Six Years of College Entry

Student Completion within Six Years of College Entry, by College Readiness

First-time-in-college students, fall 2011 cohort

2-year colleges — 74,755 / 50,324 (Enrolled in higher education); 20,415 / 14,614 (Completed certificate or degree)

Universities — 61,557 (Enrolled in higher education, College ready); 11,003 (Enrolled in higher education, Not college ready); 38,789 (Completed certificate or degree, College ready); 3,088 (Completed certificate or degree, Not college ready)

College ready / Not college ready

Cohort tracked 6 years for completion of degree.

Source: Reprinted from Texas Higher Education Coordinating Board (2018c)

However, developmental education remains one of the key strategies for helping prepare students for successful college completion. A study of Texas colleges (Boylan & Saxon, 1998) found that postsecondary institutions with the highest retention rates were those that made developmental education a priority of their establishment. To better meet the needs of underprepared students, several states are piloting new models for delivering foundational instruction (Ganga et al., 2018; Government Accountability Office, 2013; Rutschow & Schneider, 2011). In 2017, the 85th Texas legislature passed House Bill 2223, which states that that all IHEs must develop and implement a corequisite model for developmental coursework (THECB, 2018d). Corequisite can also be called mainstreaming, co-enrollment, or course pairing, and is an instructional strategy that registers underprepared students in both an entry-level freshman course and a developmental education course in the same content during the same semester (19 Tex. Admin. Code § 4.53(7)). The students subject to this strategy are ones that did

not meet the standard necessary on the TSI assessment exam or other equivalent entrance standard. They may be considered underprepared in up to three subject areas – reading, writing, and mathematics (Texas Higher Education Coordinating Board, 2017b).

To facilitate implementation of HB 2223, the THECB has provided targets for IHE to meet as these programs are established and executed. For the 2018-2019 school year, at least 25% of all developmental education students must be enrolled in a co-requisite model. The aim is 50% for the 2019-2020 school year and 75% for the 2020-2021 school year (THECB, 2018d). Morales-Vale and Humphries reported that, at the time of their 60x30 developmental education update in 2017, 73% of institutions offered a math-intensive corequisite option, 75% had a reading-intensive corequisite option, and 78% provided a writing-intensive corequisite option. The THECB (2015) explains that this corequisite model allows students to enroll in for-credit college courses while simultaneously getting the support they need to be capable of successfully completing these classes, decreasing their time-to-degree. This design relies heavily on accurate placement of students into foundational and corequisite courses to support their strengths and weaknesses based on assessment data, such as the Texas Success Initiative Assessment (TSIA).

Placement Testing

In 1983, the National Commission of Excellence in Education published *A Nation at Risk*, which confronted America's schools by stating that the nation's mediocre education system was "an act of unthinking, unilateral educational disarmament" (p. 5) that the country had done to itself and that it would have been "considered an act of war" (p. 5) had it been established by a hostile nation. The report went on to provide several recommendations to strengthen education in the United States, including increasing graduation requirements and setting higher secondary and postsecondary standards. States across America dove into the era of accountability, with Texas

helping lead the charge (Heilig & Darling-Hammond, 2008; Nelson, McGhee, Meno, & Slater, 2007). A significant part of this accountability is the standardized testing of entering postsecondary students to determine readiness for credit-bearing college classes, which is the focus of the current study. It is important to understand what this kind of assessment is and the effect it has on student education. In this section, I will provide the description and purpose of standardized testing, particularly placement exams, and provide details concerning college placement testing in Texas, specifically the Texas Success Initiative Assessment (TSIA).

Standardized Testing Description and Purpose

During his acceptance of the Republican nomination to presidency, George W. Bush explained that "too many American children are segregated into schools without standards, shuffled from grade-to-grade…regardless of their knowledge…the soft bigotry of low expectations" (The Green Papers, 2000). Years later, he continued to explicate that students in the United States are left "without understanding whether or not they can read and write and add and subtract" (Office of the Press Secretary, 2006). He believed that it was imperative to test students in order to determine their level of knowledge and provide funds to struggling schools (The Green Papers, 2000).

Standardized testing has been a staple of United States education since the Scholastic Aptitude Test (SAT) was developed in the 1920s to assess students' readiness for college. Standardized assessments became a part of the federal government's involvement in education with the adoption of the Department of Education Organization Act, which was signed into law by President Jimmy Carter in 1979. The homepage for the Department of Education states that their mission is to "promote student achievement and preparation for global competitiveness by fostering educational excellence and ensuring equal access" (U.S. Department of Education,

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n.d.b) and that the purpose of standardized testing is, at least partially, to close achievement gaps and ensure all students are college and career-ready. Fruehling (1986) points out that there are certain skills society has a right to expect from college graduates, such as reading and basic mathematics knowledge, and that standardized testing is a way to measure the attainment of those skills. He also reminds us that since the public bears the cost of primary and secondary public education, they are entitled to know whether the educational system is succeeding or not.

Popham, et al. (2014) further highlighted that states typically use a single standardized test to evaluate students accumulation of knowledge, as well as the effectiveness of both teachers and institutions, but that "no one test can serve multiple purposes equally well" (p. 309). The authors explained that currently developed tests allow the government (both state and federal) to make accountability decisions, and treat producing instructionally useful information as an afterthought. A multiple-choice format, generally used on standardized tests, is inadequate as an assessment tool since it encourages a "right-or wrong" style of thinking, which does not align to real-world situations (Sacks, 2001). Students may be able to explain their understanding, but not recognize when this knowledge should be applied to new situations (Munzenmaier & Rubin, 2013). In addition, students can circle the right answer on the test, but be incapable of explaining what they read, why the right answer is correct, and why the incorrect answer choices are wrong (Bintz, 2016). Bezuidenhout and Alt (2012) explain that this is problematic because learning means nothing if it cannot be applied. Students should be able to apply their learning to their surroundings, which helps them make meaning of the world (Crowder & Konle, 2015). If the expectation is that students are provided with an education that promotes long-term learning and acquisition of the skills necessary for 21st century success, then these standardized tests are

failing to provide information about student-development gaps, since they do not measure critical-thinking or problem-solving (Bezuidenhout & Alt, 2012).

There are many different kinds of standardized assessments that are currently in use throughout the United States. One type is the high-stakes standardized assessments implemented by states in response to requirements of the No Child Left Behind (NCLB) of 2001 and the Every Student Succeeds Act (ESSA) of 2015. These standardized tests mandated by the federal government are intended to increase the probability that high school students would be college-ready upon graduation (Barnes, Slate, & Rojas-LeBouef, 2010). NCLB and ESSA mandate yearly standardized testing as a means of assessing student progress and holding teachers and schools accountable for the education they provide (ESSA, 2015). Students must successfully pass these examinations for promotion to the next grade level and/or for graduation from high school (19 Tex. Admin. Code § 101.3022; Tex. Educ. Code § 39.023).

Another type of standardized test are the assessments used for admission to college, such as the SAT and American College Testing (ACT) examinations. These tests provide IHEs the ability to compare applicants across a common standard to assess candidate's overall readiness for college (College Board, n.d.d). However, it is possible that students can be eligible for postsecondary admission without being prepared to be successful in college-level courses (Conley, 2005). Once a student has been accepted to a particular postsecondary institution, he or she will likely be required to complete placement exams to assess their level of preparedness and for the institution to correctly place the student into classes at the appropriate level (College Board, n.d.a). The results of placement exams determine if the student is enrolled into developmental courses or can start directly in credit-bearing coursework. However, several studies have shown a low level of validity for the predictability of these exams and only weak

correlations between the results of the exam and the passing rates and course grades in the associated classes (Belfield & Crosta, 2012; Jenkins, Jaggars, & Roksa, 2009; Medhanie, Dupuis, LeBeau, Harwell, & Post 2012; Scott-Clayton, 2012). In addition, Achieve, Inc. (2007) found that placement exams in math and English tend to place weight more on low-level content taught to students during middle school or early high school, rather than content that will be necessary for success in college.

Regardless of the issues inherent in standardized testing, it is big business in the United States and appears to be growing annually. Rodriguez, Bowden, Belfield, and Scott-Clayton (2015) found that the total annual cost of placement testing for developmental education is anywhere from $300,000 to $875,000, and that approximately 60% of this cost is financed by postsecondary institutions and the rest by students. In 2012, Chingos estimated that the United States as a whole was spending approximately $1.7 billion a year on testing. Since assessments are "key trends" in postsecondary education, it is critically important that they are assessed for validity and reliability (Safran & Visher, 2010).

Texas Success Initiative

While placement exams are used by many institutions across the nation to determine student need for developmental education classes, Texas was the first state to require a standardized placement exam for college course assignments by making the Texas Success Initiative Assessment (TSIA) mandatory beginning for the fall 2013 cohort (Conley, Hiatt, McGaughy, Seburn, & Venezia, 2010; Morgan & Morales-Vale, 2018). Since the TSIA exams are the focus of this study, in the subsections below I will describe what they are, specify the exemptions to the tests, explain the alignment between TSIA and the college and career readiness standards, detail how these assessments are scored, disclose updates provided by Texas

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Higher Education Coordinating Board (THECB) the about the exams, and describe the 2016

validity study conduct by College Board (Cui & Bay, 2016) in response to their contractual

obligations with the THECB.

Description. The Texas Success Initiative (TSI) is a program of diagnostic testing and

developmental instruction designed to improve student success rates in Texas colleges (College

Board, 2014). The College Board develops and provides the assessment exams used for this

purpose as part of their partnership with the THECB (Texas Higher Education Coordinating

Board, 2016). This state mandate requires assessment of students in reading, writing, and

mathematics before they begin classes at any Texas institute of higher education (IHE) (College

Board, 2014). Chapter 51 of the Texas Education Code (TEC) provides the laws that govern

higher education and requires all Texas IHEs to assess the academic skills of all incoming

undergraduate students to determine their readiness for enrolling in first-year, credit-bearing

coursework (Tex. Leg. Code §51.333). The exams utilized for class placement may not be used

to determine admission; results guide advising and help the college to work with the student to

develop a plan to prepare the student for their freshmen level courses (Tex. Leg. Code §51.335).

Spence (2009) explains that the purpose of placement testing during enrollment is to determine a

student's academic readiness. Often, these examinations are the only measure used to determine

a student's preparation for a collegiate education (Belfield & Crosta, 2012; Scott-Clayton, 2012).

As of fall 2013, the Texas Success Initiative Assessments are the only standardized test approved

by the THECB to use for determining course placement for students (Morgan & Morales-Vale,

2018).

Exemptions. While the TSIA exams are the only accepted examinations that Texas IHEs

can use to determine student placement into developmental or credit-bearing classes, there are a

variety of ways students can be exempt from completing these tests. First, they can receive high scores on one of several other assessment exams, such as the Scholastic Aptitude Test (SAT), American College Testing (ACT), or State of Texas Assessments of Academic Readiness (STAAR) end-of-course exams in Algebra II and/or English III. To take advantage of this exemption, students must score a combined 1710 on the SAT if taken prior to March 2016 or scores of at least 530 on the math and 480 on the reading and writing section of the SAT if completed March 2016 or later. They could also earn a 23 on the ACT or a 4000 or greater on either the Algebra II or English III State of Texas Assessments of Academic Readiness end-of-course exams. The second exemption option is successful completion of a college preparatory course, as outlined in House Bill Five (Texas Association of School Administrators, 2013). Third, they can show enrollment in a certificate program lasting one year or less at a public community or technical college. A fourth exemption is the transfer of necessary college credits from another postsecondary institution, including dual-credit programs completed in high school. Finally, students could provide status as a member of the armed services, whether that be veteran, active-duty, or Reservist during the three years prior to postsecondary enrollment (Texas Higher Education Coordinating Board, 2017a).

Alignment to college and career readiness standards. A major goal of Texas public education, as stated in House Bill 3, is for Texas "to become one of the top ten states for graduating college-ready students by the 2019-2020 school year" (Texas Education Agency, 2010a, p.I-47). Therefore, it is critical that Texas IHEs place students appropriately into classes that will enable them to progress towards successful completion of their college degree or certificate. To facilitate this goal, the College and Career Readiness Standards (CCRS) were developed as part of a joint effort by the Texas Education Agency (TEA) and the Texas Higher

Education Coordinating Board (THECB) to align secondary and postsecondary understandings of college readiness, in association with federal expectations and accountability requirements (Education Policy Improvement Council, 2009).

In 2010, Conley, Hiatt, McGaughy, Seburn, and Venezia completed a study examining the alignment between the placement tests used by Texas IHEs and the CCRS. At the time of the study, there were six exams used by the IHEs for admission and/or placement. The researchers found that there was an acceptable level of dependability across all exams in terms of cognitive demand, but not for the level of rigor. The National Council of Teachers of Mathematics divides cognitive demand into four different levels – low-level memorization that reproduces prior knowledge without connections, low-level procedures focused on yielding right answers, high-level procedures that require deeper understanding and can be represented in a variety of ways, and high-level thinking that includes self-monitoring of processes (Leinwand, Brahier, & Huinker, 2014). The Glossary of Education Reform (2014) defines rigor as "instruction, schoolwork, learning experiences, and educational expectations that are academically, intellectually, and personally challenging." However, the same study (Conley, Hiatt, McGaughy, Seburn, & Venezia, 2010) determined that, across all content, the mathematics tests covered between 58 to 81% of the content in the CCRS while the English exams covered 34 – 62%. In fall 2013, the Texas Success Initiative Assessment (TSIA) became the only placement exam allowable for postsecondary course appointment (Morgan & Morales-Vale, 2018). Knowing whether the results on the TSIA exams are aligned with student performance in first-year, credit-bearing English and math courses would lend credence to the current placement exam policy.

Scoring. The multiple choice questions on the TSIA exams align to the CCR standards (College Board, 2014) and each placement test contains between 20 and 25 items to generate a

numeric score between 310 and 390. Any student who does not meet the minimum score for

college readiness must complete a diagnostic test in order to obtain information about their

academic strengths and weaknesses (College Board, 2014). These exams are computer-adaptive,

meaning that the questions will increase or decrease in difficulty based on the responses to prior

questions (Morgan & Morales-Vale, 2018). Passing standards were set using internal College

Board staff as well as outside consultants using a modified bookmark method (College Board,

2014). Members of the standard-setting committee completed a booklet of test questions ordered

from easiest to hardest, and placed a bookmark between the questions where they felt minimal

competence had been displayed. Once completed, members of the committee discussed the

placement of the individual bookmarks and determined the final cutoff score that would indicate

readiness for college coursework. Once this was complete, the committee determined the

performance-level descriptors for the cut scores. They started by using the State of Texas

Assessments of Academic Readiness (STAAR) exams for English III and Algebra II as

satisfactory descriptors, as these were the highest level exams Texas public students had to

complete in order to graduate from high school (College Board, 2014).

Committee members settled on two different cut scores, creating three categories into

which students could fall. The top category provides students a designation of college-ready,

which means they can enroll directly in credit-bearing coursework. The middle category is

termed *diagnostic* and means that students must register for developmental coursework to

prepare them for their first for-credit college classes. The bottom category defines students that

are in need of *adult basic education*, meaning that they possess knowledge and skills that are

pre-high school level (Lozano, 2016). These scores are usable for five years from the testing date

(Tex. Leg. Code §4.57(e)). The various cut scores for the categories on the different TSIA tests can be found in Tables 2.2 and 2.3.

Table 2.2

Original TSIA Categories and Cut Scores

Level/Category	Math	Reading	Writing
College-Ready	350 – 390	351 – 390	363 – 390 with an essay score of 4 OR Essay score of 5 – 8
Diagnostic	336 – 349	342 – 350	350 – 362 and an essay score of 0 – 4
Adult Basic Education	310 – 335	310 – 341	310 – 349 and an essay score of 0 – 4

Note: Data from Lozano, 2016

When the TSIA exams were first developed and implemented, they were set on phase-in schedule with three dates. The original cut scores, as seen in table 3, were implemented in the fall of 2013. Phase 2 was set to begin in fall 2017, and increased the college-ready score in math to 356 and in reading to 355. Phase 3 was to be executed in the fall of 2019 and would increase the math college-ready score to 369 and the reading score to 359. The writing multiple choice and essay scores did not phase up, but were left at the original scores implemented in fall 2013 (Lozano, 2016). However, these phase-in scores never increased, and in fact the writing score necessary to demonstrate college-readiness was lowered as of fall 2017 (Morales-Vale & Humphries, 2017; Texas Higher Education Coordinating Board, 2018b).

Table 4.

Current TSIA Categories and Cut Scores

Level/Category	Math	Reading	Writing

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College-Ready	350 – 390	351 – 390	340 – 390 with an essay score of 4+ OR < 340 with an essay score of 5 – 8 and a score of 4+ on ABE diagnostic
Diagnostic	336 – 349	342 – 350	350 – 362 and an essay score of 0 – 4
Adult Basic Education	310 – 335	310 – 341	310 – 349 and an essay score of 0 – 4

Note: Data from College Board, 2014; College Board, 2018; Tex. Leg, Code §4.57

Updates from the Texas Higher Education Coordinating Board. A TSI and developmental education update presented by Morales-Vale and Humphries (2017) reported that of students in the fall 2016 cohort, 46.4% were not college ready and that nearly half of those students remained overall unprepared one year later – 62% were still not ready in math, 42% in reading, and 47% in writing. Broken out by type of institution, only 18.1% were not ready upon entering a four-year university. Of those, 41% remained ill-equipped in math after one year, 26% in reading, and 27% in writing. For two-year institutions, 67.1% entered unprepared for college classes, and 66% of those were still not ready one year later in math, 45% in reading, and 51% in writing. However, the statewide successful completion of first college-level courses (FCLCs) increased over the five-year period from 2011 to 2015. Completions in math went up from 6% in 2011 to 16% in 2015. Likewise for reading, an increase of 24% to 37%, and writing, which improved from 19% to 30%. Morales-Vale and Humphries (2017) also explained that persistence gaps between college-ready and non-college-ready students remained large for both 2-year and 4-year institutions. For 2-year colleges, 59% of college-ready students had graduated or were still enrolled while only 38% of non-college ready students met the same criteria. At 4-year universities, those numbers were 74% for prepared students and 42% for unprepared students.

This information highlights the need to ensure that students are being correctly placed into developmental and for-credit freshman courses based on their TSIA exam results.

Validity study. As part of their contract with the THECB, College Board completed a validity study of the TSIA exams to determine their ability to correctly place students in the appropriate classes (Cui & Bay, 2016). The authors of this study examined the records of more than 20,000 students – all public, first-time, first-year Texas students – from the fall 2013 through fall 2014 cohorts. The vast majority of these student records, 81.8%, came from two-year institutions and 74.07% the students were part of the fall 2014 cohort. The authors ran biserial correlations between TSIA scores and grades in the associated courses. In addition, they also used logistic regression to predict the probability of success in math, English composition, and reading courses. They used the THECB's definition of success, which is a student earning a grade of a C- or higher.

After running all analyses, the authors determined that the correlation between TSIA college-ready score and receiving a C- or high is the associated course was 0.21 for math, 0.16 for reading, 0.07 for writing, and 0.09 for the written essay. In addition, they authors reported that the correlation between TSIA score and receiving a B- or high is the associated course was 0.26 for math, 0.20 for reading, 0.14 for writing, and 0.13 for the written essay. The results of the logistic regression models showed that, when withdrawals were included and used as a "non-successful completion" grade, a TSIA math score of 350 was associated with a 64% chance of receiving a C- or higher and a 40% chance of receiving a B- or higher. A TSIA reading score of 351 was correlated with a 68% chance of receiving a C- or higher and a 44% chance of receiving a B- or higher. A TSIA writing score of 350 AND an essay score of 5 was linked with a 75% chance of receiving a C- or higher and a 51% chance of receiving a B- or higher. In general, the

authors found that students with higher TSIA scores had a higher probability of successful course completion than students with lower results. Finally, the authors reported on the percentage of students who were correctly placed, over-placed, and under-placed using TSIA scores. Over-placed students are those that met the TSIA cut score requirements but failed the associated class, while under-placed students are those that did not meet cut score minimums for college-readiness on TSIA but still passed the accompanying course. The results can be seen in table 2.4.

Table 2.4

Percentages of Placement Using TSIA

Course/TSIA	Correct Placement	Under-placement	Over-placement
Math	62.55	14.88	22.57
Reading	68.59	10.54	20.86
English composition with TSIA-W = 350 and Essay = 5+	74.87	7.36	17.77

Note: Data from Cui and Bay (2016).

However, researchers have not repeated this validity study with students past the fall 2014 cohort. Since that time, there have been two major policy changes affecting TSIA. House Bill Five, passed by the 83rd Texas Legislature, removed the requirement for students to complete the Algebra II and English III STAAR end-of-course exams for high school graduation, which decreased that pathways towards TSIA exemption (Texas Higher Education Coordinating Board, 2018a). This changed decreased the overall percentage of students meeting TSIA minimum requirements from 72.7% in 2014 to 58.2% in 2015. The second change was that the minimum standard for meeting college readiness on the writing portion of the TSIA was decreased effective fall of 2017 (Texas Higher Education Coordinating Board, 2018a). This

change increased the percentage of students meeting TSIA minimum requirements from 58.0% in 2016 to 61.3% in 2017. It is important to examine the correlations between the TSIA exams and course performance in light of these two large policy changes and to examine these relationships for students attending four-year institutions, which are the gaps that I hope to fill with this study. In order to do so, I will draw upon the work of Fuhrman (1993) and her theory of systems coherence and alignment to explain the significance of understanding the relationship between TSIA results and freshman-level course performance.

Systems Coherence and Alignment Theory

In 1993, Fuhrman stated that "improving teaching and learning is at the heart of coherent education policy" (p. 3). She further explained that the failure of most policies is that they are inconsistent, do not possess any unity in their purposes, and place a high prominence on low-level (easy to test) skills. Present policy in Texas states that students must take the TSIA exams, or hold an allowable exemption, so that IHEs can make decisions about student enrollment into developmental and credit-bearing coursework (Tex. Leg. Code §51.333). Achieve, Inc. (2007) found that placement exams in math and English tend to assess low-level content taught to students during middle school or early high school, rather than content that will be necessary for success in college. Therefore, the goal of this study is to examine the link between the TSI assessments and student performance in the associated courses.

Newmann, Smith, Allensworth, and Bryk (2001) described coherence as a consistent set of programs guided by a framework that includes, among other things, curriculum and assessment. They further explicated the importance of this by pointing out that when experiences connect with and build on each other, students are more likely to engage with the learning (especially for difficult subjects) and therefore are more likely to be successful (Newmann,

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Smith, Allensworth, & Bryk, 2001). Coherent experiences are defined by Weston and Henderson (2015) as events that build toward a "consistent end and are intentional, continuous, unified, and clear" (p. 322). To successfully accomplish this, learning, and therefore learners, have to be at the center (Brookhart, 2018).

For learners to be the focal point, they must understand that assessments are measuring the knowledge and skills they are supposed to know. Brookhart (2018) described two kinds of coherence in assessment – horizontal and vertical. She designated horizontal consistency as connections between the curriculum (what is taught), the instruction (how the curriculum is taught), and assessment (how the taught curriculum is assessed). Vertical curriculum connects what is happening in the classroom with the school, district, state, and national/international examinations. In order to keep coherence among the various pieces, there needs to be collaboration between the parties who develop and implement testing policies – theorists, experts in curriculum and instruction, professional developers, and teachers. It is difficult to have an authentic way to assess student development because there is no agreement about desired results (Brookhart, 2018). Furthermore, discussions regarding student outcomes tend to be problematic due to conflicts over the purposes of education, and policymakers have traditionally avoided determining student outcomes at the state level (Fuhrman, 1994).

However, states have a major part to play in creating coherent education systems, as they have the jurisdiction over both secondary and postsecondary education necessary for policy integration (Fuhrman, 1994). Education reform strategy proposes creating policies that align with student expectations, but Fuhrman (1994) explained that there are several obstacles to creating these guidelines. First, our governing bodies at all levels of government (federal, state, and local) are divided into separate groups that operate with their own agendas and procedures, a

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throwback to "the progressive era of isolating education from partisan politics" (p. 3). Second, policymakers have a tendency to focus their energies on making decisions that are agreeable to their constituents and to avoid contentious policy negotiations in order to facilitate re-election. Third, there is an enormous number of policies being discussed by legislators at the various government levels. Since the 1980s, states have been creating procedures on a wide variety of education issues that used to be determined by local school districts. However, the local districts have not decreased their involvement in these policies, even as states have increased their contributions, which has led to an overload of policy initiatives, which escalates the chances that reforms will be implemented without connection to each other or to long-term goals. Finally, to manage the complexities of these issues, specialized committees are formed, which narrow the jurisdiction of each group. Most states, including Texas, have at least one legislative chamber with separate committees for elementary, secondary, and higher education (Fuhrman, 1994). Unfortunately, while this specialization allows politicians to have a variety of avenues to impress their voters, Fuhrman (1994) explicated that it contributes to fragmentation of the system, which leads to incoherence. Education guidelines wind up being constructed with a very tight focus that may or may not affect other policies. Since student preparation for postsecondary education is a key factor in college success (Gallard, Albritton, & Morgan, 2010) and misaligned standards may be part of the reason for lack of readiness (Conley, 2003), it is important to know if placement exams are correlated to course success as a way to measure the coherence in Texas state policy.

Creating coherence depends on how implementers make sense of the demands placed on them and how well these requirements fit into the school's culture and ongoing operations (Honig & Hatch, 2004). Newmann, Smith, Allensworth, and Bryk (2001) identified several

critical components for crafting coherent policy, including solid leadership, a clear vision, processes that promote both public and professional involvement, and support from the government. There should be ambitious standards for students to meet that include high-level thinking, deep understanding, and sophisticated reasoning abilities. Fuhrman (2004) described systemic education reform as incorporating societal decisions about student outcomes and coordination with policy instruments. There exists a great emphasis on monitoring student performance in order to ensure a more coherent education policy (Fusarelli & Johnson, 2004), which is the proposed goal of this study.

Developmental education courses are designed to strengthen student academic abilities for weakly prepared students. However, students often take developmental education placement exams without fully comprehending their purpose or importance (Safran & Visher, 2010). Chen and Simone (2016) studied beginning postsecondary students under the age of 24 from the 2003-2004 cohort and identified them as either weakly or strongly-prepared academically based on high school GPA, highest high school math course, and ACT/SAT scores. They found that 75% of weakly-prepared students and 48% of strongly-prepared students completed remedial courses at two-year institutions. The percentages of weakly and strongly-prepared students at four-year colleges were 77% and 18%, respectively. This meant that 23-25% of weakly-prepared students were not enrolled in remedial education. This finding could signify a lack of alignment among high school standards, postsecondary standards, and remedial education policies (Dillon & Smith, 2013; Hughes & Scott-Clayton, 2011; Kurleander & Howell, 2012). Brown and Conley (2007) explained that superior learning occurs when there are more explicit connections amid local education systems, state standards, and assessments. Questions on placement exams should

match the knowledge and skills identified by developmental coursework (Colorado Community College System, 2013).

Fuhrman's coherence and alignment theory (1993) highlights the importance of continually assessing policies to ensure that they are driving toward the overarching goal. In the case of this study, I am examining the Texas postsecondary placement exam policy, which utilizes the TSIA tests, to try and determine if it is aligned well with student performance in the associated courses. If the TSI assessments are not appropriately aligned to course performance, then Texas IHEs are placing students into classes they don't need to take. This means that students could be spending money unnecessarily, which potentially increases their debt load and contributes to inflated dropout rates (Alliance for Excellent Education, 2006; Bailey, Jeong, & Cho, 2010; NCES, 2004; Strong American Schools, 2008).

Summary

In this chapter, I reviewed the existing literature in four areas relevant to this study: college readiness, developmental education, placement testing, and coherence and alignment theory. I described the importance of college readiness and the landscape of postsecondary preparation in Texas, including the College and Career Readiness Standards (CCRS) and the Texas remedial education models laid out in the *Closing the Gaps* and 60X30 strategic plans. I then defined developmental education and inventoried the problems associated with foundational coursework, including incorrect placement, expanded time to degree completion, increased dropout rates, and enlarged cost to students and taxpayers. In the third section, I explained standardized testing, including placement exams at the national level, and detailed the components of the Texas Success Initiative Assessments. Finally, I described Furhman's systems coherence and alignment theory, which provides a context for the importance of aligning

expectations and definitions of readiness with the placement instruments used to determine preparation level.

The following chapter draws on the context of chapter two and presents the methods I will employ in this study, including information about my research design, location and participants, data collection, statistical procedures, and study limitations. The penultimate chapter presents the major statistical findings, tables, and graphical representations. Chapter five concludes with a summary of the study, implications for policy and practice, and recommendations for future research.

Chapter Three

Methodology

There is a gap in the literature regarding the relationship between student performance on state-mandated standardized assessments used for college class placement in Texas institutes of higher education (IHEs) and student performance in postsecondary coursework. Since both the Texas Higher Education Coordinating Board (Texas Higher Education Coordinating Board, 2015) and the state legislature (Tex. Leg. Code §4.001(b), 2018; University of Texas, 2010a) have highlighted the importance of college readiness and their intention to ensure Texas students are graduating from higher education with a degree or certificate, it is critical to explore this relationship. Knowing if a meaningful association exists between these variables can assist educators and policymakers in making decisions about the implementation of the Texas postsecondary placement exam policy. In this chapter, I detail the methods used to fulfill the purpose of this study, including a review of the purpose and research questions, the general research design, and data collection. I also include a description of the data analysis and conclude with a summary of the chapter.

Purpose Statement and Research Questions

The purpose of this study is to examine the relationship between results on the Texas Success Initiative Assessments and postsecondary course outcomes at a large, public, Research I university in Texas. While validity research has been previously conducted (Cui & Bay, 2016), it has not been repeated since House Bill Five decreased the pathways to TSIA exemption (Texas Higher Education Coordinating Board, 2018a). In addition, there has not been research focused solely on students at four-year institutions. It is also important to note that the TSIA maker, College Board, was the entity that sponsored the Cui and Bay validity study. Analyzing TSIA in

independent academic research adds to the available literature. Recall that the following research questions guide the study:

    (1) How does student performance on TSIA exams correspond with associated content-area, postsecondary course results?

    (2) Does the relationship between TSIA exams and course results, if found, persist in the presence of other factors shown to affect academic performance?

Research Design

I will use a quantitative design, including descriptive and correlational statistics, to perform a secondary analysis of administrative data from a large university to investigate the research questions I have posed. Such an approach will allow me to assess the relationship between my variables (Creswell, 2012) – student performance on TSIA placement exams for postsecondary course enrollment and performance in associated, credit-bearing coursework. These methods are appropriate for this study, as I am looking to understand the relationship between a variety of numerical variables across thousands of observations. Due to the nature of the research questions, it was appropriate to first determine if there is any statistically significant relationship between the variables, then to analyze the strength and direction of that relationship (should one be established), and finally to determine if the relationship persists while accounting for other factors known through the literature to affect college course performance.

Data Collection

In the following section, I provide the details of my data collection. This includes a description of the study site and the participants. In addition, I will describe all the variables that I will use in this study.

Site and Participants

This study draws upon data from the University of Texas at Arlington, a large, Research I institution in Texas; this is a very diverse (Gregor Aisch, 2017; Sullivan, 2013; University of Texas at Arlington, n.d.a) regional university with an enrollment of nearly 30,000 undergraduates (University of Texas at Arlington, 2017). Participants in the study include all first-time-in-college (FTIC) freshmen enrolled full- or part-time who completed TSIA examinations as part of their entrance requirements for college class placement. Because Texas has required the use of the TSIA exams as the sole assessment instrument for readiness since fall 2013 (Morgan & Morales-Vale, 2018), all participants in this study began their enrollment between fall 2013 and fall 2018. Since developmental courses are, by design, meant to increase a student's readiness to complete credit-bearing coursework (Chen & Simone, 2016), only students who enrolled directly into credit-bearing courses will be considered. This will allow me to avoid the confounding variable of students having completed a developmental course before enrolling in for-credit classes. In addition, only first enrollments will be considered to ensure no students completed additional credited classes within the content. Any student with more than 250 days between their TSIA test date and course enrollment date will be eliminated to avoid any concern that they might have completed additional coursework that would help prepare them for success in the first-year, credited English or math courses.

These requirements for inclusion provide a total sample of 1,577 observations for English and 1,703 observations for mathematics. I obtained all data from the university's department of analytics. Since the data was completely de-identified and I would never be able to link the data to specific students, this study does not meet the federal definition of human subjects research, hence Institutional Review Board (IRB) approval was not required.

Variables

The data included students' TSIA exam results for math and reading, as well as their final grades in their first-year, credit-bearing, postsecondary English and mathematics courses. In addition, it included information about their gender, race/ethnicity, parent income level, and parent education level, as these factors have time and again been shown to influence postsecondary academic achievement (e.g. Ross et al, 2012; Sirin, 2005). I also received data for student results on admission exams, including Scholastic Assessment Test (SAT) and American College Test (ACT) scores.

TSIA scores. The institution used as the site of this study offers several courses that fulfill developmental course needs for underprepared students. Placement into these classes is determined via the Texas Success Initiative (TSI) used as part of the Texas Higher Education Coordinating Board's (THEBC) 60x30 plan (Texas Higher Education Coordinating Board, 2017a). Texas Education Code requires institutes of higher education to evaluate all incoming undergraduate students to determine their readiness for enrollment in freshman-level English and math courses. The assessment instrument used must have a minimum score to demonstrate proficiency and students scoring below that threshold are eligible for placement into developmental coursework (Tex. Educ. Code §§ 51.333(a), 51.334(a-b)). Students must be assessed before they are allowed to enroll in entry-level college classes for credit, unless they are exempt from testing.

The current evaluation tool utilized by college and universities in Texas is the Texas Success Initiative Assessment (TSIA). In order to meet minimum readiness criteria, students must score at least a 350 on the math section and a 351 on the reading section (Texas Higher Education Coordinating Board, 2017a). Current cut scores for the exams can be found in Table 3.1.

Table 3.1

Current TSIA Categories and Cut Scores

Level/Category	Math	Reading
College-Ready	350 – 390	351 – 390
Diagnostic	336 – 349	342 – 350
Adult Basic Education	310 – 335	310 – 341

Note: Data from College Board (2018).

Courses and grades. Students who are exempt from testing or who successfully complete testing and demonstrate proficient levels of college readiness are placed directly into credit-bearing college classes. Those who are non-exempt and do not meet proficiency levels in testing are placed into developmental classes. Table 3.2 details the available credit-bearing freshman courses in English and math at this institution (University of Texas at Arlington, 2018b; University of Texas at Arlington, 2018c).

Table 3.2

First Year Credit-Bearing Courses

Course Number	Course Title	Course Description
ENGL 1301	Rhetoric and Composition I	Introduction to college reading and writing, emphasizing recursive writing processes, rhetorical analysis, synthesis of sources, and argument
MATH 1301	Contemporary Mathematics	Covers material in traditional algebra together with real-world applications of mathematics to develop problem-solving and critical-thinking skills
MATH 1302	College Algebra	Designed as preparation for high-level math courses studying functions, relations, inequalities, graphing, and systems of equations and matrices

| MATH 1315 | College Algebra for Economics and Business Analysis | Covers material in traditional algebra with emphasis on business and financial application |

Note: Data for English courses from University of Texas at Arlington (2018b) and for math courses from University of Texas at Arlington (2018c).

As indicated in the tables above, students deemed college-ready move directly into first-year English (ENGL 1301) or one of three first-year math courses, depending on their major of choice. The university catalog explains that students planning to enroll in higher-level math courses should take MATH 1302; these students typically are in a STEM-related field. Non-STEM majors enroll in MATH 1301, while business majors move into MATH 1315 (University of Texas at Arlington, 2018c).

For this study, I will use A, B, and C as passing grades and F as a failing grade. I will utilize a course grade of D as both passing and failing. To conform to the Texas Higher Education Coordinating Board (THECB) definition of passing, being achievement of a C- or higher (Morgan & Morales-Vale, 2018), a grade of D will be considered a failing grade. However, the study site considers a D as a below-average passing grade and will allow students to advance to the next course (UT Arlington, 2018a). Therefore, it is important to provide analysis results that show how TSIA scores and course performance align with both THECB and with the university itself. My data will not include students with an I, as these students have simply not yet completed the course and may end up with a passing grade when they are done (University of Texas at Arlington, n.d.b). I will also not include students who received a Z, Q, or W. Students with a W have to possess a passing grade prior to withdrawal (University of Texas at Arlington, n.d.b) and there is no way to know whether students with a Q had a passing or failing grade prior to the drop. In instances where I need to have a non-categorical variable (e.g.

for the Pearson *r* correlation analysis), I will convert the grades into grade points, with A = 4, B = 3, C = 2, D = 1, and F = 0. I will consider letter grade and grade points the same.

Gender. In prior research, there has been much discussion concerning the difference between 'gender' and 'sex.' Oakley (2016) described the difference by explaining that 'sex' is a biological term, whereas 'gender' is a cultural one. For this study, I use the term 'gender,' as that is the term used in the dataset received from the study site, in which there are only two options, female and male. I will represent gender as dichotomous, where 1 = female, 0 = male.

Race/ethnicity. As with gender, there has been much research into the paradigms of race and ethnicity, which have been shown to be separate constructs, though many researchers use the terms interchangeably (Bonilla-Silva, 1999; Smedley, 1998). For this study, I will utilize the term 'race/ethnicity' to show that both are taken into account in this study and because that is how the site originally recorded the data. Student ethnicity is reported by students as part of the application process. The study site utilizes the following categories: (a) American Indian/Alaska Native, (b) Asian, (c) Black/African-American, (d) Foreign, (e) Hispanic/Latino, (f) Native Hawaiian/Other Pacific Islander, (g) White, (h) Multiple Ethnicities, and (i) Not Specified. These categories will be given dummy variables for the regression analysis. The category with the largest number of participants will be used as the reference group.

Parent income level. In regards to parent income level, the following groupings are defined by the university site: (a) Less than $20,000, (b) $20,000 – $39,999, (c) $40,000 – $59,999, (d) $60,000 – $79,999, (e) $80,000 – $99,999, (f) $100,000 – $149,999, (g) $150,000 – $199,999, and (h) More than $200,000. These categories will be given dummy variables for the regression analysis and, as with race/ethnicity, the group with the largest number of participants will be employed as the reference category.

Parent education level. Parent education level is reported by students as part of the application process. The following groupings are defined by the site of this study: (a) No high school, (b) Some high school, no diploma, (c) HS diploma, GED, home school, (d) Some college, but no degree, (e) Associate's degree, (f) Bachelor's / Four year degree, (g) Graduate / Professional degree, (h) Not Reported, and (i) Unknown. I will use the highest education in the household, which will allow me to use data from many family structures, and reduce incidence of missing data. These categories will be given dummy variables for the regression analysis with the largest-participant group used as reference.

Admission exams. This institution utilizes the SAT and ACT exams for admission purposes. For this study, ACT scores will be converted into SAT scores using the College Board's concordance tables (College Board, 2018b). If the student has scores for both tests, the higher score will be selected. SAT scores range from 400 to 1600. Standardized z-scores will be utilized for the regression analysis.

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Data Analysis

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I will analyze the data for this study using Statistical Package for Social Sciences (SPSS) software, version 25 (IBM Corp., 2017). Specifically, I will run descriptive, correlational, and logit statistics to examine the nature of the relationship (if any) between TSIA test results and course performance. Analyses will be performed for both content areas, mathematics and reading. The following subsections will detail the statistical procedures I will employ to address each of my research questions.

Descriptive Analysis

Loeb et al. (2017) explain that descriptive statistics are important in providing a "general understanding of patterns across a population of interest" (p. 1) and can help give educational

stakeholders the information they need to make sound decisions regarding education

improvement. Therefore, it is important that I begin by finding the means and standard

deviations for each of the TSIA tests – math and reading, as well as the grade frequency

distributions for students enrolled in credit-bearing courses (ENGL 1301, MATH 1301, MATH

1302, and MATH 1315), as these are the independent and dependent variables of interest for the

study, respectively. I will display results using frequency and distribution in tables, as well as via

histogram in order to provide a visual representation of the data that will make underlying

patterns easier to see and allow for the identification of outlier data (Gravetter &Wallnau, 2013).

Then, I will then complete a cross-tabulation of the two variables of primary interest –

student performance on TSIA, measured as a binary pass/fail, and associated course outcome,

also measured as a binary pass/fail. I will display the results of this analysis in a 2x2 matrix. The

cross tabulation will allow me to examine if there is a significant difference between expected

and observed frequencies (Gravetter & Wallnau, 2013) in the course grades based on exam

performance.

Chi-Squared Analysis

Utilizing the cross tabulation table, I will perform a chi-squared test using student TSIA

score, measured as a binary pass/fail, as my independent variable and course grade, also

measured as a binary pass/fail as my dependent variable. Chi-squared is valuable when working

with two categorical variables (McHugh, 2013) in order to determine if those variables have a

statistically significant relationship to each other or if they are independent of one another

(Benhamou & Melot, 2018). In order to use this statistical analysis, six assumptions must be met:

(a) data must be in frequencies, (b) categories for each variable must be mutually exclusive, (c)

each participant only contributes one data point for each variable, (d) the groups are independent,

(e) both variables are categorical, and (f) the value of each expected cell should be 5 or more in 80% of the cells and no cell have less than one (McHugh, 2013).

The chi-square analysis will allow me to determine if there exists any statistically significant relationship between the variables and provide an overall understanding of how well a passing or failing score on the TSIA aligns with receiving a passing or failing score in the associated course. Once I have determined if there is a relationship between TSIA results and course grades, I can move on to examining the strength of the relationship.

Correlation Analysis

While the chi-squared test is one way that I will look at the relationship between my two variables of interest, TSIA exam results and student course performance, a correlation analysis provides me a second method to examine this relationship. Fraenkel, Wallen, and Hyun (2012) explain that the purpose of correlational research is to identify relationships of variables to gain an understanding of significant phenomena. Using a chi-squared analysis allows me to examine the connection between passing or failing the TSIA exam and passing or failing the associated class. With a correlation analysis, I can observe if, and how, participant raw score on the TSIA exam is related to their final course grade. Both tests allow me to use different measures to assess a similar outcome – student results in their first year, credited coursework. According to Fuhrman's Coherence and Alignment Theory (1993), for students to have the best results, policy instruments should align with proposed outcomes. Therefore, after completing the cross-tabulation and chi-squared tests of my data, it will be critical to determine, based on their TSIA performance, whether and to what degree students enrolled in credit-bearing math and English classes succeed. After preparing the dataset, I will calculate a Pearson r, using raw TSIA scores as one continuous variable. For the other continuous variable, I will convert course grades into

grade points (A = 4, B = 3, C = 2, D = 1, and F = 0). This analysis will enable me to understand how well the two variables move together and how strong their association is with each other. The significance will be set at .05. Havlicek and Peterson (1977) explain that there are four assumptions that must be met in order to complete a Pearson's *r* correlation: (a) both variables must be continuous, (b) there is a linear relationship between the variables, (c) scores are independent of each other, and (d) the variables show a normal distribution.

Using guidance from Creswell (2012), I will analyze each correlation for direction (positive or negative), form (linear or nonlinear) and strength (effect size). Effect size guidelines are informed by Cohen's (1988) work and can be found in Table 3.3. I will display all results from these Pearson *r* correlation tests in tables and scatterplots to provide a visual representation of the data to aid understanding.

Table 3.3

Correlation Effect Sizes

Strength of Association	Coefficient, *r*	
	Positive	Negative
Small	0.1 to 0.3	-0.1 to -0.3
Medium	0.3 to 0.5	-0.3 to -0.5
Large	0.5 to 1.0	-0.5 to -1.0

Note: data from Cohen (1988)

Logit Analysis

After discovering the strength of the correlation between the variables, it will be beneficial to know whether this strength persists in the presence of other factors that have been established through the literature as determinants of postsecondary course grades. These

elements include gender, race/ethnicity, parent income level, and parent education level (Ross et al, 2012; Sirin, 2005). In order to do this, I will employ a logistic regression, which will allow me to see how more than one variable impacts the outcome of passing or failing the course. In addition, this model shows the contribution of several independent variables while holding constant the effect of all others (Stolzfus, 2011). Therefore, this analysis will show which independent variables are the most significant in passing or failing freshman-level, credit-bearing English and math classes.

Running a logistic regression relies on data meeting four assumptions: (a) there is independence of observations, (b) there is a linear relationship between any non-dichotomous independent variables and the logit transformation of the dependent variable, (c) no multicollinearity, meaning that one independent variable cannot be predicted by any of the others with accuracy, and (d) there not be an abundance of outliers that affect the accuracy of the regression model (Stolzfus, 2011). To find sources of multicollinearity, I will calculate variance inflation factors (VIFs) for all independent variables. Any variable with a VIF over 10 will be excluded from the model.

The predictor variables will include passing or failing TSIA, as well as race/ethnicity, gender, socioeconomic status (SES), and parent education level. As Scholastic Assessment Test (SAT) or American College Test (ACT) scores were required for admission to the university, they will also be included as a predictor variable. Therefore, the logistic regression model is $\log (p/1-p) = \beta_0 + \beta_1 \text{*TSIA} + \beta_2 \text{*race/ethnicity} + \beta_3 \text{*gender} + \beta_4 \text{*parentincome} + \beta_5 \text{*parented} + \beta_6 \text{*SAT}$. β_0 is the intercept and remains constant. The other β values are the coefficients for each of the associated predictor variables and each determines the relationship between the predictor and the log of the outcome variable (Peng, Lee, & Ingersoll, 2002).

In order to assess the fit of the resultant model, I will calculate pseudo R^2. There are several pseudo R^2 calculations, each of which measures different aspects of the model. Collectively, their purpose is to provide a representation of the fitness of the model (UCLA, 2011). I will report the Cox-Snell and Nagelkerke versions of pseudo R^2, as they are the most commonly reported, as well as Tjur's *D*, which provides an intuitive representation of the model's predictive ability (Tjur, 2009). The resulting table will also include the odds ratios and Wald statistics, which will allow me to determine which independent variable(s) reliably predict passing or failing the class. The Wald statistic tests the combined significance of several coefficients (Rodríguez, 2019), while the odds ratios are measures of the impact that a 0 to 1 (or no to yes for dichotomous variables) increase in each covariate has on the odds of successfully passing the class. Any statistically significant independent variable with an odds ratio greater than 1.0 will indicate a greater likelihood of passing the class, when the other independent variables are kept constant. Knowing whether TSIA scores are a reliable predictor of passing or failing the associated first-year courses is helpful in determining the usefulness of the current Texas placement exam policy for higher education.

Summary

In this section, I explained the methodology of the research process for this study. I included a review of the purpose statement and research questions, as well as an explanation of the research design, data collection and variables, and data analysis techniques. In the following sections, I will provide the findings of the data analysis, an explanation of these discoveries, and a discussion of the conclusions, implications for practice, and suggestions for future research.

Chapter Four

Findings

The purpose of this study was to examine the relationship between Texas Success Initiative Assessment (TSIA) scores in reading and mathematics and performance in corresponding first-year, credit-bearing postsecondary classes. Since policymakers in the state of Texas want to have 60% of their population ages 25-34 holding a postsecondary degree or certificate by 2030 (Texas Higher Education Coordinating Board, 2015), and developmental education is an essential component of college course offerings to strengthen the readiness of postsecondary students (Chen & Simone, 2016), it was important to analyze this relationship.

This study was guided by the following research questions:

(1) How does student performance on TSIA exams correspond with associated content-area, postsecondary course results?

(2) Does the relationship between TSIA exams and course results, if found, persist in the presence of other factors shown to affect academic performance?

In this section of the study, I discuss the various aspects of the data analysis. For each of the research questions, I present a table of the descriptive statistics, the findings of the cross tabulation, chi-square analysis, and correlation tests, as well as the results of the logistic regression. I also assess the regression model fit and situate the findings within current research. I present the findings in two sections; one for English 1301 and the TSIA reading exam and a second for the credit-bearing mathematics courses and the TSIA math exam. I conclude with a summary of the chapter.

English 1301 and TSIA Reading

The dataset obtained from the university contained 1,577 participants who conformed to the selection criteria laid out in this study. They began their postsecondary education on or after fall 2013, had a recorded TSIA reading exam score, received a usable final grade in their first enrollment of their credited freshman-level English class (ENGL 1301), had not completed any developmental education classes prior to their credited course enrollments, and had fewer than 250 days between their TSIA exam and their English class enrollment. The descriptive characteristics of these 1,577 students can be found in Table 4.1.

Table 4.1

Descriptive Characteristics as a Percentage of the Sample for ENGL 1301

Descriptive	Frequency	Percent
Race/ethnicity		
American Indian/Alaska Native	3	.2
Asian	192	12.2
Black/African American	262	16.6
Hispanic/Latino	655	41.5
Native Hawaiian/Other Pacific Islander	1	0.1
White	243	15.4
Multiple Ethnicities	47	3.0
Foreign	173	11.0
Not Specified	1	0.1
Gender		
Female	820	52.0
Male	757	48.0
Family Income		
Less than $20,000	241	15.3
$20,000 - $39,999	351	22.3
$40,000 - $59,999	280	17.8
$60,000 - $79,999	177	11.2
$80,000 - $99,999	114	7.2
$100,000 - $149,999	144	9.1
$150,000 - $199,999	61	3.9

More than $200,000	55	3.5
Not Reported	153	9.7
Highest Parent Education Level		
No high school	155	9.8
Some high school, no diploma	167	10.6
HS diploma, GED, home school	239	15.2
Some college, no degree	203	12.9
Associate's degree	111	7.0
Bachelor's/Four-year degree	261	16.6
Graduate/Professional degree	152	9.6
Not reported/Unknown	289	18.3

Table 4.1 shows the descriptive characteristics as both frequency and percentage of the sample. Since one of the goals of the Texas 60x30 strategic plan is to have postsecondary institutions educating students in proportion to their share of the Texas population (Texas Higher Education Coordinating Board, 2000), it is interesting to note that the percentage of white students (15.4%) is far below the latest census percentage for Texas of 46.0%, while the African American and Hispanic/Latino numbers (16.6% and 41.5%) are higher than their census counterparts of 11.5% and 37.6%, respectively (Texas Department of State Health Services, 2015).

For the 1,577 students used in the analyses for English, 1,545 passed their TSIA reading exam and 32 did not. Scores ranged from a low of 319 to a high of 390, with a mean of 359.81 and a standard deviation of 7.78. The averages and standard deviations for the exam can be found in Table 4.2. It should be noted that the average score is higher than the "college-ready" cut score of 351. The individual scores on the exam are also displayed as a histogram against a normal curve in figure 4.1.
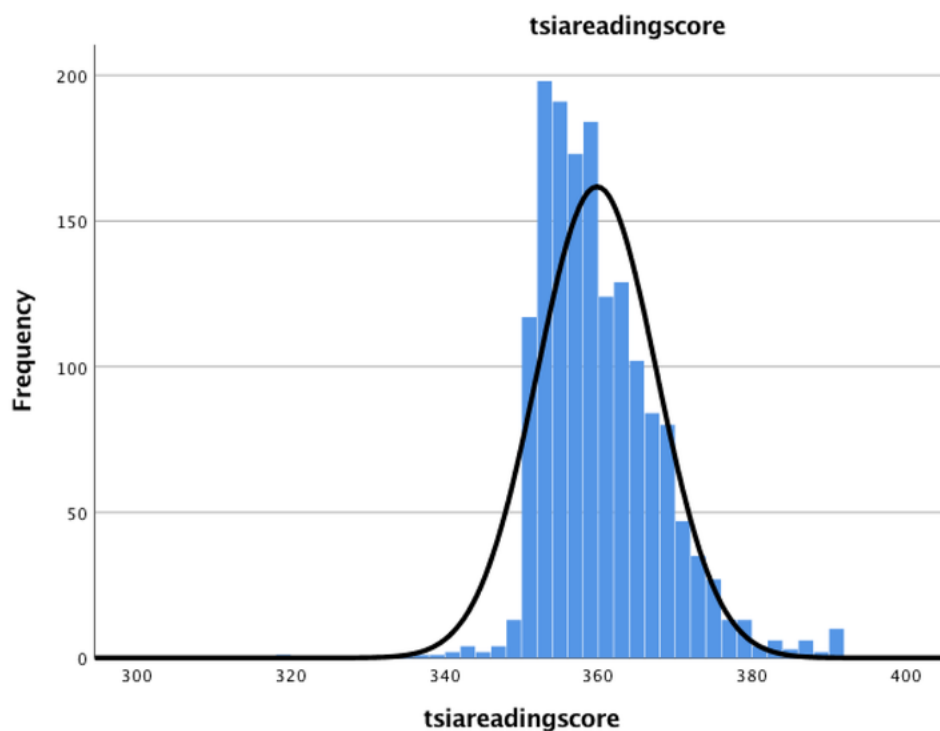
Table 4.2

Descriptive Analysis of Participants' TSIA Reading Scores

	n	Range	Min	Max	Mean	Std. Dev.
TSIA Reading	1577	71	319	390	359.81	7.777

Figure 4.1

TSIA Reading Score Histogram with Normal Curve

tsiareadingscore

The frequencies and percentages for ENGL 1301 grades (and corresponding grade points earned in parentheses) can be found in Table 4.3. The grade distribution is also displayed as a histogram with a normal curve in Figure 4.2. For the statistical tests utilized in this study, I converted grades into grade points to approximate a continuous variable, aligned with Pearson *r* correlation assumptions. It should be noted that the histogram does not indicate a normal distribution of ENGL 1301 grades.
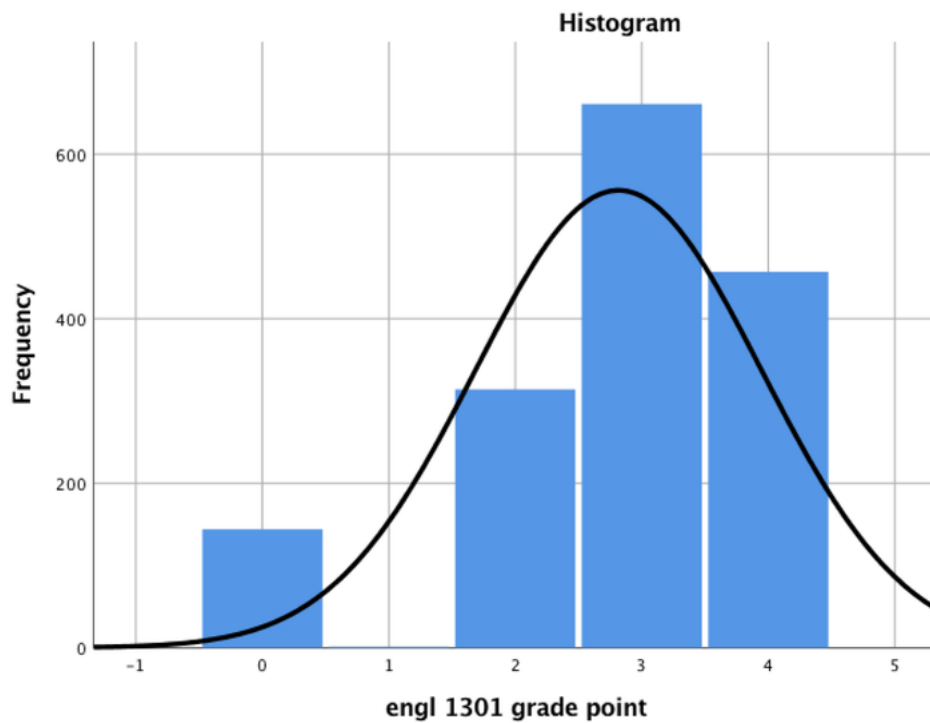
Table 4.3

ENGL 1301 Grade Distribution Frequencies and Percentages

Grade	Frequency	Percent
A (4)	457	29.0
B (3)	661	41.9
C (2)	314	19.9
D (1)	1	0.1
F (0)	144	9.1

Figure 4.2

ENGL 1301 Grades Histogram with Normal Curve

Cross-Tabulation and Chi-Squared Analysis

I created a cross-tabulation table to examine the number of students who passed or failed their TSIA reading exam in comparison to the number of students who passed or failed the

subsequent first-year, credited English course (ENGL 1301). The results of this cross tabulation can be found in Table 4.4.

Table 4.4

Cross-Tabulation for ENGL 1301 and TSIA Reading

		ENGL 1301		
		Fail	Pass	Total
TSIA-R	Fail	4	28	32
	Pass	141	1404	1545
	Total	145	1432	1577

According to the information contained in Table 4.4, of the 32 students who failed their TSIA reading exam (and were therefore projected to fail the credit-bearing freshman English class due to lack of readiness for college-level English) 28 of them, or 87.5% went on to pass ENGL 1301. Therefore, only 12.5% of the students with a failing TSIA reading score also failed the credited class. Additionally, of the 1,545 students enrolled in ENGL 1301 who passed their TSIA reading exam, 90.9% passed the class as projected by their exam results, but 9.1% of the students projected to be ready to take and pass ENGL 1301 did not do so.

In order to determine if a statistically significant relationship exists between TSIA reading scores and ENGL 1301 course results, I performed a chi-squared test of independence with students' course results as the dependent variable and their TSIA reading results as the independent variable. Both variables were considered as pass/fail. The results of the chi-squared analysis are shown in Table 4.5.

Table 4.5

Results of Chi-squared Test of Independence for TSIA Reading and ENGL 1301

	Value	_df_	Asymptotic Significance (2-sided)	Exact Significance (2-sided)
χ^2	.427[a]	1	.513	
Continuity Correction	.199	1	.730	
Likelihood Ratio	.389	1	.533	
Fisher's Exact Test				.529
Linear-by-Linear Association	.427	1		
_n_ of valid cases	1577			

a.   1 cells (25.0%) have expected count less than 5. The minimum expected count is 2.94

The results of the chi-squared analysis show a _p_ value greater than .05, so I concluded that there is not a statistically significant relationship between student results on the TSIA reading exam and whether they pass or fail ENGL 1301, $\chi^2 = (1, n = 1577) = .43, p = .51$. However, the data for this analysis violated the assumption that the value of each expected cell should be 5 or more in 80% of the cells and no cell have less than one (McHugh, 2013). Since the chi-squared analysis was based on a 2x2 matrix with one of the cells having a value less than 5, it is important to adjust for this violation. McHugh (2013) explained that when this assumption of chi-squared is violated, and a 2x2 table is being analyzed, the likelihood ratio should be examined. This test gave a likelihood ratio of $\chi^2 = (1, n = 1577) = .39, p = .53$. As the _p_ value for the likelihood ratio is greater than .05, this supports the conclusion drawn from the original chi-squared test that there is no statistically significant relationship between the variables.

Correlation Analysis

After completing the cross-tabulation and chi-squared analyses, I performed a Pearson _r_ correlation with the raw scores for the TSIA reading test and course grades in ENGL 1301 to see if the results would support the findings from the chi-squared analysis. In order to be utilized in

the correlation analysis, ENGL 1301 course grades were converted into numeric values, with A = 4, B = 3, C = 2, D = 1, and F = 0. The grade 'D' was utilized as a failing grade. TSIA reading scores were left as their raw value, and ranged from 319 – 390. While the assumption of a normal distribution of data was violated for both variables, Havlicek and Peterson (1977) explain that the Pearson *r* analysis is not sensitive to violations or normality, and the failure to meet this assumption has little to no effect on the results, particularly with larger samples such as that utilized in the present study. The results of the Pearson *r* correlation are shown in Table 4.6.

Table 4.6

Results of Pearson r correlation for TSIA Reading and ENGL 1301 Grades

Correlation	Significance	*n*
.031	.221	1577

The results of the Pearson *r* correlation shown in Table 4.6 support the finding from the chi-squared analysis, *r* = .03, *p* = .22. Namely, there exists no statistically significant relationship between the score student receive on their TSIA reading exam and the final grade they earn in their first-year, credited English class (ENGL 1301). This is in line with research that suggests that high-stakes testing has little to no correlation achievement in English-Language Arts, as explained by Nichols, Glass, and Berliner (2012) in their literature review. As there was only a single observation with a grade of 'D,' the analyses were not rerun using 'D' as a passing grade. In addition, because there was no significance found in either the chi-squared analysis nor the Pearson *r* correlation, I did not perform a logistic regression.

Credit-Bearing Mathematics and TSIA Math

The dataset obtained from the university contained 1,703 participants who conformed to the selection criteria laid out in this study – that they began their postsecondary education on or after fall 2013, had a recorded TSIA mathematics exam score, received a usable final grade in their first enrollment of their credited freshman-level math class (MATH 1301, 1302, or 1315), that they had not completed any developmental education classes prior to their credited course enrollments, and that there be fewer than 250 days between their TSIA exam and their math class enrollment. The descriptive characteristics of these 1,703 students can be found in Table 4.7.

Table 4.7

Descriptive Characteristics as a Percentage of the Sample for MATH Classes

Descriptive	Frequency	Percent
Race/ethnicity		
American Indian/Alaska Native	2	0.1
Asian	235	13.8
Black/African American	279	16.4
Hispanic/Latino	721	42.3
Native Hawaiian/Other Pacific Islander	1	0.1
White	285	16.7
Multiple Ethnicities	59	3.5
Foreign	120	7.0
Not Specified	1	0.1
Gender		
Female	1043	61.2
Male	660	38.8
Family Income		
Less than $20,000	240	14.1
$20,000 - $39,999	365	21.4
$40,000 - $59,999	330	19.4
$60,000 - $79,999	192	11.3
$80,000 - $99,999	142	8.3
$100,000 - $149,999	180	10.6
$150,000 - $199,999	71	4.2

More than $200,000	70	4.1
Not Reported	112	6.6
Highest Parent Education Level		
No high school	162	9.5
Some high school, no diploma	160	9.4
HS diploma, GED, home school	241	14.2
Some college, no degree	226	13.3
Associate's degree	117	6.9
Bachelor's/Four-year degree	296	17.4
Graduate/Professional degree	168	9.9
Unknown/Not reported	333	19.5

Table 4.7 shows the descriptive characteristics as both frequency and percentage of the sample. It is important to note that the percentage of white students (16.7%) is far below the 2010 Texas census percentage of 46.0%, while the African American and Hispanic/Latino numbers (16.4% and 42.3%) are higher than their census counterparts of 11.5% and 37.6%, respectively (Texas Department of State Health Services, 2015). This echoes what was seen in the participants included in the reading analyses. Additionally, the percentage of female students (61.2%) is significantly higher than their census proportion, 50.3% (U.S. Census Bureau, 2019)

For the 1,703 students used in the analyses for mathematics, 1,673 passed their TSIA reading exam and 30 did not. Scores ranged from a low of 319 to a high of 390, with a mean of 357.07 and a standard deviation of 6.79. The averages and standard deviations for the exam can be found in Table 4.8. It should be noted that the average score is higher than the "college-ready" cut score of 350. The individual scores on the exam are also displayed as a histogram against a normal curve in Figure 4.3.
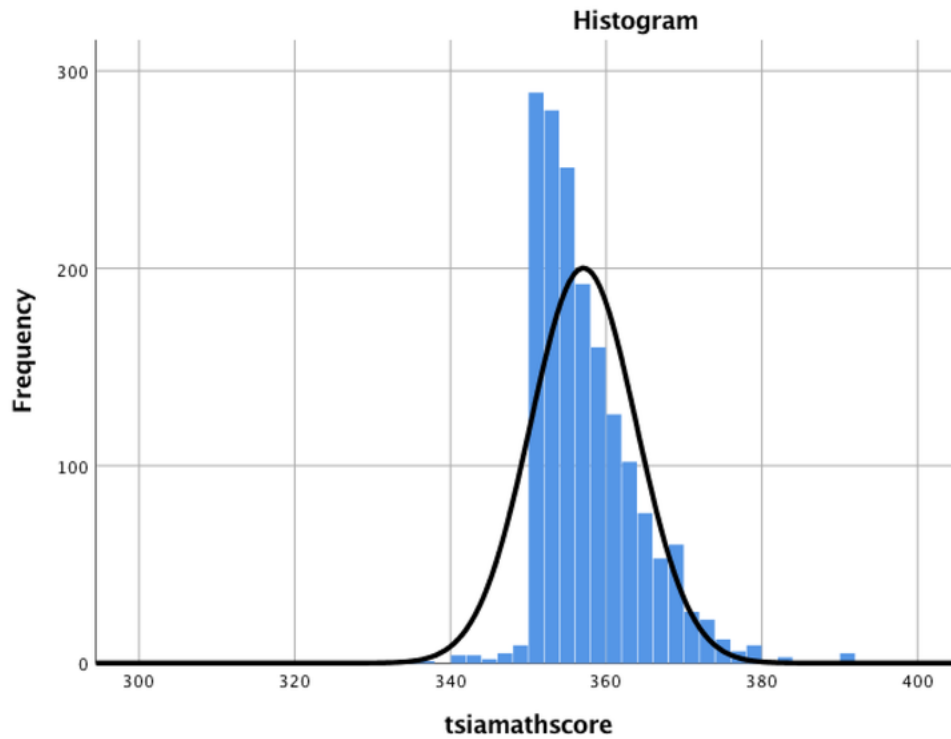
Table 4.8

Descriptive Analysis of Participants' TSIA Mathematics Scores

	n	Range	Min	Max	Mean	Std. Dev.

TSIA Math	1703	71	319	390	357.07	6.787

Figure 4.3

TSIA Math Score Histogram with Normal Curve

The frequencies and percentages for math grades can be found in Table 4.9. The grade distribution is also displayed as a histogram against a normal curve in Figure 4.4. For the statistical tests utilized in this study, I converted grades into grade points to approximate a continuous variable, aligned with Pearson *r* correlation assumptions. It should be noted that the histogram does not indicate a normal distribution of ENGL 1301 grades.

Table 4.9

Math Grade Distribution Frequencies and Percentages

Grade	Frequency	Percent

A (4)	322	18.9
B (3)	536	31.5
C (2)	434	25.5
D (1)	167	9.8
F (0)	244	14.3

Figure 4.4

Math Grades Histogram with Normal Curve
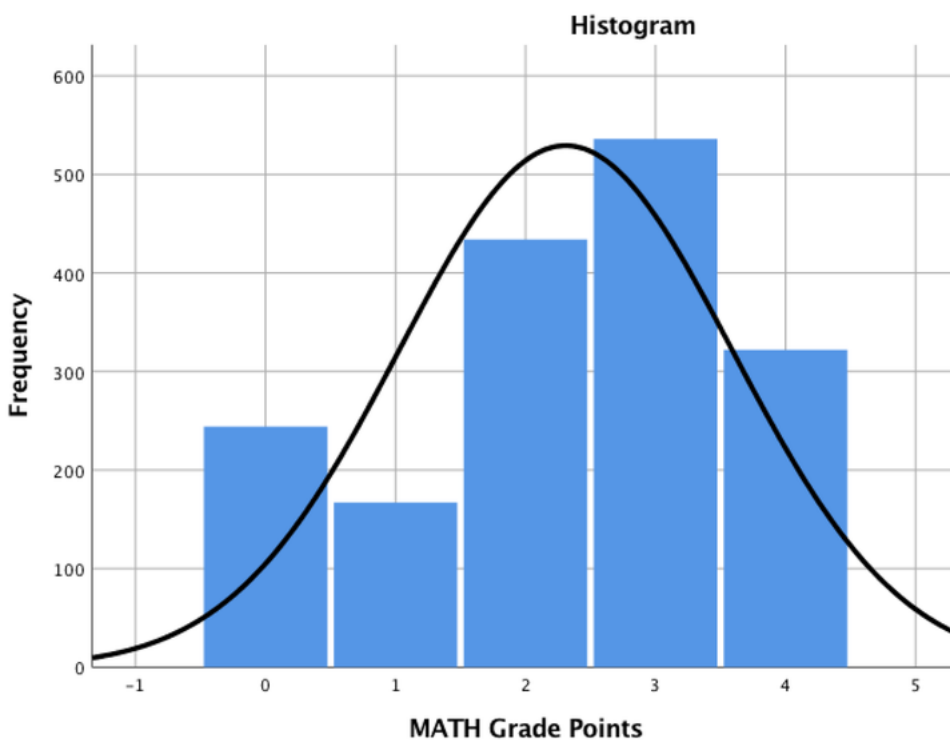
Cross-Tabulation and Chi-Squared Analyses

I created cross-tabulation tables to examine the relationship between passing or failing the TSIA mathematics exam and passing or failing the credit, first-year math course. Since 167 students earned a 'D' in their credited mathematics course, cross-tabulation and chi-square analyses were performed using 'D' as a passing grade and then again as a failing grade. I did this

to see if there was a difference in the results when utilizing the College Board definition of success (earning a 'C-' or better in the class) or when considering a 'D' as a passing grade, as the study site does.

      'D' as a failing grade. I used a cross-tabulation table to examine the number of students who passed or failed their TSIA mathematics exam in comparison to the number of students who passed or failed their subsequent first-year, credited mathematics course (MATH 1301, 1302, or 1315). For this analysis, the grade of a 'D' was considered failing. The results of this cross tabulation can be found in Table 4.10.

Table 4.10

Cross-Tabulation for Credit-Bearing Math and TSIA Mathematics with D as Failing

		Credited MATH		
		Fail	Pass	Total
TSIA-M	Fail	8	22	30
	Pass	403	1270	1673
	Total	411	1292	1703

      According to the information contained in Table 4.10, of the 30 students who failed their TSIA math exam (and were therefore projected to fail their credit-bearing freshman math class due to lack of readiness for college-level math) 22 of them, or 73.3% went on to pass their credit-bearing mathematics course. Therefore, only 26.7% of the students with a failing TSIA math score also failed the credited class. Additionally, of the 1,673 students enrolled in a credited math class who passed their TSIA math exam, 75.9% passed the class as projected by their exam results, but 24.1% of the students projected to be ready to take and pass a credit-bearing math course did not do so.

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In order to determine if a statistically significant relationship exists between TSIA math scores and course results in the three credited math classes, I used a chi-squared test of independence with students' course results as the dependent variable and their TSIA mathematics results as the independent variable. Both variables were considered as pass/fail. The results of the chi-squared analysis are shown in Table 4.11.

Table 4.11

Results of Chi-squared Test of Independence for TSIA Mathematics and Credit-Bearing Math with D as Failing Grade

	Value	*df*	Asymptotic Significance (2-sided)	Exact Significance (2-sided)
χ^2	.107[a]	1	.744	
Continuity Correction	.013	1	.911	
Likelihood Ratio	.105	1	.746	
Fisher's Exact Test				.829
Linear-by-Linear Association	.107	1	.744	
N of valid cases	1703			

a.   0 cells (0.0%) have expected count less than 5. The minimum expected count is 7.24

The results of the chi-squared analysis show a *p* value greater than .05, so I concluded that there is not a statistically significant relationship between student results on the TSIA mathematics exam and whether they pass or fail credit-bearing math, $\chi^2 = (1, n = 1703) = .11$, *p* = .74.

'D' as a passing grade. I created a second cross-tabulation table to examine the number of students who passed or failed their TSIA mathematics exam in comparison to the number of students who passed or failed their subsequent first-year, credited mathematics course (MATH

1301, 1302, or 1315). For this second cross-tabulation, the grade of a 'D' was considered passing. The results of this cross tabulation can be found in Table 4.12.

Table 4.12

Cross-Tabulation for Credit-Bearing Math and TSIA Mathematics with D as Passing

		Credited MATH		
		Fail	Pass	Total
TSIA-M	Fail	7	23	30
	Pass	237	1436	1673
	Total	244	1459	1703

According to the information contained in Table 4.12, of the 30 students who failed their TSIA math exam (and were therefore projected to fail their credit-bearing freshman math class due to lack of readiness for college-level math) 23 of them, or 76.7% went on to pass their credit-bearing mathematics course. Therefore, only 23.3% of the students with a failing TSIA math score also failed the credited class. Additionally, of the 1,673 students enrolled in a credited math class who passed their TSIA math exam, 85.8% passed the class as projected by their exam results. However, 14.2% of the students projected to be ready to take and pass a credit-bearing math course did not do so.

In order to determine if there exists a statistically significant relationship between TSIA math scores and course results in the three credited math classes, I used a chi-squared test of independence with students' course results as the dependent variable and their TSIA mathematics results as the independent variable. Both variables were considered as pass/fail, with a 'D' utilized as a passing grade.. The results of the chi-squared analysis are shown in Table 4.13.

Table 4.13

Results of Chi-squared Test of Independence for TSIA Mathematics and Credit-Bearing Math

with D as Passing Grade

	Value	*df*	Asymptotic Significance (2-sided)	Exact Significance (2-sided)
χ^2	2.018[a]	1	.155	
Continuity Correction	1.340	1	.247	
Likelihood Ratio	1.754	1	.185	
Fisher's Exact Test				.182
Linear-by-Linear Association	2.017	1	.156	
n of valid cases	1703			

a. 1 cells (25.0%) have expected count less than 5. The minimum expected count is 4.30

The results of the chi-squared analysis show a *p* value greater than .05, so I concluded that there is not a statistically significant relationship between student results on the TSIA mathematics exam and whether they pass or fail credit-bearing math, $\chi^2 = (1, n = 1703) = 2.02$, $p = .16$. However, the data for this analysis violated the assumption that the value of each expected cell should be five or more in 80% of the cells and no cell have less than one (McHugh, 2013). Since the chi-squared analysis was based on a 2x2 matrix with one of the cells having a value less than five, it is important to adjust for this violation. As with the reading analysis, when this assumption of chi-squared is violated, and a 2x2 table is being analyzed, the likelihood ratio should be examined (McHugh, 2013). This test gave a likelihood ratio of $\chi^2 = (1, n = 1703) = 1.75$, $p = .19$. As the *p* value for the likelihood ratio is greater than .05, this supports the conclusion drawn from the original chi-squared test that there is no statistically significant relationship between the variables. The chi-squared results from considering a final class grade of a 'D' as passing were the same as using 'D' as a failing result – no statistical significance.

Correlation Analysis

   After completing the cross-tabulation and chi-squared analyses, I examined the raw scores for the TSIA mathematics test and correlated them with the associated course grades in credit-bearing math. For this analysis, math course grades were converted into numeric values, with A = 4, B = 3, C = 2, D = 1, and F = 0. TSIA mathematics scores were left as their raw value and ranged from 319 – 390. While the assumption of a normal distribution of data was violated for both variables, as in the reading analysis, failure to meet the assumption of normality has little to no effect on the results (Havlicek & Peterson, 1977), especially with larger samples as in the present study. The results of the Pearson *r* correlation are shown in Table 4.14.

Table 4.14

Results of Pearson r correlation for TSIA Mathematics and Credit-Bearing Math Grades

Correlation	Significance	N
.276[**]	.000	1703

[**]. Correlation is significant at the 0.01 level (2-tailed)

   The results of the Pearson *r* correlation shown in Table 4.14 did not support the findings from the chi-squared analysis. While the chi-squared test showed no significance in the relationship between overall binary pass/fail for the test and pass/fail of the class, the Pearson *r* correlation demonstrates that the numeric achievement for both variables do, in fact, move together. The correlation analysis shows a significant relationship between the score students' receive of their TSIA mathematics exam and the final grade they earn in their first-year, credited mathematics classes, $r = .28$, $p < .001$. The value of the correlation coefficient indicates that the two variables have a small correlation (i.e. a small linear relationship). It also indicates that the variables tend to change in the same direction. In particular, students who score higher on their

TSIA mathematics exam are more likely to receive a higher final course grade in their first-year, credited math class. This finding matches prior research conducted by Nichols, Glass, & Berliner (2012). They explained that their review of the literature indicated that testing results have little correlation to achievement in mathematics.

Logit Analysis

Since the correlation analysis showed a small, positive relationship between student score on the TSIA mathematics exam and their final course grade in their first-year math class, I followed the correlation test with a logistic regression. Course result (pass or fail) was used as the dependent variable. I calculated variance inflation factors (VIFs) for all independent variables: gender, race/ethnicity, parent income, parent education, and admission test score. Any variable with a VIF over 10 would have been excluded from the model. None of the independent variables had VIF values close to 10; the highest was 1.24 between gender and parent level of income. Therefore, all independent variables could be included in the regression model. However, descriptive analysis showed that almost 20% of the participants did not have a reported parent education level, which would need to be treated as missing data and subject to case-wise deletion. As the general rule-of-thumb is that no more than 10% of observations have missing values, I did not include parent education in the regression. I created two different models to confirm that I was seeing all significant relationships within my data. The first model utilized all variables in the groups provided by the institution in order to maintain precision in my analysis and try to account for any significance within my variables. The second model consolidated the data into fewer groups in an effort to obey the rule of parsimony. Having both models allowed me to compare and determine if one was a significant improvement over the other.

Model 1: All groups. I began by running the logistic regression using the data as provided by the study site. Because there was only one participant for each of the race/ethnicity groups "Native Hawaiian" and "not specified," and only two participants in the "American Indian/Alaska Native" group, they were placed into a single group labeled "Other." All other variable groups were left as defined by the university. Each of the categorical variables (race/ethnicity, gender, and parent income) was dummied, and the group with the largest number of participants was used as the reference group (Hispanic/Latino, Female, and $20,000 - $39,999). A little over six percent of students did not report parent income, and were therefore excluded from the analysis.

I used several values for pseudo R^2 to assess the overall model fit, as each assesses a different aspect of the model fit. I present the two most commonly reported pseudo R^2 values, the Cox-Snell and Nagelkerke versions of pseudo R^2, as well as Tjur's coefficient of discrimination (Tjur's *D*). The Cox and Snell value for the logistic regression is $R^2_{CoxandSnell} = 0.055$ and the Nagelkerke value is $R^2_{Nagelkerke} = 0.082$. Both of these measures of pseudo R^2 are meant to show the degree to which the created model (a model with the independent variables) is an improvement to the predictability of the null model (UCLA Institute for Digital Research and Education, 2011). The null model is one that does not use independent variables, therefore the predicted dependent variable is the mean of all values of this variable. A higher pseudo R^2 value indicates a greater improvement over the null model (UCLA Institute for Digital Research & Education, 2011). The Nagelkerke pseudo R^2 is a rescale of the Cox and Snell pseudo R^2 to achieve an upper bound of 1.00. Both the Cox and Snell and Nagelkerke pseudo R^2 values are small, demonstrating that the overall logistic regression model does not display much of an improvement over the null model.

Tjur's D provides an intuitive representation of the model's predictive ability by subtracting the mean predicted value for course failers from the mean predicted value for the course passers (Allison, 2013). The higher the Tjur's D, the better the model does at predicting outcomes (Williams, 2018). For this logistic regression model, the mean predicted value for the students who passed the course was 0.78 and the value for the students who failed the course was 0.72, making the difference between them 0.06; roughly equivalent to the Cox and Snell and lower than the Nagelkerke values of pseudo R^2. The low value for Tjur's D suggests that this model has low explanatory power. In addition, the Pearson χ^2 statistic for the Hosmer-Lemeshow test is $\chi^2 = 7.30$, $p = .51$. This tests the extent to which the fitted model reproduces the observed data. A p-value greater than .05, as seen here, indicates the model fits the data well (Allison, 2013). However, it is important to bear in mind that the Hosmer-Lemeshow χ^2 is very sensitive to small discrepancies in large samples (Paul, Pennell, & Lemeshow, 2012).

In Table 4.15, I present the logarithmic coefficients, odds ratios (exponentiated versions of the raw coefficients), standard errors, Wald statistics, and p-values (significance). The predictors significant at the $p < .01$ level were standardized score on TSIA math and race/ethnicity, including Black/African American and White. This binary logistic regression shows that for a one standard deviation increase in TSIA mathematics exam score, the odds of passing the credit-bearing freshman math course increase by a factor of 1.80, $p < .001$. In other words, students that score one standard deviation above the mean of TSIA mathematics are nearly twice as likely to pass the credited first-year math class than students scoring at the mean. Therefore, I concluded that, when controlling for other independent variables known to have an effect on academic performance, a student's score on his or her TSIA math test does have a positive effect on their likelihood of passing the credited math class. This central finding aligns

with the previous validity study conducted by Cui and Bay (2016). Black/African American and White students were less likely to pass the credited math course than Hispanic/Latino students, with odds ratios of .631 and .552, respectively, when controlling for all other variables.

Table 4.15

Logistic Regression Model 1 of Passing First-Year Credit-Bearing Math on the Major Study Variables

Variables	Coefficient	Odds Ratio	Std. Err.	Wald	Sig.
Race/ethnicity (ref: Hispanic/Latino)				16.931	.010**
Asian	.049	1.050	.204	.058	.810
Black/African American	-.461	.631	.177	6.803	.009**
Foreign	-.069	.933	.376	.034	.855
Multiple Ethnicities	-.697	.498	.328	4.510	.034*
Other	-.474	.623	1.177	.162	.687
White	-.595	.552	.200	8.881	.003**
Male	-.317	.728	.131	5.831	.016*
Parent Income (ref: $20,000 - $39,999)				15.957	.043*
Less than $20,000	.270	1.310	.259	1.089	.297
$40,000 - $59,999	.851	2.341	.416	4.183	.041*
$60,000 - $79,999	.352	1.422	.196	3.224	.073
$80,000 - $99,999	.119	1.126	.226	.275	.600
$100,000 - $149,999	.701	2.017	.423	2.754	.097
$150,000 - $199,999	.458	1.581	.250	3.375	.066
More than $200,000	-.212	.809	.204	1.084	.298
TSIA Math Standardized	.585	1.795	.121	23.480	.000***
Admissions Test Score Standardized	.134	1.144	.069	3.839	.050*

*$p < .05$. **$p < .01$. ***$p < .001$

All other variables in the model were not significant at the $p < .01$. However, it is of note that students who identified as multiple ethnicities were significant at the $p < .05$ level, with an odds ratios of .498 less likely to pass the credited course than their Hispanic/Latino peers. Students who report a parent income level of $40,000 - $59,999 were 2.341 times more likely to

pass the credited course than those whose parent's earn $20,000 - $39,999. This finding supports

prior research showing the students from families with higher income levels tend to perform

better in school (e.g. Reardon, 2013; Ross et al., 2012; Sirin, 2005). Males were .728 times less

likely to pass credit-bearing math than females. Additionally, for a one standard deviation

increase in admissions test score, the odds of passing the credit-bearing freshman math course

increase by a factor of 1.144, $p = .050$. In other words, students that score one standard deviation

above the mean on their admissions exam are 1.144 times more likely to pass the credited first-

year math class than students scoring at the mean.

Model 2: Consolidated groups. In order to ensure that I was seeing all significant

relationships within my data, I built a second logistic regression model that collapsed the large

number of terms in the original model into fewer levels. This enabled me to compare the two

models and determine if there was a substantive fit improvement when utilizing fewer terms. I

collapsed the race/ethnicity groups from eight to five, using Asian, Black, Latino, White, and

Other as my groups. The group "other" was comprised of students who were coded as American

Indian/Alaska Native, Native Hawaiian/Other Pacific Islander, Foreign, Multiple Ethnicities, and

Not Specified. I turned parent income from nine groups into two groups by dividing the students

who had a parent income level reported into two – 54.9% of my participants had parents earning

below $60,000, while 38.5% had parents earning $60,000 or more. The remaining 6.6% did not

report a parent income level or reported parent income as "unknown", and were therefore

excluded from the analysis. As with the first model, each of these categorical variables was

dummied, along with gender, and the group with the largest number of participants was used as

the reference. For this model, the largest groups were Hispanic/Latino, income less than $60,000,

and female.

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As with the first model, I examined several values for pseudo R^2 to assess the overall model fit. I present the two most commonly reported pseudo R^2 values, the Cox-Snell and Nagelkerke versions of pseudo R^2, as well as Tjur's coefficient of discrimination (Tjur's *D*). The Cox and Snell value for the second logistic regression is $R^2_{CoxandSnell} = 0.046$ and the Nagelkerke value is $R^2_{Nagelkerke} = 0.070$. Both of these measures of pseudo R^2 are still providing information about the degree to which the created model is an improvement to the predictability of the null model (UCLA Institute for Digital Research and Education, 2011). Keep in mind that a higher pseudo R^2 value indicates a greater improvement over the null model (UCLA Institute for Digital Research & Education, 2011). Both the Cox and Snell and Nagelkerke pseudo R^2 values for the second model are smaller, even more so than those in the first model, demonstrating that the overall logistic regression model does not display substantial improvement over the null model and that the second is not an improvement over the first.

As in model one, Tjur's D provides an intuitive representation of the model's predictive ability by subtracting the mean predicted value for students who failed their credit math course from the mean predicted value for students who passed the course (Allison, 2013). Recall that the higher the Tjur's D, the better the model does at predicting outcomes (Williams, 2018). For this logistic regression model, model two, the mean predicted value for the students who passed the course was 0.78 and the value for the students who failed the course was 0.73, making the difference between them 0.05. Just like with model one, Tjur's D is roughly equivalent to the Cox and Snell and lower than the Nagelkerke values of pseudo R^2, and its low value implies that this model has little explanatory power. The Pearson χ^2 statistic for the Hosmer-Lemeshow test for the second model is $\chi^2 = 7.318$, p = .503. This tests the extent to which the fitted model reproduces the observed data. A *p*-value greater than .05, as seen here, indicates the model fits

the data well (Allison, 2013). However, recall that the Hosmer-Lemeshow χ^2 is very sensitive to small discrepancies in large samples (Paul, Pennell, & Lemeshow, 2012).

In Table 4.16, I present the logarithmic coefficients, odds ratios (exponentiated versions of the raw coefficients), standard errors, Wald statistics, and *p*-values (significance) for the second regression model. The only predictors significant at the *p* < .01 level for the second regression model were standardized score on TSIA math, and the races of Black/African American and White. This binary logistic regression shows that for a one standard deviation increase in TSIA mathematics exam score, the odds of passing the credit-bearing freshman math course increase by a factor of 1.81, *p* < .001. In other words, students that score one standard deviation above the mean of TSIA mathematics are nearly twice as likely to pass the credited first-year math class than students scoring at the mean. Therefore, I concluded that, when controlling for other independent variables known to have an effect on academic performance, a student's score on his or her TSIA math test does have a positive effect on their likelihood of passing the credited math class. This central finding aligns with the conclusion about TSIA math scores from the first model and with the previous validity study conducted by Cui and Bay (2016). Additionally, Black/African American and White students were less likely to pass the credited math course than Hispanic/Latino students, with odds ratios of .630 and .567, respectively, when controlling for all other variables

Table 4.16

Logistic Regression Model 2 of Passing First-Year Credit-Bearing Math on the Major Study Variables

Variables	Coefficient	Odds Ratio	Std. Err.	Wald	Sig.

Race/ethnicity (ref: Hispanic/ Latino)				15.174	.004**
Asian	.059	1.061	.203	.086	.770
Black/African American	-.463	.630	.176	6.925	.008**
Other	-.427	.653	.253	2.843	.092
White	-.567	.567	.193	8.650	.003**
Male	-.310	.733	.131	5.648	.017*
Parent Income (ref: Less than $60,000)				8.169	.017*
$60,000 or more	.239	1.270	.138	2.999	.083
TSIA Math Standardized	.594	1.810	.120	24.619	.000***
Admissions Test Score	.131	1.141	.068	3.730	.053

*$p < .05$. **$p < .01$. ***$p < .001$

Like the first model, gender was significant at the $p < .05$ level. Specifically, males were .733 times less likely to pass their credit-bearing math course than females. Unlike the first model, standardized admission exam score was not significant, even at the $p < .05$ level.

Summary

In this chapter, I reviewed the purpose and research questions for this study and I analyzed the two research questions in terms of both reading and mathematics. For reading, I presented the descriptive statistics for the participants, as well as the findings of the chi-squared and correlation analyses. Since both the chi-squared and Pearson r correlation tests showed no relationships between the variables of interest (student score on TSIA reading and performance in ENGL 1301), I did not conduct a logistic regression. For mathematics, I presented the descriptive statistics for the participants and the results of the chi-squared and Pearson r correlation tests. The cross-tabulation and chi-squared tests were run twice, once using 'D' as a failing grade and a second time, using 'D' as a passing grade. While neither chi-squared test indicated a significant relationship between the variables of student result on TSIA math and performance in credit-bearing math classes, the Pearson r correlation did. Therefore, I completed two logistic regression models, one with all variables utilized as provided by the study institution

and a second which consolidated the variable groups to determine if there was a substantive fit improvement when utilizing fewer terms. All independent variables were analyzed for variance inflation factors (VIFs). None displayed high enough values to be eliminated from the logistic regression models. However, since a large percentage of the participants (almost 20%) did not report a parent education level, that variable was excluded from the models. The results of both logistic regression models showed that student standardized score on the TSIA math exam was significant at the $p < .01$ level, as were the races of Black/African American and White, with a one standard deviation increase in TSIA math score equaling a higher likelihood of passing the credited math course and both Black and White students being less likely to pass than their Hispanic/Latino peers. Both models also showed gender as significant at the $p < .05$ level, with males less likely to pass their credit-bearing math course than females. Additionally, model one showed parent income of $40,000 - $59,999 and standardized admission test score as significant at the $p < .05$ level. No other variables showed significance in either model.

In the final chapter of this dissertation, I discuss the implications of my findings with considerations for policy, practice, and future research. Additionally, I position these findings in regards to Fuhrman's Systems Coherence and Alignment Theory introduced in chapter two. Chapter five concludes with an overall contribution of this study to educational literature.

Chapter Five

Implications

According to Fuhrman's Coherence and Alignment Theory (1993), policy instruments should be aligned to desired student outcomes. Further, student performance must be monitored to ensure that education policy remains coherent (Fusarelli & Johnson, 2004). This study, therefore, serves as a monitor of student performance on the Texas Success Initiative Assessment exams, independent of the assessment creator, College Board. These tests are the current required instrument of Texas' standardized exam policy for postsecondary course placement. The proposed outcome of these exams is to identify students' strengths and weaknesses in reading and mathematics in order to place them into appropriate college-level classes that will enable them to eventually complete their postsecondary certificate or degree.

In this chapter, I provide a summary of the study along with the findings from my analyses. I then present the practical implications of the findings from the data analysis. Finally, I conclude by presenting ideas for future research, highlighting opportunities for contributions to the literature of the field.

Summary of the Study

While the number of students attending college is projected to increase over the coming years (Digest of Education Statistics, 2017; National Center for Education Statistics, 2018), many students may not be prepared to successfully complete a postsecondary degree (Greene & Winters, 2005; Porter & Polikoff, 2012; Royster, Gross, & Hochbein, 2015). Postsecondary institutions enroll any students deemed underprepared in developmental courses to prepare them for their credit-bearing coursework (Alliance for Excellent Education, 2006; Bailey, Jeong, & Cho, 2010; Horn & Neville, 2006; Scott-Clayton, Costa, & Belfield, 2014). Developmental

classes come with potential complications (Alliance for Excellent Education, 2006; Bailey, Jeong, & Cho, 2010; National Center for Education Statistics, 2004; Strong American Schools, 2008), but they remain a standard component of college course offerings to strengthen the readiness of postsecondary students (Chen & Simone, 2016). Generally, students are enrolled in classes based on placement exam performance (Bailey, Jeong, & Cho, 2010). However, studies show that such exams are often only weakly correlated to course grades and passing rates (Belfield & Crosta, 2012; Jenkins, Jaggars, & Roksa, 2009; Medhanie, Dupuis, LeBeau, Harwell, & Post 2012; Scott-Clayton, 2012). Texas utilizes the Texas Success Initiative Assessments (TSIAs) in mathematics, reading, and writing to govern course placement decisions at postsecondary institutions (Tex Leg Code §51.333) in an effort to fulfill the primary goal of the 60x30 strategic plan. This plan states that by 2030, 60% of Texans ages 25-34 will hold a postsecondary degree or certificate (Texas Higher Education Coordinating Board, 2015).

The purpose of this study was to examine the relationship between the Texas Success Initiative Assessment (TSIA) tests in reading and mathematics and associated content-area course performance in postsecondary education. My goal was to provide data to help determine whether the current implementation of Texas higher education placement exam policy (minimum scores required to demonstrate college-readiness) is linked with correct placement into credit-bearing college classes, as defined by earning a passing grade. The research questions I employed were:

(1) How does student performance on TSIA exams correspond with associated content-area, postsecondary course results?

(2) Does the relationship between TSIA exams and course results, if found, persist in the presence of other factors shown to affect academic performance?

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In pursuit of these research questions, I used passing scores set by College Board to determine student readiness for enrollment in credit-bearing college courses, and postsecondary course results, as determined by final class grade/points. I performed analyses for both reading and mathematics.

Findings

Through descriptive, inferential, correlational, and logit analyses, I found no statistically significant relationship between student score on TSIA reading and ENGL 1301 grade. Because no significance was found in either the chi-squared, $\chi^2 = (1, n = 1577) = .427$, $p = .513$, or Pearson r correlation tests, $r = .031$, n = 1577, $p = .221$, there was no need to conduct a logistic regression. As there was only one student who earned a 'D' in ENGL 1301, I did not rerun the cross-tabulation and chi-squared analyses.

The findings for mathematics were unlike the English. I ran cross-tabulations and chi-squared tests twice, since nearly 10% of students received a 'D' as their final grade in their credit course. Both runs of the chi-squared test indicated no significance in the relationship between passing/failing the TSIA math exam and passing/failing the credited course. Results from using 'D' as a failing grade were $\chi^2 = (1, n = 1703) = .107$, $p = .744$. Results from using 'D' as a passing grade were $\chi^2 = (1, n = 1703) = 2.018$, $p = .155$. However, the Pearson r correlation did show significance, $r = .276$, $p < .001$. Therefore, I built two logistic regression models, one using all the variable groupings provided by the university and a second one that collapsed these variables into fewer groups to determine if one model was a better fit than the other.

Both logistic regression models showed that student standardized score on the TSIA math exam and the races of Black/African American and White were significant at the $p < .01$ level. A one standard deviation increase in TSIA math score resulted in students being nearly twice as

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likely to pass the credit-bearing math class (the odds ratio for model one was 1.80, $p < .001$ and for model two was 1.81, $p < .001$). Black and White students were both approximately 0.55 - 0.63 times less likely to pass the credit math course than their Hispanic/Latino peers.

Additionally, females were more likely than males to pass the credit math course with an odds ratio of .728 for model one and .733 for model two, $p < .05$. Model one also indicated that student score on their admissions exam was significant at the $p < .05$ level. Students who scored one standard deviation above the mean were 1.144 times more likely to pass their first-year math class. Model one also showed that students who reported a parent income of $40,000 - $59,999 were 2.341 times more likely to pass the credit-bearing math course than students who reported a parent income of $20,000 - $39,999. These findings for standardized admission exam score and parent income were not replicated in model two. A comparison of the pseudo R^2 values for the models revealed that a) neither was a particularly substantial improvement over the null model, and b) that the second model was not a substantive improvement over the first.

Practical Implications

Research shows more than 60% of community college students and 40% of four-year college students will enroll in at least one foundational course (Ganga, Mazzariello, & Edgecombe, 2018) and only 17% of students enrolled in remedial reading courses will go on to receive their bachelor's degree within eight years, compared to the 58% of students who are not enrolled in remedial courses (National Center of Education Statistics, 2004). These data underscore the need for this study. If the TSIA exams cannot aid in accurately predicting which students will pass or fail a credit-bearing course, then the ones who are incorrectly placed waste time and money attempting to complete courses and earn their degree. With this issue in mind, the results of this study have several practical implications. In this section, I discuss the financial

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implications of the findings, testing options other than the TSIA exams for assessing college readiness, the practicality of using a single exam to make placement decisions, and the concept of "college readiness."

Financial Implications

My findings in this study imply that the TSIA exams may not always do what they are meant to do - accurately determine whether or not students need developmental coursework. Placement results were fairly well-aligned for students who passed their TSIA exam, but less so for those who failed. In English, over 90% of those projected to pass based on their TSIA exam did so. However, 87.5% of the students predicted to fail due to their TSIA reading results actually passed ENGL 1301. Overall, approximately 10.7% were inaccurately placed into ENGL 1301 based on their TSIA results; they were either projected to pass, but failed, or they were projected to fail, but passed. The numbers for mathematics are even less aligned. Specifically, only 75.9% of those students projected to pass their credited math course did so. And 73.3% of the students predicted to fail instead passed the course. Overall, about 25% of the students placed into one of the three credit-bearing math classes were incorrectly placed based on their TSIA math results.

These findings call into question the number of students who have been placed in developmental coursework based on their TSIA results that may have successfully completed the credit-bearing course. This is a problem, as students not only paid for testing that may inadequately assess their readiness, but also pay in terms of time and tuition due to the resulting erroneous placement (Alliance for Excellent Education, 2006; Strong American Schools, 2008). Postsecondary institutions also bear a cost burden for these assessments, as Rodriguez, Bowden, Belfield, and Scott-Clayton (2015) found that they cover approximately 60% of the annual

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$300,000 to $875,000 cost for the testing. This cost included factors such as personnel, facilities, and grading the exams. The costs of subsequent remedial instruction add to this burden, especially if students are misplaced. The direct cost to colleges of placing students into incorrect coursework based on tests was approximately 10 times what they spend on the actual test (Rodriguez, Bowden, Belfield, and Scott-Clayton (2015). The balance of this placement testing (40%) is carried by the students; calculated by the cost of lost opportunity, using minimum wage values, in time students spend preparing for, commuting to and from, and taking the exams (Rodriguez, Bowden, Belfield, and Scott-Clayton (2015). Many students take out loans to pay for their postsecondary education, including developmental coursework required by placement exam results. In 2016, 56% of Texans graduated with debt averaging $26,292 (Institute for College Access and Success, 2017). The current outstanding education debt in the United States is in excess of $1 trillion (Cilluffo, 2017; Nova, 2018; Stolba, 2019) and 40% of borrowers are expected to default by 2023 (Nova, 2018). For students that drop out of college without completing their degree, paying back loans can become impossible.

Student loan default has major implications for taxpayers, who will bear the brunt of the nonpayment, since their taxes are used to provide the loans. Mitchell (2019) reported that the federal government has admitted that this loss could be up to $31.5 billion over the next decade. Cooper (2016) is less conservative and estimated that cost to be $170 billion - $130 billion for the loss on the actual loans and an additional $40 billion for the administrative costs associated. Knowing that TSIA exams incorrectly placed 10.7% of English students and 25% of math students in this study means that researchers and stakeholders need to examine alternatives to the TSIA exams.

Other Testing Options

Outside of the TSIA examinations, there are other standardized tests that are utilized by various entities to measure students' level of college readiness. For example, Texas public school students are required to complete five State of Texas Assessments of Academic Readiness (STAAR) exams in order to graduate from high school (Tex. Leg. Code §§ 39.023(c); 19 Tex. Admin. Code § 101.3022). Two of these exams are in English (English I and English II) and one is in math (Algebra). Texas already states that these assessments should be capable of determining placement into higher education classes of the same content (Tex. Leg. Code § 39.0232(a)) by measuring student performance using progress and college readiness standards to ensure students will graduate high school ready to perform college-level work at higher education institutions (Cadena, 2014; Texas Education Agency, 2010a).

The Texas Education Agency (2013) published a technical report regarding standard-setting for the STAAR exam. In this report, they explained that Level II performance standards, the minimal "satisfactory" scores (now called "meets grade level"), should eventually be set at reaching 60% of the STAAR questions correct. This proposed final score would be linked to a high school course grade of a 'B' or better and a 60% likelihood of receiving a 'C' or better in college courses. Level III performance standards, the "advanced" scores, are meant to be correlated to a high school course grade of an A and a 75% probability of a C or better in college courses. These STAAR assessments are a potential alternative to the TSIA tests, since they are required for the majority of Texas students (except those that attend private institutions), are readily available since results are reported to the state, and bestow no additional cost burden to either the students or the postsecondary institutions (Kingston & Anderson, 2013).

Also, the majority of students attending institutes of higher education (IHEs) complete admissions testing, typically the SAT and/or ACT exams. Studies have shown some alignment

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between admissions test scores and college GPA (Bridgeman, McCamley-Jenkins, & Ervin, 2000; Ramist, 1984; Ramist, Lewis, & McCamley-Jenkins, 1993; Wilson, 1983), and it may be that these exams are better aligned with student outcomes in credited math and English courses than the TSIA tests.

Testing for College Success

The results of this study showed no relationship between the TSIA reading exam score and student performance in credit-bearing English (ENGL 1301). In addition, I found a small, positive relationship between TSIA mathematics exam score and performance in credit-bearing mathematics courses. These findings align to a review of previous research conducted by Nichols, Glass, and Berliner (2012) that suggested that high-stakes testing has little correlation to math achievement and even less to reading achievement. The findings of this study and prior research may indicate that content knowledge is only one aspect of college success.

Conley (2007, 2012) believed that college success requires content knowledge, learning skills, transition knowledge, and cognitive strategies such as analysis, interpretation, accuracy, precision, problem-solving, and reasoning. He developed a model of college readiness that consists of aspects both external and internal to the school environment. Figure 5.1 below delivers a pictorial representation of this model.

Figure 5.1

Facets of College Readiness

Contextual Skills
and Awareness

Academic
Behaviors

Key Content
Areas

Key Cognitive
Strategies
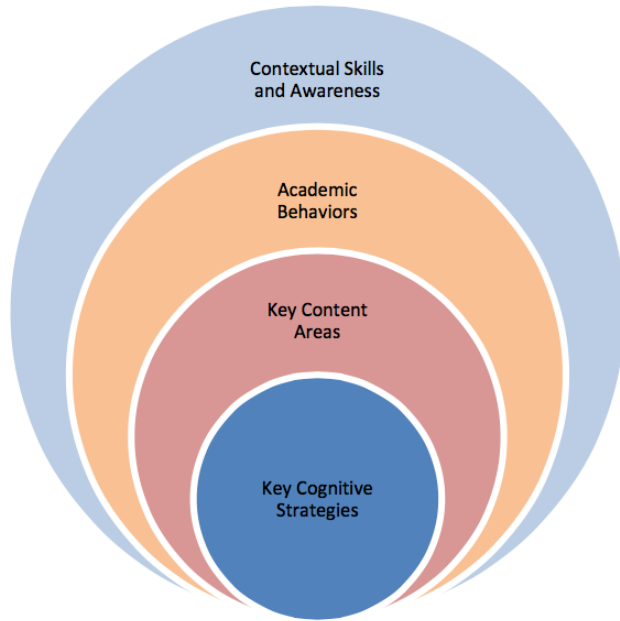
Source: Conley, 2007

At the core of Conley's model are the cognitive and content skills and strategies. These are often measured by utilizing achievement tests, high school grade point averages (GPAs) and class rankings, and rigorous academic preparation generally seen with students partaking in advanced academic courses. Conley views these as the foundation from which students can build their readiness for postsecondary education. With the increased need for students prepared for the rigors and demands of college instruction, more researchers have been examining the knowledge, skills, and behaviors that go beyond the traditional measures of college readiness (Ramsey, 2008), including "measures used to evaluate characteristics such as adjustment, motivation, and student perceptions" (p. 2). Ramsey adds that these valuations "are not measurable using typical standardized tests" (p. 2). Conley (2007) explains that the four aspects of this model should not be interpreted as mutually exclusive; instead, they display continuous and overlapping interactions. As such, the intention of this model is to provide a framework for identifying relevant criteria for university admissions decisions.

The idea of examining both cognitive and noncognitive competencies for college readiness is echoed by Curry (2017), who stated that for attainment in postsecondary education, students need to have strong reasoning and problem-solving skills, not just knowledge of procedures specific to a particular content. Academic behaviors are just as critical to student readiness and potential success as academic knowledge. These activities include a student's ability to self-monitor and exert self-control, as well as their capacity to manage time, construct notes, communicate with professors, make effective use of study groups, and prepare for exams (Collier & Morgan, 2008; Conley, 2007, 2008). Wiley, Wyatt, and Camara (2010) explained that self-monitoring is a critical proficiency for students to have, as it allows them to independently assess their own competency, identify gaps in their knowledge, and adjust their academic learning accordingly. The acquisition of self-monitoring behaviors helps to facilitate the transition from high school into the social and academic demands of college (Collier & Morgan, 2008; Roderick, Nagaoka, & Coca, 2009).

Karp and Bork (2012) explained that weak correlations between placement exam scores (like TSIA) and course grades/passing rates may reflect the fact the college readiness is a combination of many academic and non-academic factors that placement assessments cannot fully capture. Zientek, Yetkiner, Fong, and Griffin (2013) suggested that approximately 40% of the variance in placement test grades is explained by individual traits like motivation, ability to self-regulate, and capacity for assertion. Therefore, it may be more beneficial to examine a variety of student traits, and not just a single exam, when making placement decisions.

What Is College Readiness?

There have been many types of measurement that postsecondary institutions have used to try and indicate college-readiness, including high school GPA, high school class rank, and

college admissions exams (ACT, 2005; Greene & Forster, 2003; Wiley, Wyatt, & Camara, 2010). Some have tried examining the level of rigor of students' high school curriculum, with the idea that a more intense curriculum would mean a higher likelihood of success in college (Adelman, 2006; Attewell & Domina, 2008). However, these metrics only show small correlations to student performance; Strayhorn (2013) found that these conventional measures typically account for roughly 25% of the variance in outcomes, leaving more than 70% unaccounted for. Currently, institutions in Texas use placement exams to determine readiness (Ganga et al., 2018); however, my study of these exams showed evidence that college readiness is not something that can be determined by a multiple-choice exam covering content knowledge. Specifically, variability in student course outcomes as represented by Tjur's D was extremely low: 0.06 for the first logistic regression model and 0.05 for second. This indicated that both models had very low explanatory power and were not capturing all the components affecting student performance in their freshman credited math and English classes. If employing a single multiple-choice exam of content knowledge is not sufficient to determine a student's readiness to be successful in college, as the findings of this study imply, then the next step would be determining which other attributes should be assessed. To do this, it becomes imperative to understand what, exactly, is meant by "college readiness."

The difficulty encountered when finding the best way to determine college readiness is the fact that the term "college readiness" does not have a universally agreed-upon definition among stakeholders (Strayhorn, 2014). Conley (2008) provided two definitions of college readiness. First, he defined it as "the degree to which previous education and personal experiences have equipped [students] for the expectations and demands they will encounter in college" (p. 3). He also offered a second definition, "the level of preparation a student needs in

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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" (p. 4). This second definition is closely aligned with the one utilized by the Texas Education Code, which defines college readiness as the ability for a student to enroll and succeed in an entry-level course in the same content area without remediation (Tex. Leg. Code §39.024, 2018). Colleges and universities generally use standardized tests of content knowledge to determine the readiness level of new students (Chen & Simone, 2016; College Board, n.d.a).

While content knowledge is certainly necessary for college success (and is easily determined via multiple-choice examinations), researchers have also noted the importance of non-content competencies (Collier & Morgan, 2008; Conley, 2007, 2012; Curry, 2017; Roderick, Nagaoka, & Coca, 2009; Wiley, Wyatt, & Camara, 2010). To be successful, students need strong academic behaviors, including time management, note-taking ability, and study skills (Conley, 2007, 2012; Strayhorn, 2014). Bitton and Tesser (1991) found that planning and time management were significant predictors of college success, adding 21% to the variance in college outcomes when controlling for SAT scores. A qualitative study conducted by Bryd and MacDonald (2005) found that students identified time management, knowledge of the college system, and focus on their goals among the significant factors to their success. In addition to content knowledge and academic behaviors, researchers have pointed to the importance of social integration and students' sense of belonging (Strayhorn, 2019; Tinto, 1993; Wilson et al., 2014). Strayhorn (2019) explained that students cannot focus on advanced needs like belonging and engagement on campus until they have their basic needs fulfilled. Tinto (1993) pointed out how social bonds felt by students can impact their retention and, eventually, graduation by affecting their expectations, intentions, commitments, and overall goals. When students feel satisfied with

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their lives and connections in an educational setting, they are more willing to engage in more mundane tasks which can enhance educational persistence and degree attainment (Noyens, Donche, Coertjens, van Daal, & Van Petegem, 2019).

Additionally, students' engagement in their own learning at the postsecondary level has been shown to be positively related to academic outcomes (Richardson, Abraham, & Bond, 2012), and Conley (2007) explained that motivation for engagement must be both emotional and cognitive in nature. Tapia and Marsh (2000) found that students' math grades were correlated to noncognitive parameters such as motivation, self-confidence, value, and enjoyment of math. Likewise, House (1996) determined that student achievement in college courses, particularly math, was significantly predicted by expectations and academic self-concept. However, motivation is not a static concept, and prior research asserts that motivation levels can change during and after the transition from high school to college (Kyndt et al., 2015; Pan & Gauvain, 2012). Contextual knowledge, or sociocultural capital, is another area that can influence students' ability to be successful in a postsecondary setting (Bowles, 1972; Conley, 2007, 2012; Davies & Rizk, 2018; Sacks, 2009). Strayhorn (2014) found that talking to parents, siblings, and/or faculty about college and academic matters were all positively related to college readiness and Ramsey (2008) explained that studies of the relationships between noncognitive aspects of education and student outcomes show that support and encouragement from parents positively influences college persistence for multiple student groups. A meta-analysis of more than 100 studies concluded that contextual elements were linked to both student GPA and retention (Robbins et al., 2004).

However, noncognitive characteristics such as academic behaviors, motivation, and contextual knowledge may prove difficult to measure readily, making them cumbersome for use

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in calculating "readiness" (Klasik & Strayhorn, 2018). It is unsurprising, therefore, that Strayhorn (2014) points out that the vast majority of the existing literature is focused on traditional metrics of college readiness (such as high school GPA and standardized testing) and that other, non-content, readiness indicators need to be examined in more depth. The findings of my study endorse this suggestion.

Research Implications

Studies examining the relationship between placement testing and student performance in either developmental or credited coursework are sparse. The only study of the validity of the TSIA examinations and their relationship to student class performance was sponsored by the test creator, College Board (Cui & Bay, 2016). The present study adds to the research by providing an independent exploration of the relationship between TSIA exam scores and credit-bearing course performance in first-year mathematics and English classes. Additional research on a larger scale than this study could provide results that are more applicable to schools across the state. In particular, the Cui and Bay (2016) study looked at students from both two-year and four-year institutions, making it difficult to determine if there are differences in between the two. This study focused on a single four-year institution, but it would be beneficial to repeat the study at other four-year institutions to determine if these findings hold true elsewhere. It is also important that this study be conducted at two-year community colleges. It is possible that these findings only apply to students attending four-year universities and not community or technical colleges.

The participants in this study included those whose TSIA exams results sound have obligated them to enroll in developmental education courses. Two percent of the students enrolled in ENGL 1301 and two percent of the students taking a credited math course in their freshman year failed their TSIA reading and TSIA mathematics exams, respectively. These

students did not complete any developmental education courses before enrolling in their credited coursework. And while the TSIA results for these students predict class failure, most of them passed the credited course (87.3% of the English students and approximately 75% of the math students). It would be interesting to explore if there is something about those students that may have influenced their ability to pass their credited coursework despite having failed their course placement exam. This information could have major implications for course placement policies.

Future research could also investigate if there are statistically significant differences in freshman credited course performance for students who fail their TSIA placement exams depending on whether or not they complete developmental education classes. It may be that while some students pass their credit course(s) without remediation, students who complete developmental classes first outperform those who do not. Furthermore, this study calls into question the meaningfulness of student grades on their TSIA examinations, but assumes that final course grades are a "true" measure of performance. However, the question of the validity of this assumption bears consideration – do course grades accurately reflect understanding? An examination of research regarding grading conducted by Brookhart et al.(2016) found that variability in the grades teachers give their students included factors such as different criteria, level of rigor, and quality of student work. In a study of college grade reliability, Beatty, Walmsley, Sackett, Kuncel, and Koch (2015) concluded that "colleges appear to systematically differ in the average reliability of the grades they issue" (p. 36). It may be that course results for the participants in this study were influenced by differences in teacher grading.

In addition, researching the relationship between course performance and other exams may provide a better alternative to the TSIA tests. For example, the STAAR tests are a potential alternative to the TSIA exams. If achievement on the required Algebra I, English I, and/or

English II STAAR end-of-course (EOC) exams are more highly correlated with course performance in postsecondary English and math classes, then postsecondary institutions would have no need for additional testing through the TSIA to determine placement of incoming freshman students. These state assessments are required for the majority of Texas students and are easily obtainable by colleges and universities (Kingston & Anderson, 2013). Admissions exams provide a second possible alternative to TSIA exams, especially given their prolific use. Anderson (2018) reported that almost two million students took the SAT in high school. In addition, close to two million students completed the ACT exam. There have been several studies that have reported some degree of alignment between admissions test scores and college GPA, whether freshman or overall (Bridgeman, McCamley-Jenkins, & Ervin, 2000; Ramist, 1984; Ramist, Lewis, & McCamley-Jenkins, 1993; Wilson, 1983). However, future research could examine whether or not there is a relationship between student score on admission exams and course performance in freshman credit-bearing math and English classes, and whether that relationship is better aligned than the one with TSIA exams.

Finally, research should be conducted on non-content student attributes to determine which, if any, show any relationship to student achievement. As previously noted, noncognitive characteristics such as academic behaviors, motivation, and contextual knowledge may be useful, in addition to content knowledge, when making decisions regarding students' level of preparedness for a postsecondary education. Taking multiple factors, both cognitive and non-cognitive, into account when making placement decisions could enhance accuracy of student class placement and potentially increase the number of students completing a college education.

Summary

There is little research regarding the relationship between college placement exams and credited course performance. The number of college-going students is projected to rise in the coming years (Digest of Education Statistics, 2017; National Center for Education Statistics, 2018), but many students may not be ready for college work. To determine readiness, students must complete placement exams to determine whether they can enroll directly into credited coursework or if they have to take developmental classes first. Developmental classes can increase the time and cost of a college education, leading to an rise in dropouts (Alliance for Excellent Education, 2006; Bailey, Jeong, & Cho, 2010; NCES, 2004; Strong American Schools, 2008). It is important to determine whether the placement exams are well-aligned with student course performance, as having college placement exams properly aligned with expectations for college readiness can help institutes of higher education accurately place students into the classes they need to successfully complete their degree.

In this study, I have attempted to fill the gap in this research and provide data that can assist policymakers when making decisions about Texas' placement exam policy. I discussed the practical implications of my findings, including financial consequences, testing alternatives to the TSIA examinations, the reasonableness of utilizing a single multiple-choice exam to make decisions regarding students' readiness for college and course placements, and what "college readiness" entails. I also considered the implications for future research, including replication of this study at other postsecondary institutions, exploration of the other testing options like the STAAR exams, and investigation into non-cognitive student attributes for determining preparedness for college. It is important that research into placement exams and their relationship

to student academic performance continue in order to increase the coherence of the placement policy utilized by the state of Texas.

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