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Examining Paths to Success by Assessing Performance of Undergraduate Pre-service Teachers on High-Stakes Texas Examinations of Educator Standards Teacher Certification Exams

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EXAMINING PATHS TO SUCCESS BY ASSESSING PERFORMANCE OF
UNDERGRADUATE PRE-SERVICE TEACHERS ON HIGH-STAKES
TEXAS EXAMINATIONS OF EDUCATOR STANDARDS
TEACHER CERTIFICATION EXAMS

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Dean of the Graduate School

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Dedication

There is no doubt, your love is fierce... Thank you for walking by my side through this wonderful journey and never letting go. My heart will forever be tethered to you.

This dissertation is dedicated to my wife Georgina, for whom without, this endeavor could not have been completed. Thank you for your endless support and words of encouragement. I could never quantify in words how much it means to me to have shared the trials and tribulations of this doctoral degree with someone as wonderful as you. Tu sei perfetta per me. This Doctoral degree is as much yours as it is mine.

To my parents, thank you for the love you've given me through the years. You both inspire me to strive to be a better person every day.

Andrea and Gael, you are always on my mind and I hope my dedication and determination inspire you to someday realize all of your goals. I will always love you!!!

“In our sleep, pain which cannot forget falls drop by drop upon the heart until, in our own despair, against our will, comes wisdom through the awful grace of God.” – Aeschylus.

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by

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DISSERTATION

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The University of Texas at El Paso
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I hope to have made you all proud!!!

Abstract

The purpose of the study was to identify predictors of success for pre-service teachers in state mandated high-stakes teacher certification exams. In the last decade, Texas legislators have centered their attention in the preparation and certification of educators and have turned to more rigorous accountability measures to reach their objective of having programs be more selective about the candidates they prepare. The uniqueness of the student population at the institution served as the catalyst to bring to light the importance of not leaving behind these vulnerable populations. A path analysis model was developed to analyze the relationships of four exogenous and two endogenous variables in 378 cases. Additionally, the study aimed to identify if the variables in the model affect native and transfer students alike as they pursue their dream of becoming fully certified teachers. Native students are identified as students who completed all of their academic training at the Border University, while Transfer students started their academic training at an institution other than Border University. The study identified SAT, qualifying exams and GPA to be the best predictors of success on the TExES content and PPR teacher certification exams. Additionally the study also found that, on the TExES content exam, the effect of these factors is different for transfer students' performance. The study concluded that educator preparation programs across the state of Texas should place close attention to these three factors in their admission process, not as gatekeepers, but rather as an early warning system to foster student success.

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Chapter 1: Introduction

Teacher preparation continues to be an issue of interest for policymakers and researchers across the United States. Candidates interested in seeking teacher certification in elementary, middle school, secondary or all-level education are required to achieve satisfactory scores in tests administered by their state certification agency or their vendors (Burke, 2005). The standards set forth by the State Board of Educator Certification in Texas (the governmental body that oversees educator certification), in conjunction with the Texas Administrative Code (the set of rules governing educator certification enacted by Texas State legislators) provide the criterion that candidates must meet to be deemed qualified to enter the profession.

According to rule §230.13 Title 19 Part 7 of the Texas Administrative Code, in addition to having a bachelor's degree and completing an Educator Preparation Program (EPP), candidates must also successfully complete the required certification exams for the field and grade level they plan to teach. The changes in certification requirements resulted in response to questions about teacher quality. For at least two decades, scholars in both policy and research circles have studied at length the link between educator preparation programs, the candidates they prepare, and their ensuing effectiveness in the classroom to evaluate program quality (Ballou & Podgursky, 2000; Burke, 2005; Darling-Hammond, 2000a; Darling-Hammond & Youngs, 2002; U.S. Department of Education, 2002). Lincove, Osborne, Dillon, and Mills (2014) found that the promoted use of value-added estimation methods or VAMs by policy-makers have led to new policies at the federal and state level. In turn, VAM's have also added an additional level of complexity to the accountability standards of EPP's due to questions regarding the reliability and validity of those research models when applied to determine the accountability status of individual programs (Lincove et al., 2014). The Texas legislature has

followed the footsteps of states such as Louisiana, Florida, Tennessee and North Carolina in racing to use VAMs as a measuring tool in determining the effectiveness of EPPs in preparing candidates to deal with the intricacies of the profession. However, the results of a value-added estimation can be heavily influenced by the interpretation, selection, and estimation of its values (Lincove et al., 2014). Furthermore, studies and supporters advocating for the need to improve the level of preparation received by pre-service teachers argue for the existence of a positive effect on pupil achievement from teacher performance in a preparation program and certification (Darling-Hammond, 2000b; Goe, 2002; Goldhaber & Brewer, 2000; Wenglinsky, 2000).

1.1 Background of the Problem

Education reforms are as varied in context and complexity of design as the individuals who develop them, the agencies that adopt them, and the populations that they affect (Tyack and Cuban, 1995). The accountability movement in the United States has been growing in speed, size, and demands since the early 1980's. Its timeline can be traced back to the release of the report *A Nation at Risk* by the U.S. Department of Education, the later enactment of the Improving America's Schools Act (IASA) of 1994 and the subsequent enactment and reauthorization of the No Child Left Behind Act (NCLB) of 2001. As public school accountability demands funneled down from district administrators, through school principals, to the classroom, it was logical to expect that a similar level of scrutiny would soon follow for the preparation of pre-service teachers. In the last decade, there has been a rapid and noticeable increase in the accountability demands placed on the K-12 education system in Texas and state legislation has been directed to improve the standards used to evaluate the performance and preparation of teachers.

In the last decade, Texas State legislators have centered their attention on the preparation and certification of educators in the state. In the opening statement of Texas Senate Bill 174, Texas Senators Florence Shapiro (R) from Plano and Eliot Shapleigh (D) from El Paso made evident their desire to improve the quality of the Texas education system by raising the quality of the teachers in the classrooms and the accountability of the programs preparing those teachers. They proposed this could be achieved by having educator preparation programs be more selective in their admission of new candidates and requiring the programs to deliver the instruction and support necessary to develop candidates into quality educators, ready to enter the profession and effectively address the needs of K-12 students in Texas (S.B. No. 174, 81(R), 2009). The process enacted by S.B. 174 is governed by the interpretation and operationalization of the Texas Education Code via the Texas Administrative Code (TAC). The State Board of Educator Certification (SBEC) oversees the set of rules governing educator preparation in Texas, found in TAC Title 19 Part 7. Through the amendment of the Texas Administration Code in 2009, legislators enacted a list of mandatory criteria required for admission to a teacher preparation program. As presented in TAC 19 §227, candidates seeking admission to an EPP must meet the following program admission criteria: minimum GPA of 2.5 on a 4-point scale; 12 college credit hours in the subject-specific content area for the certification sought or 15 college credit hours if seeking 7-12 grade math or science certificate. Candidates must also satisfy Texas Success Initiative minimum requirements for reading, writing and math, demonstrate English language proficiency skills, and participate in an interview or screening instrument to determine if the applicant's knowledge, experience, skills, and aptitude are appropriate for the certification sought.

Leading to the introduction and subsequent enactment of Texas SB 174 in June of 2009, several studies had looked at the correlation between aptitude standards such as GPA and SAT/ACT scores and candidates' performance in an EPP (Decker et al., 2004; Kane et al., 2008; Levine, 2006; Rice, 2003). Although the studies only identified a small yet significant correlation between the factors observed, given the political climate on education generated by the election of President Obama in 2008 and the growing desire for higher quality education, it is not surprising to find no recorded opposition to Texas SB 174. Texas accountability standards for educator preparation programs are nestled in 21 Tex. Educ. Code §21.045, appropriately titled "Accountability System for Educator Preparation Programs." Within this portion of the Texas Education Code, SBEC is given the authority to propose and amend as necessary, the rules to establish the standards that will govern the accountability of educator preparation programs. The latest changes to both codes came about through the enactment of Texas Senate S.B. No. 174, and the subsequent amendment to the TAC 19 Part 7 §229 by SBEC, respectively. EPPs are accountable for performance in five distinct criteria: results of candidates performance on state certification exams; appraisals of first-year teachers by campus administrators; impact of candidates who completed the program on student achievement in the classroom; compliance in regards to standard set for frequency, duration and quality of candidate field supervision during their practicum; and percentage of candidates who respond when surveyed to be sufficiently prepared or well prepared to enter the profession by the program. From the accountability standards in TAC 19 §229, the ones that have raised the most concerns with programs across the state are the candidates' performance on the state certification exams and the impact they will have on student success. Although impact on student success has proven difficult to evaluate, given that the state has yet to determine the criteria or measurement instruments, the recent

changes made to TAC rule regarding candidates' performance on certification exams have the potential to negatively impact both pre-service teachers and programs alike.

In the amendments to TAC 19 §230.21 enacted on August 28, 2016 and §229.4 enacted on December 27, 2017, the State of Texas made clear the importance and role that state certification exams will play in the certification of future educators and the performance of educator preparation programs. TAC 19 §230.21 indicates that a candidate shall not retake any given certification exam more than four times. This means that candidates have five attempts (original attempt plus four retakes) on each of their required exams to complete testing requirements. This is a significant change from the previous rule, which allowed candidates an unrestricted number of attempts in each of the exams required. Subsequently, TAC 19 §229.4 changed the way in which programs are held accountable for the performance of their candidates on the aforementioned exams. Prior to the rule change, a program pass-rate was calculated by taking the highest achieved score for each program completer during the academic year in a given certification field and dividing it by the number of candidates who completed the program in that certification field during the same period. This performance standard was relatively easy to achieve, given that typically a candidate needed to complete all required state exams for their certification field prior to completing the program, which in turn led to programs displaying a high level of performance on this metric. Under the new rule, programs will not only be accountable for the performance of all candidate regardless of program completion status, but will also be accountable for students achieving a passing score within the first two attempts. This is a very radical and drastic change since it will affect the timeliness and type of interventions a program can provide to aid students in passing the exams.

1.2 Statement of the Problem

Based on observed gaps in the literature and findings from previous research on the topic, the study strived to identify the factors that have an effect on teacher certification scores attained by pre-service teachers on content and pedagogy exams in Texas. Similarly, the study aimed to use the emerging model to gauge if the impact on native and transfer students differs.

1.3 Purpose of the Study

Inspired by the challenges faced on state teacher certification exams by candidates participating in an educator preparation program along the United States-Mexico border, the purpose of the study, then, is to identify factors that have the most potential to influence the scores obtained on state certification exams. Specifically, the study focused on three major objectives:

1. To examine what factors in a proposed predictive model have a direct or indirect effect on scores attained on Texas content and pedagogical state certification exams.
2. To determine the best predictors of success for the Texas content and pedagogical certification exams.
3. To examine if the model of best predictors found equally impact native and transfer students.

1.4 Hypothesis

Based on the review of the literature noted in the next chapter, the study hypothesizes that no one factor will completely predict performance on the state certification exams. Rather, from the factors used, a model will emerge identifying those with the most potential to strongly predict the success of students on state certification exams. Finding these predictors will help inform

policy and aid educator preparation programs design interventions according to the needs of their students.

1.5 Definition of Key Terms

Border University – pseudonym given to the institution where the study took place.

Content Exam – a psychometric battery of questions with high level of reliability and validity.

The exams are design to assess if a candidate has the required grade level content knowledge and skills to become a classroom teacher in Texas public.

Educator Preparation Program – a program authorized by the Texas Education Agency to prepare educators in Texas.

Initial Teaching Certificate – per TAC 19, the most basic type of educator certification stowed upon novice teachers by the Texas Education Agency and granting them authorization to teach the subject matter and grade level assigned to the certificate.

Native Student – a student who entered higher education at the four-year institution where she/he plans to complete degree requirements.

Pedagogy and Professional Responsibilities (PPR) Exam – a psychometric battery of questions with high level of reliability and validity. The exam is design to assess if a candidate has the required pedagogical knowledge and skills to become a classroom teacher in Texas public schools.

Pre-service Teacher – a candidate currently enrolled in an educator preparation program and actively working on completing program and state teaching certification requirements as defined by Title 19 Part 7 of the Texas Administration Code.

Texas Administrative Code (TAC 19) – the body of rules that governs education in Texas, administered by State Board of Educator Certification and the Texas Education Agency.

Texas Examination for Educator Standards (TExES) – the battery of standardized exams written by Educational Testing Agency (ETS) to measure the potential of a pre-service teacher to effectively teach a subject matter at the appropriate grade level.

Transfer Student – a student who attended a two-year institution and transferred credits to a four-year institution for degree completion.

US-Mexico Border – an international boundary along the southern most region of the United States and the northern region of Mexico. In the US, this region extends from California on the west to Texas on the East.

1.6 Significance of the Problem

Given the importance and role that the state comprehensive exams play in the certification of educators in Texas and subsequently in the accountability and accreditation of Educator Preparation Programs, it is vital for programs to be able to predict the success of their candidates on state certification exams and understand the factors that have the potential to impede such success. In Texas, the term pre-service teacher is used to identify individuals actively participating in an educator preparation program. Currently, the literature on the topic shows a limited quantity of quantitative studies conducted with the specific focus of observing the performance of Latino pre-service teachers. Additionally, even fewer studies have been conducted with the aim of identifying predictors of success of this vulnerable population on state certification exams. This topic is of particular interest, given the potential that state certification exams (standardize exams designed by Educational Testing Service) have to preclude Latinos' from entering an educator preparation program, attain their teaching certificate, and/or enter the profession.

As institutions of higher education continue to increase the use of standardized exams as a form of gatekeeper to higher education, underserved populations in Texas continue to lag behind. Given that content mastery has been linked to positive results on standardized exams (Lawrence & Crehan, 2001; Mikitovics, & Crehan, 2002), one could argue that the performance of Latinos across Texas on standardized exams, displayed in Table 1.1 below, could be linked to the quality of instruction they receive. The work of Lankford, Loeb and Wyckoff (2002) helps support this theory, since they found that the quality of teachers at urban schools tends to be subpar when compared to that of their suburban counterparts.

Table 1.1: *Texas Public High Schools Graduating Class of 2015 SAT and/or ACT Performance at or Above Criterion by Race/Ethnicity*

Texas high school examinees at or above criterion ^a			
<u>Group</u>	<u>Examinees</u>	<u>Number</u>	<u>Percent</u>
African American	39,690	2,336	5.9
American Indian	1,335	228	17.1
Asian	13,089	6,636	50.7
Hispanic	148,961	11,107	7.5
Pacific Islander	486	92	18.9
White	104,375	30,229	29.0
Multiracial	5,451	1,355	24.9
State	313,387	52,009	16.6

Note. Adapted from Texas Education Agency (TEA, 2017). College Admissions Testing Results for Graduating Seniors in Texas Public Schools, Class of 2015, p.17.

^aThe criterion for SAT is a combined score of 1110 on the critical reading and mathematics sections of the examination, and the criterion for the ACT is a composite score of 24.

Studies on the topic of cultural bias (Contreras, 2005, 2011; Gándara, 2010; Gándara & Contreras, 2009; Gándara & Lopez, 1998), as summarized in Table 1.1 above, illustrate the

standardized test bias that exists across cultural cross-sections and in particular against Latino students. Additionally, Table 1.2 below illustrates the trends' effects these biases have had on this student population over the last five years reported. Although the number of Latino students continues to grow and far outpaces the number of white students, the percent of Latinos meeting minimum requirements continues to account for less than half of their white counterparts and far below the performance of all other ethnic groups except African Americans.

Table 1.2: *Texas Public High Schools Class of 2011 through Class of 2015 SAT and/or ACT Performance at or Above Criterion by Race/Ethnicity*

Texas high school graduates at or above criterion ^a										
	2011		2012		2013		2014		2015	
<u>Group</u>	<u>Grads</u>	<u>%</u>	<u>Grads</u>	<u>%</u>	<u>Grads</u>	<u>%</u>	<u>Grads</u>	<u>%</u>	<u>Grads</u>	<u>%</u>
African American	33,368	6.2	38,213	5.6	38,795	5.5	38,045	5.8	39,690	5.9
American Indian	1,287	18.2	1,427	14.9	1,310	14.8	1,278	14.8	1,335	17.1
Asian	10,222	49.8	10,871	48.9	11,650	48.3	12,420	49.6	13,089	50.7
Hispanic	116,378	7.1	131,106	7.1	139,775	7.0	141,904	7.2	148,961	7.5
Pacific Islander	387	21.2	396	10.9	394	14.5	401	17.0	486	18.9
White	98,926	30.4	195,767	28.6	104,460	28.3	103,763	29.0	104,375	29.0
Multiracial	3,871	26.1	4,856	25.1	5,013	25.5	5,293	25.4	5,451	24.9
State	269,439	17.7	292,636	16.6	301,397	16.2	303,104	16.6	313,387	16.6

Note. Adapted from Texas Education Agency (TEA, 2017). College Admissions Testing Results for Graduating Seniors in Texas Public Schools, Class of 2015, p.17.

^aThe criterion for SAT is a combined score of 1110 on the critical reading and mathematics sections of the examination, and the criterion for the ACT is a composite score of 24.

With the exception of African Americans, tables 1.1 and 1.2 illustrate that there is a clear disproportionate representation between Latinos and all other ethnicities in respect to the percentage of students at or above desired criterion on SAT/ACT performance. That is why the

study aimed to investigate links between predictors of success (i.e., scores on representative forms, student type (native/transfer), scores obtained in other standardized exams (THEA, SAT and/or ACT), overall grade point average, number of college credit hours completed prior to first testing attempt) and scores achieved on state certification exams. The study will concentrate on data obtained from the program's undergraduate population, given that completion of certification exams is a prerequisite to participate in the clinical teaching practicum. Additionally, failure to complete the program practicum has the potential to become an aspirational barrier, preventing students from achieving their educational goals, receiving their undergraduate education and/or securing future earning potential by negating them access to the profession. It is evident by the code amendments enacted in 2009 and subsequently in 2016 that after more than two decades of educator accountability in Texas, the quality of the teachers in K-12 classrooms continues to be a topic of concern for practitioners and scholars in the field. The literature points towards the testing of candidates seeking certification as the best indicator to assess the level of competency in their certification field. However, a major problem with standardized testing is the implication of test biases toward certain segments of the population, placing minorities at a greater disadvantage when attempting to complete an educator preparation program and enter the profession.

The Educator Preparation Program at Border University offers undergraduate candidates the opportunity to pursue their teacher certification at one of four different levels (elementary, middle school, secondary and all-level education), encompassing 21 different certification fields. The programs of study for secondary and some all-level education are administered in conjunction with the Colleges of Liberal Arts, Science, and Health Sciences. This is due to requirements set forth by the State of Texas, which mandates that undergraduate secondary

education teachers pursue a degree in the field they intend to teach. During the 2012-13 fiscal year, the program had 345 program completers who obtained their initial teaching certificate; this is a 12.44% drop in the production of certified teachers from the previous fiscal year. The primary reason for the reduction in the number of certified teachers from the program is the inability of candidates to successfully complete their mandated state certification exams: 134 or 25.6% of the candidates who completed the program failed to pass all mandated exams by the end of the reporting period. The deadline to complete all certification requirements (complete preparation program and pass certification exams) is the end of the fiscal year, following the completion of the educator preparation program. This mandate by state legislation is reported in the State Board for Educator Certification Annual Legislator Budget Board Measure.

The study was framed on the principals and model used by Harrell et al. (2009) at the University of North Dallas. In their study, Harrell and her team looked at the content knowledge of candidates enrolled in their online graduate teacher certification program. The authors collected data from the participants' Texas Examination for Educator Standards (TExES) Life Science 8-12 and Mathematics 8-12 exams. The sample contained 82 candidates who held a bachelor's degree and a minimum undergraduate GPA of 2.8 on a four-point scale. The researchers used descriptive data in a linear regression model to draw conclusions regarding the content knowledge of the participants and the significance of the predictors observed. In addition to the results from the TExES exams, the research team used the overall undergraduate GPA, the number of upper division courses in the content area and the time elapsed between their last course and the first attempt at the state exam for each candidate. Harrell's research team concluded that although all three factors (number of upper division courses, GPA and time lapsed) were significant predictors of success for positive results on the TExES Life Science and

Mathematics 8-12 exams, $F(3,81) = 3.076$, $p = .032$, only GPA was statistically significant after accounting for 10% of the variance in the scores (Harrell et al., 2009).

The work of Harrell et al. (2009) served as the foundation for the study. However, the study expanded the research scope to include performance of students across multiple certification fields leading to a classroom teacher certificate. Classroom teacher certificate, as designated by TEA, authorizes a person to be employed by a school district to deliver instruction in a given subject matter and grade level to students in the state of Texas (TAC 19 Chapter 233.1). In Harrell et al. (2009), researchers examined the relationship between results obtained by candidates on the Texas Examinations of Educator Standards and three variables. The observed variables were: a) the number of upper division courses completed in their content field prior to taking the state exam; b) grade point average on content courses; and c) time elapse between the last upper level content course and initial attempt on the state exam. The group studied at the University of North Dallas consisted of post-baccalaureate students participating in an alternative certification program and seeking a secondary education certificate.

The present study investigate the link that exists between predictors of success such as overall grade point average, the number of credit hours completed in the program, and scores achieved on state mandated certification exams. Additionally, the study controlled for gender and ethnicity as well as disaggregated data obtained by student type to ascertain the full impact on each of these separate groups. Finally, the study expanded the scope of previous research on the topic and looked at the undergraduate population to include multiple areas of initial certification offered at the program.

The proposed study may prove valuable for administrators of educator preparation programs in Hispanic Serving Institutions, particularly those located along the U.S./Mexico

border, by offering information on predictors of success specific to their student population. The information gathered by the study could be used during the candidate selection process to better identify those candidates in need of additional support.

1.7 Delimitations of the Study

The study was designed to identify predictors of success on Texas State teacher certification exams for candidates participating in a Hispanic Serving Institution along the U.S./Mexico border. Although generalizations could be drawn about similar populations in other institutions along the same border region, it is important to note that other factors can prove to be more relevant at other institutions according to the cultural and socioeconomic diversity of the community they serve. Therefore, it might prove problematic to draw generalizations from the study and advocate for the findings to be applicable to all Hispanic Serving Institutions, even those with similar student populations. Additionally, future replications of the study could yield different results, given that the study focuses on the current forms of the TExES content and pedagogy exams. New versions of the exams could change the outcome observed by this study or provide avenues for research not currently present.

1.8 Researcher's Bias

The researcher holds the position of Certification Officer for the College of Education at the institution where the study was conducted. In this role, the researcher works with candidates seeking initial and professional certification, as well as with the Texas Education Agency to ensure the program adheres and complies with all mandated requirements. The researcher has a long-standing personal and professional interest in identifying predictors of success on the state certification exams in order to inform program stakeholders and better design interventions for

students. When the decrease in the number of certified teachers from the program was identified, the researcher decided to investigate and embark on the endeavor of identifying predictors of success and provide better support for students; hence, the study.

1.9 Assumptions

The study worked with a full sample from the program population; that is to say, that all records included all of the data points needed for data evaluation. Although there is literature pertaining to grade inflation in higher education, the researcher also found that conventional practice deems acceptable for grade point average to be taken at face value and seen as a true representation of students' effort, abilities and performance. Given the effort required and dedication needed to meet the minimum requirements for admission into a preparation program, the study equates the desire of a candidate to participate in the program with their desire to become a certified teacher and voluntarily taking on the shared identity of the profession.

1.10 Limitations

Since the study investigated data from only three academic years, given the recent changes in accountability standards in Texas, a concern arose regarding the robustness and effectiveness of the sample size in accurately identifying the best set of predictors of performance on the state-mandated exams. The researcher mitigated the concern during the statistical assumption testing phase of the study and it was determined that the data set had the adequate power to yield statistically sound results. Additionally, the assessment of student performance was performed using the TExES exams, which the literature calls into question due to their potential to demonstrate bias towards marginalized populations. Although the representation of the population was not lost due to the removal of incomplete records in the

sample, the majority of the individuals included were Hispanic and Females leading to a highly homogeneous sample. It is important to note that the study took place in a region of Texas considered to be isolated from the rest of the state due to its geographical location nestled at the most western tip of the state. Despite being the sixth largest metropolitan area in Texas, the distance separating the region from other major cities in the state is much greater than the distance connecting it with major cities in New Mexico, Arizona and Mexico. This geographic isolation could limit the generalizability of findings to only include programs with similar demographics and context.

1.11 Chapter Summary

While scholars and practitioners in the field accept the practice of testing pre-service teachers to determine their level of content mastery, application of ethical and professional standards, and the potential to excel in the classroom instruction, identifying predictors of success on state certification exams is essential to foster student success in teacher preparation programs. Additionally, the general questions, delimitations and researcher bias of the proposed study were presented in this chapter.

Chapter 2: Literature Review

Research is needed to help identify predictors of success on state teacher certification exams for pre-service teachers matriculated at Hispanic Serving institutions. McDonald, Jones, Maddox, and McDonald (2011) found that “Higher education is always searching for ways to predict student success in order to select the 'right' students into each academic school” (McDonald et al., 2011, p. 905). The study proposed to identify predictors of success for pre-service teachers in state certification exams for students along the U.S.–Mexico border. The interest and focus of this study grew from an observed increase in the number of candidates participating in a teacher preparation programs in Texas who struggle to meet the required passing scores on their state certification exams. Identifying those factors that can effectively determine if a candidate will be successful in the state exams can prove beneficial for program administrators to develop better interventions to aid their students in meeting state certification requirements. The literature reviewed for this study, and contained in this chapter, encompasses the research in the field relevant to the factors identified as potential predictors of performance for pre-service teachers on high-stakes teacher certification exams.

2.1 Admission Criteria

The article titled “Determinants of undergraduate GPAs: SAT scores, high-school GPA and high-school rank” written by Cohn, Cohn, Balch, and Bradley (2004), describes a study designed to assess to what degree SAT scores, high-school GPA (HSGPA) and class rank could predict success in college. According to the results of their study, Cohn et al. (2004) concluded that a correlation existed between scholastic performance in college and the results the student obtained in their SAT exam. A secondary line of research of their study was to observe if there

were race–sex differences in determining success in college. Based on their findings, the authors concluded that class rank and SAT tend to be better predictors of college GPA for white students and concluded that females are more likely to achieve a 3.0 GPA than their male counterparts. This last statistic is of particular interest for the study, given that the demographics of the program at Border University is comprised primarily of female students.

Komarraju, Ramsey, and Rinella (2013) further established a relationship between high school GPA, SAT scores and ACT scores to college readiness in their article titled “Cognitive and non-cognitive predictors of college readiness and performance: Role of academic discipline.” Their study investigated the relative strength in predicting college scholastic performance as indicated by a student’s GPA by observing and analyzing the student’s ACT score, final high school GPA and non-cognitive college readiness skills. The results yielded by their study indicated that students with higher high school GPA seemed to hold stronger study skills and be more determined, confident while also demonstrating a higher level of academic discipline in their freshman year of college. The research team also concluded that although college admission offices typically rely heavily on ACT scores to determine the potential performance in college of a given applicant, other factors such as high school GPA, are just as reliable in predicting scholastic performance in college.

In their research titled “SAT and ACT predict college GPA after removing g” Coyle and Pillow (2008) examined whether the SAT and ACT could effectively predict student college GPA after removing g factor. According to the article, the g factor represents the variances which are common to cognitive tests, hence, the higher the g loading reliability, the better the test is in predicting life outcomes such as school grades. The study found that both SAT and ACT tests have a strong correlation to their g factor and in fact were great predictors of future

scholastic achievement. Although they did not identify the non-g factors that contribute to the validity of both SAT and ACT exams, by comparing g and non-g scores to predict GPAs the research team was able to determine that even with g factors removed both test could successfully predict GPA.

The drawback and main criticism of the research in the field is that it is often conducted in institutions where the majority of the student population is white, traditional students. In an age when campus demographics continue to shift and the number of minority students continues to increase, such as in the case of Hispanic Serving Institutions, it is critical for similar research be conducted at these institutions to properly gauge the impact on minority students. This could also begin to fuel a possible discussion regarding college and program admission criterion and the impact they could have on vulnerable populations. If research has shown that performance on standardized tests is dismal for minority students, how is it that legislators and administrators continue to insist in using those factors as proper identifiers of potential students? The inequity of performance by minorities, which has been linked to testing biases, could also lead to possible recommendations regarding recruitment efforts for future teachers and setting more realistic admission standards that focuses in the overall scholastic achievement, instead of only on one of the many factors by which it can be represented.

Studies performed by Lawrence and Crehan (2001) and Mikitovics and Crehan (2002) identify the use of admission exams for educator preparation programs as effective tools to predict the success of their candidates. In their paper titled “A Study on the Validity Evidence of the Pre-Professional Skills Test (PPST) as a Screening Device for Entrance into Teacher Education Programs,” Lawrence and Crehan (2001) discusses the relationship found between (PPST) and ACT scores. The PPST exam is also known as the Praxis I. It is a test developed by

ETS, also the developers of the TExES exam used in Texas, for the purpose of screening candidates interested in completing a certification program leading to teacher licensing. Although not an accepted exam in the state of Texas, according to ETS (2000), 28 states do utilize this exam as a screening instrument. The paper originally presented at the Annual Meeting of the National Council on Measurement in Education in Seattle in 2001, provides further evidence of the potential link that exists between standardized tests and professional skills test such as the TExES. A subsequent study that supported the findings in Lawrence and Crehan (2001) is Mikitovics and Crehan (2002). In their article “Pre-Professional Skills Test scores as college of education admission criteria,” the researchers draw conclusions that support the previous findings in Lawrence and Crehan (2001) regarding using PPST instruments as precursors to entering the teacher education program. Additionally, the study finds a positive correlation between ACT scores and scores achieved in PPST exams. Although both studies reported a high number of students taking the PPST test, both found that only a small number of the candidates in the pool had ACT scores. This is an important point to keep in mind when evaluating the data for the study, as a similar challenge will be faced, given the open enrollment policy currently observed at Border University. The findings reported in these two articles support the rationale for using previous performance in standardized tests as predictors of success in state mandated teacher certification exams.

2.2 Predictors of Success

The issue with identifying clear, accurate, and effective predictors of success for pre-service teachers is not an issue observed only in Texas. According to Burke (2005), policymakers across the United States are taking a hard look at pre-service teachers and the programs that train them. In his study conducted in the state of New York, the findings were

published in an article titled “Teacher Certification Exams: What Are the Predictors of Success?”

Burke found a direct link between SAT scores and the scores achieved on state teacher certification exams by participants of teacher preparation programs in the state of New York. The author also found that the single best predictor for performance in the state of New York Liberal Arts and Science Test (LAST) and the Content Specialty Test (CST) was the scores achieved on the SAT exam. Additionally, the author identified high school GPA as the most effective factor in predicting success in college and overall college GPA as a significant factor that predicted performance on the state certification exams. Interestingly enough, Burke’s study indicated the existence of an inverse correlation between the number of times candidates had to take the certification exam and their SAT scores. This means that the lower the SAT score for students, the greater the number of attempts they will take to complete their state certification exams. According to Burke’s article, the accountability standards in the state of New York are similar to the ones in Texas. In both states, pre-service teachers must achieve an 80% mastery level on the required exams, while programs are accountable for 80% of all testers in their program passing the teacher certification exams. Burke’s study used data from a sample consisting of forty females completing their Bachelor’s degree without offering additional demographical or descriptive data for the group. Given the accountability similarities and challenges faced by students in both states, the article provides substance and support to use SAT scores and overall college GPA as a direct predictors of success on TExES exams.

Burke (2005) mentions that accountability issues across the United States have educator preparation programs looking for better ways to identify and admit the best candidates into their programs. A similar observation is documented in Pennsylvania by Blue, O’Grady, Toro, and Newell (2002). In their paper titled “How Do We Find the Best Teachers? A Study of the

Relationships among SAT, GPA, Praxis Series Test Scores, and Teaching Ratings” presented at the annual meeting of the Association of Teacher Educators in Denver, the authors found a moderate to high correlations between: 1) SAT scores and final GPA; 2) SAT scores and Praxis scores; and 3) final GPA and Praxis scores. The scores used in their study represent undergraduate pre-service teachers participating in a teacher preparation program in the state of Pennsylvania. The study analyzed twelve different data points ranging from SAT scores to GPA scores at different points of the education career of 328 elementary education pre-service teachers identified as program completers of a teacher preparation program. Reported in their study, there was no significant correlations found between college GPA and SAT scores of students entering college with low SAT scores. However, the group found a moderate to high correlation between SAT scores and final college GPA. Additionally, the study also found a similar correlations between SAT and Praxis II, as well as, between GPA and performance on the Praxis II exam. This led the group to raise questions regarding the focus and importance that state agencies and legislators give to SAT as a predictor of success in state certification exams. The group indicated that although it might seem that SAT scores could in fact identify a certain type of educator, it could also have an adverse effect on the pool of future teachers, given that it could shrink the diversity of the pool. This is of particular interest to programs that serve a high number of minority students. Their study helps establish the link between college admission criteria (SAT→GPA) and provides evidence of the need to evaluate the current admission criterion used for teacher education programs (demonstrating college readiness and GPA) set forth by the Texas Administrative Code. As proposed previously in the literature, there is a direct link between criteria used for admission to the university and educator preparation programs, SAT scores, GPA, and scores achieved in state teacher certification exams.

Another example of how educator preparation programs in different states across the U.S. are looking for ways to identify quality candidates for their programs is presented in the article titled “Teacher Candidate Success on State Mandated Professional Tests: One Predictive Measure” by McDonald, Jones, Maddox, and McDonald (2011). In their article, the authors explore the relationship between college GPA and performance on state mandated teacher certification exams in the state of Virginia. The study uses data from candidates who completed a teacher certification program and attempted the Virginia Communication Literacy Assessment (VCLA) and the Virginia Reading Assessment (VRA), two of the state mandated teaching examinations in the state of Virginia. The study worked under the assumption that once an individual experiences success, she/he will likely expect success thereafter, and will work harder to achieve it due to the expectation of success. According to the authors, Albert Bandura originally coined this behavior/thinking cycle of self-efficacy over three decades ago. After an in-depth analysis of the data using a predictive model, the researchers identified a statistically significant relationship between GPA and mean scores on both the VCLA and the VRA. The authors concluded that a better overall performance in the classroom, measured by GPA, produces higher scores on both professional assessments. Despite the small sample size of 196 participants, it represented the complete number of student at the institution who completed the program and attempted the state mandated exams over the course of three years. The demographics of the study are a point of concern, given that it only contained sixteen minority students with a relatively even distribution among African-American, Asian and Hispanic students. Despite the demographical challenges found in the McDonald et al. study, it will aid in the development of the research model and as a foundation for this study, given the direct link

identified by the study between college GPA and performance on state mandated teacher certification exams.

Although not a study performed in the social sciences, the article “Predictors for success for first semester, second-degree Bachelor of Science in Nursing students” by Kowitlawakul, Brenkus, and Dugan (2013), the article evaluates different admission criterion typical of nursing programs to identify predictors of success for their students. The study evaluated admission data of sixty candidates admitted to a Bachelor of Nursing program. The researchers obtained data from admissions records, academic records and departmental records typically used by the program in the admission process. The research team used the program’s data to create a quantitative research model to compare the independent variables described above to the scores achieved by the students in the Kaplan admission test records. The study found a strong correlation between program success and GPA. Given that both the Nursing and Teaching fields require rigorous certification exams post-program completion, the results from the study could be used to identify predictors of success for pre-service teachers. Additionally, the worked performed by Kowitlawakul, Brenkus, and Dugan (2013) introduces a new possible predictor of success to add to the research model for the proposed study. Described in their study as admission tests, participants in the proposed study currently take a qualifying exam expected to yield, with a level of certainty, the readiness to test and level of content mastery required for the teacher certification exams. The qualifying exams are representative forms released by ETS used by the program at Border University as a checkpoint prior to the candidate receiving approval to take the actual state exam. The study will look at how direct and indirect effects, through qualifying exams as a mediating factor, affect performance on teacher certification exams.

Given the ethnic homogeneity of the EPP at Border University, it is important to look at some of the literature on race and academic performance. The study and subsequent article by Dollinger and Clark (2012) titled “Test-Taking Strategy as a Mediator between Race and Academic Performance,” serves that purpose. In their study, the authors proposed that the disparate results in standardized tests between races can be attributed to the use of ineffective test taking strategies. The study consisted of 407 participants and looked at data obtained from the exam scores in a prescribed Psychology of Personality course, self-reported GPA and a measurement of verbal ability using a 25 item multiple-choice vocabulary test. The group from a mid-western university had 82 African-American students, of which 50 participants were females, and 325 participants identified as Caucasian, with 179 of them being females. The results of the study suggested that given that minorities are not afforded the same opportunities to develop their test-taking skills, this leaves them at a disadvantage when preparing for exams. Furthermore, the study suggests that the negative effect of the lack of life experiences extends beyond the high-stakes testing and into academic performance. The findings presented by Dollinger and Clark are of interest to the study and the development of a sound research model, given that the majority of students in the Border University EPP (over 80% of the program population) are minority students.

2.3 Texas Teacher Certification Exams

Through the review of the literature, there were three articles emerged that examined the issue of performance in state certification exams for pre-service teachers in the state of Texas. One of the studies written about in the article “An examination of teacher quality variables associated with passing state content tests” by Harrell, Harris, and Jackson (2009) forms part of the theoretical framework for the study. However, the study expanded the scope of their

research in three areas. First, it include a broader range of certification exams; second, it shifted the focus from alternatively certified teachers to the traditional undergraduate initial teacher certification program; and third, it replicated their study in an HSI with a minority majority student population.

In her article, “Do state examinations measure teacher quality?” Harrell (2009) used a linear regression model to identify and conclude that the best model for prediction of success consisted of three factors. The three factors identified are: 1) overall college level GPA; 2) completion of upper level course work; and 3) time elapsed between initial testing attempt and completion of their last upper-level course in their content area. The study yielded all three of the factors as statistically significant predictors of success for teacher candidates on the Texas Examination for Educator Standards (TExES) exam. The article also raises some interesting questions regarding plausible systematic issues, indicating that educator preparation programs should place a closer emphasis on the structure of programs of study and almost “track” their students and advise against deviating from the prescribed plan. As a follow up to her original article, Harrell wrote a second article in collaboration with two of her colleagues. The article “An examination of teacher quality variables associated with passing state content tests” written by Harrell, Harris, and Jackson (2009), which further supports the findings presented in the work by Harrell (2009) by looking at a larger sample of candidates and replicating her previous study. The study conducted at a Texas institution, contained information on 287 candidates participating in an online alternative teacher certification program. The demographics of the study indicated that 61.3% of the students were females and 81.9% of the total number of participants were white. The study concluded that the same three factors previously identified in

Harrell (2009) also proved to be true for the new data set of students participating in a post-baccalaureate program who sought to become certified teachers in Texas.

In the article by Bycio and Allen (2007) “Factors associated with performance on the Educational Testing Service (ETS) major field achievement test in business (MFAT-B)”, the authors evaluate the correlation between the business core course GPA and the Major Field Achievement Test in Business (MFAT-B), which is a standardized test similar to the TExES exam. In their study, the researchers analyzed the data of 132 students to identify if a correlation existed between GPA and performance on the certification exam. The results from their study indicated that not only does content specific business core GPA, but also overall university GPA, were significant predictors of performance on the MFAT-B. The findings in the study play a significant role in the model of this study, as it provides precedent for a similar study and a direct link between overall GPA and an ETS developed test. This is in addition to the body of literature discussed in this chapter linking GPA to performance on standardized tests.

2.4 Competing Theoretical Frameworks About College Student Success

It has been four decades since Bandura (1977) stipulated that the behavior of individuals is highly influenced by their personal beliefs held about their capabilities and the outcome of the effort they put forward, a construct, which continues to be a cornerstone and deeply influences the work performed in the field of self-efficacy. The study looked at the work performed and findings observed by scholars in the fields of expectancy theory of motivation and expectancy-value theory (Bandura, 1977, 1986, 1997; Geiger & Cooper, 1995; Dever, 2016; Eccles et al., 1983; Eccles & Wigfield, 2002; McLaughlin, 2015; Pajares, 1995, 1996, 2009; Usher & Pajares, 2008; Wigfield & Eccles, 2000). The collective consensus of these scholars work have concluded that student persistence, performance and academic success can be directly

linked to the expected probability that an increase in the effort given will ultimately yield the desired results. Thus, the higher the stakes, the harder students will desire to work to achieve them.

The study also looked at a relatively new framework designed by Elger (2007), known as Theory of Performance. Although the researcher would have preferred a well-established and reviewed theoretical framework for the study, unfortunately one did not emerge. Therefore, presented subsequently in this chapter, the researcher intends to apply Elger's model to provide the operationalized definition of the dependent variables in the study. It is important to note, that in the realm of educator preparation and certification, the majority of students have a desire to work hard and prepare for the rigors of state mandated certification examinations with the objective of becoming a fully certified educator in the state of Texas.

2.4.1 Expectancy theory of motivation.

The Expectancy Theory of Motivation found in Geiger and Cooper (1995), was originally developed and discussed in Vroom (1964). Geiger and Cooper indicate that, "the motivation to act is a combination of the perceived attractiveness of future outcomes and the likelihood one's actions will lead to these outcomes" (Gaiger & Cooper, 1995 p. 251). Expectancy Theory of Motivation consists of two independent models, Valence Model and Force Model. The one to which the study prescribes is the Force Model, which, according to Ginger and Cooper (1995), implies that a student's motivational force to achieve academic success is explained by the attractiveness of academic success and the expected probability that increased effort will lead to academic success (Geiger & Cooper, 1995). A good example of this principle is the number students interested in becoming certified teachers in Texas each year. They not only understand, but also have the desire and determination to meet the minimum admission requirements to enter

an educator preparation program. This model is reflected on the grade point average, one of the admission requirements for educator preparation programs across Texas and an independent variable in the study. Although the admission requirement is not as rigorous as some practitioners would prefer it to be, achieving a 2.50 GPA on a four-point scale can prove challenging for some students.

2.4.2 Expectancy-value theory.

Expectancy-value theory can help explain the decision making process that takes place prior to students entering an educator preparation program. According to the definition provided by Dever (2016), expectancy-value theory stipulates that it is possible to predict student achievement outcomes, choices, and persistence by the value placed by the student, on the achievement context and expectations of success. Entering an educator preparation program is not an easy decision to make. The candidate must fully commit to the amount of time spent on the field learning about the profession, the rigor of the exams required for certification, and the financial investment beyond tuition and books for the process. In average, teacher prospects in Texas spend a minimum of three to four hundred dollars in testing and certification fees on top of their educational expenses before they can secure a job. That is why students interested in entering the teaching profession must deeply evaluate their abilities and aspirations to make the conscious decision of entering an educator preparation program. The work of Jacquelynne Eccles and her colleagues on Expectancy-value theory (as presented in Dever, 2016, p.419), provide the foundation for the decision model potentially used by students when applying for admission to an educator preparation program.

Interest value is defined as the student's level of intrinsic interest or liking of the task (this value displays the student interest on the profession).

Attainment value is the importance that the student places on the academic task or domain personally and is tied to personal identity (this value represents the student disposition).

Utility value includes the student's perceptions of how useful what he or she learns in school is to one's personal goals or future plans outside of school (this illustrates the transition from student to teacher).

Cost assesses the extent to which the student believes he or she needs to sacrifice or endure anxiety, social consequences, and so on to do well academically (this is the evaluation of the return on investment).

2.4.3 Theory of performance.

As mentioned before, the Theory of Performance (ToP) is a relatively new theoretical framework introduced by Elger (2007), who indicates that the model can be used to explain performance and performance improvement over time. The major tenant of the theory, and reason for choosing it to frame the study, is that it uses the components of the model to holistically evaluate performance. Sonnentag and Frese (2002) see performance as a dichotomous concept consisting of a behavioral and an outcome aspect. Essentially, what their definition tells us is that performance is an action from an individual and the ensuing result to such action (Sonnentag & Frese, 2002). Elger (2007) adds to the definition, indicating that performance must produce a result with a given value. With the newly defined construct, the study will interchange performance with success, given that success in the study is a value resulting from the actions of preparing for the exam and the score attained.

The components of Elger's Theory of Performance have been discussed previously in this chapter and are illustrated Tables 2.1 and 2.2 below is how they fit the research design to inform

the overarching question of the study. The model consists of six components (level of identity, levels of skills, level of knowledge, context performance, personal factors and fixed factors) for which Elger provides a description, exemplar and classification rule for each. The author of the model goes on to explain the exemplar column as a “lucid example of a component” and the rules as “guidelines to define the component” (Elger, 2007, p.12).

Table 2.1: *Components that Holistically Interact to Establish Level of Student Success*

Component	Description	Exemplars	Classification Rules
Level of Identity	As individuals mature in a discipline, they take on the shared identity of the professional community while elevating their own uniqueness.	A student uses disciplinary slang to describe engineering design activities. A teacher examines his performance through the lens of student learning.	associated with maturation in a discipline or culture associated with maturation in life internalized by person - the individual takes on the shared identity
Level of Skills	Skills describe specific actions that are used by individuals in multiple types of performances.	making assumptions; persisting; being humble; setting goals; observing;	describe an action action is relevant in a broad range of performance contexts
Level of Knowledge	Knowledge involves facts, information, concepts, theories, or principles acquired by a person through experience or education.	Facts/information—names of states, conversion factor between feet and inches Concepts—democracy, chair, force, Principles/theories—relationships between the tilt of the earth and the seasons; law of conservation of energy	derives from human experiences can be communicated or recognized
Context of Performance	This component includes variables associated with the situation that the individual performs in.	Learning of a student is coupled with the organization of a class.	relates to circumstances associated with the performance applies to multiple performance within the context—not a personal factor.
Personal Factors	This component includes variables associated with the personal situation of an individual.	Performance of a teacher is impacted when he or she is ill A student's performance is impacted by the quality of his or her home environment	involves life situation of an individual
Fixed Factors	This component includes variables unique to an individual that cannot be altered.	Performance in basketball is impacted by height Genetic factors influence performance	involves an individual immutable; cannot be altered

Note. Adapted from Elger (2007). *Theory of Performance*, p.13.

As mentioned previously, Table 2.2 illustrates how each one of the components match with the variable and assumptions of the study. Variables and assumptions in the study are linked to one or more of the components in Elger's model.

Level of Identity – the study does not have a variable that represents this component in the model. However, it is assumed that the individual identifies with the profession since they initiated and completed the application process for admission into an educator preparation program.

Level of Skills – given that this component is linked to the actions used by an individual to perform, variables in the study that represent this component are: number of hours prior to attempting an exam; Grade Point Average; and performance on representative exams.

Level of Knowledge – the variables that best align with this component are the cumulative effects of the Grade Point Average from performance in multiple courses across time; results on previous standardized exams and scores on representative exams. This is due to the nature of these two variables to gauge content mastery.

Context of Performance – this component will represent the dependent variables in the study which is performance on state content and PPR certification exams. This links to the study since the component deals with the situation in which the individual performs in or outcome.

Personal Factors – this is another area in which the study does not have a variable represented. However, the region in which the study is to be conducted (US-Mexico border) can speak volumes about the impact on the home environment. Several key

participating student grouping variables selected for examination will attest to this component (i.e., type of student).

Fixed Factors – this component is linked to the socioeconomic factors of the study (i.e., race/ethnicity; gender; type of student) as they make up the attributes that describe the individuals in the study.

Table 2.2: *Integration of Theory of Performance to Student Success*

Elger's Model for Performance	Model for Student Success Identified by Variables from the Study
Level of Identity	Not measured by the study but assumed due to enrollment on EPP
Level of Skills	Skills acquired through: Taking standardize exams Taking qualifying exams and test preparation activities The accumulation of college semester credit hours
Level of Knowledge	Knowledge acquired from: Individual course participation and performance Scores on standardize exams Reported cumulative GPA
Context of Performance	Performance on representative qualifying exams Performance on TExES exams
Personal Factors	Demographics not measured by the study but assumed constant for all records
Fixed Factors	Context of the study – Undergraduate initial teacher certification program in a HSI along the U.S./Mexico border.

Note. Alignment of Variables in the Study to Elger's Theory of Performance and Units of Measurement

2.5 Chapter summary

The literature contained in this chapter provides a survey of the trends in the field. From the presiding body of literature, the major lines of research that surfaced as possible predictors of success on state mandated teacher certification exams are: 1) overall college GPA; 2) number of college credit hours; 3) performance on standardized exams; and 4) scores on representative exams. As an added measure, the research model will also include an extra level of research comprised of the socioeconomic factors discussed in the literature (type of student, gender and ethnicity). Adding this extra set of variables will make for a more robust study and help better understand the data by accounting and controlling for these demographical variables and groups.

Chapter 3: Methodology

The previous chapters introduced the proposed area of research. The first two chapters included the research problem, purpose and proposed hypothesis that will help guide the data analysis. Additionally, key terms for the study and a review of relevant literature related to the study were also included therein. Due to the current accountability shift in higher education and implemented changes to the Texas Administrative Code, which govern Educator Preparation Programs, the research is an effort to identify predictors of success that will allow programs to implement timely interventions to support low performing candidates and ensure a passing score on the first attempt.

3.1 Setting

In the broadest of conceptualizations, this study aims to address the needs and support the success of undergraduate Latino pre-service teachers participating in educator preparation programs in Hispanic serving institutions on the US-Mexico border with a student population of approximately 25,078 of which 80% of them are of Hispanic descent. Thus the setting of the study consists of all undergraduate pre-service teachers, from a pool of 2,412 candidates enrolled in the preparation program at the institution, who attempted both state content and pedagogy exams at least once during the 2014, 2015 and 2016 academic years. A total of 883 pre-service teachers were identified in the data set as having met the criterion for the study and in the process of completing teacher certification requirements in Texas. The researcher expected that by using data for three academic years, the sample would be large enough to satisfy power requirements for a path analysis model with five variables.

3.2 Research Design

The proposed study employed a correlational research design using a path analysis theoretical model to look at causal effects as described by Hatcher (1994):

Path analysis can be used to test theoretical models that specify causal relationships between a number of observed variables. Path analysis determines whether your theoretical model successfully accounts for the actual relationships observed in the sample data...models in which all variables are manifest (observed) variables. (p. 143)

Therefore, the study will gather empirical secondary data about the performance indicators for each of the subjects included in the study. There will be no manipulation of the variables by the researcher; instead, the covariance between variables will be observed to identify variances and observe the relationships between a set of multivariate non-experimental data within a causal model to determine how well they fit and which factor(s) better predict the outcome (Wuensch, 2016).

3.3 Population and Sampling Plan

The enrollment numbers for the educator preparation program at Border University for the 2014, 2015 and 2016 academic years consists of 3,105 initial and professional certification candidates. After disaggregating the data into initial and professional program participants, the estimated total of undergraduate population is 2,412 pre-service teachers. A sample was drawn from this population, since the study focused only on candidates seeking initial teaching certification who took both content and PPR state certification exams. The secondary data file contained 883 records identified for potential inclusion into the study. After the completion of the initial data screening, 385 records contained complete data and were included in the study.

Hatcher (1994) and Hair et al. (2010) identify 200 as the minimum number of records required in a sample size to conduct an effective path analysis study. Based on their estimation, the study sample exceeds this minimum requirement.

3.4 Data Collection

The educator preparation program at Border University provided secondary program data for every pre-service teacher who tested during the 2014, 2015 and 2016 academic years. The data set contained state testing records for 883 candidates who took the content and PPR exams at least once during the observed period. Additionally, the data set contained scholastic data as well as demographical data. The study utilized path analysis to estimate the magnitude, significance, and direction of dependencies between the variables in the model. The path analysis model graphically illustrates the interrelationships that exist between the variables through the analysis of their correlational structure. Additionally, the resulting diagram was used to analyze and illustrate total effects into its respective direct, indirect and mediated effects as discussed in the literature (Edwards & Lambert, 2007; Everitt & Skrondal, 2010; Webley & Lea, 1997).

The model consisted of a series of exogenous variables for which their variance is caused by factors outside the model, and endogenous variables for which their variance is explained, at least in part, by other variables within the model (Wuensch, 2017). The study also contains an exogenous variable serving as a mediator through which the effect of independent variables transmits onto the dependent variables (Edwards & Lambert, 2007). It is possible to see, as illustrated in Fig. 3.1 below, where each of the factors aligns within the causal model. A double-ended arrow indicates that the correlation between the factors will remain unanalyzed, since one

is not the cause for the other and/or shared causality may exist. A single-ended arrow indicates the factors expected to exert influence on another and the directionality of influence exerted.

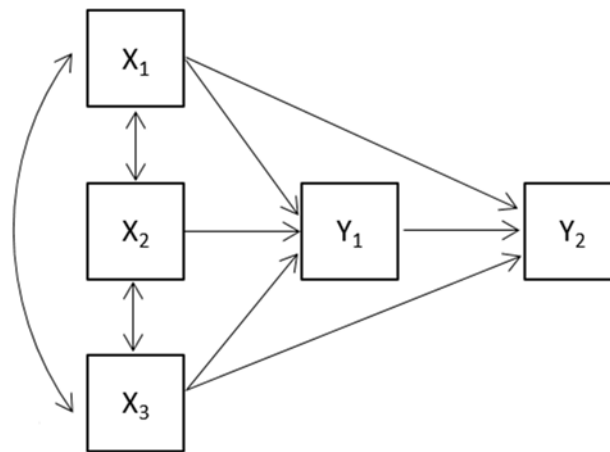


Figure 3.1. Causal diagram for predictors of success

The outcome or dependent variables for the study will be the recorded performance of program participants on state content and PPR teacher certification exams. As mentioned earlier, the study has four direct factors or independent variables and controlled for gender and ethnicity. The first exogenous factor in the model is overall GPA, a variable selected because of the correlation indicated by the literature that should exist between the content in the exam and the knowledge gained from the coursework in the program. Hence, content mastery should yield higher grades and be reflected on the scores achieved on the certification exam. The next exogenous factor in the study is the number of semester credit hours (SCH) completed by the candidate prior to her/his first attempt at the state certification exam. The variable links to the literature and TEA requirements indicating that a candidate must have a minimum number of semester credit hours for becoming an effective teacher. The third exogenous factor in the model is performance on previous standardize exams. The literature indicates that proficiency on standardized exams (i.e.,

ACT, SAT, THEA) seems to be transferable. Thus, satisfactory scores on these exams should translate to similar scores on the Texas state certification exams.

Edwards and Lambert (2007) provide the foundation for the identification of the mediator factors in the study. According to their article “Methods for Integrating Moderation and Mediation: A General Analytical Framework Using Moderated Path Analysis,” the authors define mediation as the intervention of an outside factor between dependent and independent variables, hence the name of “mediator” (Edwards & Lambert, 2007). The role of the mediator factor in the study lays on the representative qualifying exams. The variable equals the average score of all attempts on each of the content and PPR exams.

In their article titled, “A comparison between academic performance of native and transfer students in a quantitative business course,” by Buhagiar and Potter (2014) reported results from a study they conducted at the University of Central Florida. The authors looked at the performance of native and transfer students in a core curriculum economics course for which all participants satisfied all of the same course prerequisites. They attributed the difference in academic achievement in the class to the strength of the curriculum at the two or four-year institution where the prerequisites were completed (Buhagiar & Potter, 2014). This is of particular importance, given that the program at Border University is comprised primordially of transfer students. For the purpose of the study, the group of native students will include all students who have only completed coursework at the institution. Conversely, the group of transfer students contained students identified by the institution as having completed coursework at a prior institution. The additional disaggregation of the data set might bring to light issues of course rigor and academic capital at Border University.

The Dean of the College of Education at Border University extended permission and access to the data set. In it, the researcher received the number of courses completed, over all GPA, standardized testing results, student type and scores on qualifying exams of pre-service teachers participating in their program. Finally, the College of Education also provided data from the Education Testing Service testing system, which houses certification exam results. Given that the study worked with data for all cases that met the parameters of the study for those years, there was no need for a sampling technique.

3.5 Description of the Study Variables

The study utilized secondary program data obtained from the EPP at Border University, this section offers a brief description of the variables contained in the data set relevant to the study.

3.5.1 SAT.

The value allocated to the SAT score represents the score achieved in Critical Reading + Math components of the test and they range from 400-1600. Students taking the test are not penalized for guessing since the score is based on the number of correct answers. Studies conducted by the College Board, regarding the predictive validity of the SAT exam, indicate that the content and skills covered in the SAT are the most critical for predicting student success and college readiness. Thus, its results have a strong positive relationship with grades obtained in matching college course domains. The reliability of the SAT exam is estimated to between .89 and .94 (College Board, 2015; 2018).

3.5.2 GPA.

The GPA used for the study was based on the number of quality points in a four-point scale per semester credit hour completed divided by the number of semester credit hours attempted. The study took the reported GPA at face value and considered it to be free of measurement error.

According to the literature GPA represents the most stable multidimensional measure of a student cognitive and noncognitive performance over time (Brookhart et al., 2015). The cumulative reliability of GPA ranges between .89 - .92, giving it similar predicting values to those observed in the SAT score (College Board, 2015; Westrick, 2017).

3.5.3 Semester credit hours.

Semester credit hours is non psychometric data generated by adding the number of semester credit hours completed by the student. Given that the state mandates a minimum of 60 credit hours prior to admission into an EPP, the value of the variable ranges between 60-120 credit hours which is typically the number of hours associated with the completion of an undergraduate degree. In addition, the final count on this variable was based on completed number of semester credit hours and not attempted credit hours.

3.5.4 TExES exams.

The TExES exams are criterion-referenced examinations designed to measure the examinee's knowledge in relation to established criterion (ETS, 2018). Pre-service teachers are evaluated on their content knowledge (content exam) and classroom practice and dispositions (Pedagogy and Professional Responsibilities exam). Scores are based in a 300 point scale and the required minimum passing score is 240.

3.5.5 Qualifying practice exams.

The qualifying exams are representative forms of the TExES exams created by ETS from released and surplus items. They serve as precursors to the TExES exams and aid student to identify areas in need of improvement. Results of the exams are measured in a scale of 0-100.

3.5.6 Median income.

Median income was not a variable originally included in the data set. The value was generated by running the permanent address zip code through the income by zip code application found in the Cubit Planning website. A median income was assign to each of the zip codes present

in the data set leading to the generation of a total of 30 independent median income values. Median income ranged from \$13,110 – \$83,889.

3.6 Proposed Analysis and Expected Findings

The statistical technique used to analyze the data was path analysis. The research method was selected for its potential to help evaluate how each of the factors in the model interact with each other, and how the relationships of the observed variables identify the path predictors of success that influence scores on state certification exams. Unlike in a multiple regression procedure, path analysis specifies the relationships amongst factors that are free of measurement error in order to obtain unbiased estimates of the effects of the factors on the outcomes. Path analysis also allows for simultaneous analysis of all of the factors in the model, including mediation, instead of one at a time. The path model will also show direct and indirect effects that the independent variables have on the dependent variable, identifying true predictors of success (Edwards & Lambert, 2007; Everitt & Skrondal, 2010; Lani, 2017; Webley & Lea, 1997). The emerging model consisting of the exogenous variables in the study was applied to the results in the content and PPR exams independently. The model in the study contains two endogenous or outcome variables represented by the average score achieved in the qualifying exam and the score achieved by program participants on the corresponding state certification exam. The variables are quantitative in nature and measured on rational scales of 0 to 100 points in the case of the qualifying exams and 0 to 300 points for the state certification exams. The exogenous or predicting variables (number of college credit hours completed, candidate's GPA, and scores on standardize exams) will also be a quantitative in nature and represented by rational scales. Overall GPA is measured in a standard four-point scale, in the case of transfer students, the study will also account for grades obtained in courses taken at a previous college or

university rather than simply using institutional credits hours. Semester credit hours completed is the next observed variable. The total number of college credit hours completed in the content area represents the number of college credit hours completed, including transfer credits when present, prior to their first attempt at the state certification exam. This scale contains whole numbers and ranges from 0 to 120 credit hours. The Texas Higher Education Coordinating Board (THECB) sets the 120 credit hour maximum number for the state, which aligns with the adequate program length presented in “*The principles of accreditation: Foundations for quality enhancement*” published by the Southern Association of Colleges and Schools (SACS) (SACSCOC, 2008; THECB, 2017). Performance on standardized exams will look at scores obtained in other exams (i.e., ACT, SAT) as a way to predict future performance on the state certification exams.

The study used an added advanced statistical module of SPSS called analysis of moment structures (AMOS). AMOS version 23 is a powerful structural equation modeling software designed by Arbuckle (2015) within the IBM SPSS software that supports research by extending standard multivariate analysis methods to build models that reflect complex relationships. The software also allows the researcher to draw models graphically.

Although the researcher expects a “best-fitting data” model to emerge from the study comprised of several predictors rather than a single one, he expects to find that qualifying exams are one of the strongest predictors of success. The researcher also expects to see results similar to those represented in the literature, with a correlational link between the score achieved in the state certification exam, GPA, SAT scores and the number of content hours completed. Finally, the researcher expects to observe the difference in performance between native and transfer students discussed in the literature.

3.7 Chapter Summary

Although there is extensive research in the field that correlates GPA to scores on standardized tests and the impact that grade inflation has on a student's GPA, there has been little to no research done in the interrelations that may exist between these proposed factors and the high-stake nature of the teacher certification exams. Additionally, the research may bring to light the urgent need of proper articulation across institutions of higher learning, in particular the courses designed to develop future educators. The main objectives of this research were to help inform stakeholders of the importance of proper candidate identification/selection and timely interventions, as well as, to educate legislators about the impact of high stakes testing in higher education. The study also aimed to engage and add to discourse of professional identity in the K-12 education system identified by the literature and stress the need to begin addressing this issue as early as the next generation of educators who complete an educator preparation program. Just as society would frown upon an individual lacking the knowledge to become a medical doctor, we must also expect full content mastery from the individuals who enter the teaching profession and are responsible for the academic development of future generations.

Chapter 4: Results

The present chapter will report on the results of the data analysis performed to examine the proposed research questions. The chapter will begin reiterating the purpose of the study followed by information on the secondary data sample set, description of data screening procedures performed and descriptive statistics for the final sample. Additionally the chapter will cover in detail the research method, assumptions associated with the path analysis procedure and development of the path model. Finally, the chapter will present the results for the path analysis model and discussion of effects on both Native and Transfer student populations.

The purpose of the study was to identify factors with the potential to influence scores on state teacher certification exams obtained by undergraduate pre-service teachers along the United States-Mexico border. The specific focus was three fold: 1) examine what factors in a predictive model have a direct or indirect effect on scores attained on required exams; 2) to identify predictors of success for the exams; and 3) examine if the model impact native and transfer students alike.

4.1 Data

The College of Education at Border University granted access and allowed the researcher to analyze their educator preparation program data for the 2014-2017 academic years. The study specifically targeted the undergraduate initial certification students who had attempted both content area and Pedagogy and Professional Responsibilities (PPR) TExES exams at least once during the evaluation period. To ensure student data confidentiality, the data set did not include any individual personal identifiers; instead, each record was coded with a unique individual identifier. This was possible due to the nature of the study and a precise research plan, which

required no interactions between the researcher and the individuals included in the data set by the College of Education's assessment and data office. The original set of 883 secondary data records consisted of 15 data points for each record: Record ID; Age; Gender; Ethnicity; Permanent Address Zip Code; SAT Score; ACT Score; Student Type; Overall hours; Overall GPA; Certification Field; Qualifying Content Score; TExES Content Score; Qualifying PPR Score; and TExES PPR Score. Upon initial analysis of the data, it became evident that data screening would be required to have a working sample to analyze.

At the recommendation of a dissertation committee member, median income was included as an independent variable in the study. The expectation was that it would help measure the role that income might play in predicting the outcome of the study and introduce additional variability to an already highly homogenous sample of Hispanic students. Given that the data set did not include the actual income for the reported records, the researcher converted the permanent address zip code of each record into a median income using the income by zip code tool developed by Cubit Planning Inc. (2018). Thus, each individual case was assigned to a zip code based on the personal address and the median income for that area was added to the case.

4.2 Data Screening

The objective of data screening was to identify potential outliers and records with complete data points across all variables in order to produce statistically sound results. The next step to a complete working data set was to identify the variables for inclusion in the study and evaluate them for missing values. Working from the original list of 14 data points included in the sample and the factors identified by the literature with the most potential to inform positive results on state certification exams the list was narrowed down to nine variables, which were the

ones that emerged as true contributors to the study. The study contained four independent variables (SAT, overall course hours, overall GPA and median income), two dependent variables (scores on TExES content and TExES PPR exams), a control variable to compare the model across groups (student type) and two overarching demographic variables (gender and ethnicity). After the initial analysis was completed, four variables (ACT, SAT, qualifying content exam and qualifying PPR exam) contained missing data points for a good number of records. Given the robustness of the secondary data set and the potential for creating bias when large amount of data is missing at random (Allison, 2001), the number of data imputations were minimized in order to avoid increasing the potential for Type I and II errors (Hair et al. 2006).

In an effort to prevent the unnecessary elimination of records, since ACT and SAT scores are highly correlated, the researcher performed a transformation using the ACT scores of 90 records in order to generate their missing SAT score. The transformation of scores aligned with the SAT to ACT concordance table published by The College Board (2016). Given that ACT scores were not present for all of the remaining records and in accordance to the conventional practice in the literature towards working with complete data sets (Allison, 2001; Briggs et al., 2003; Kline, 2011), after completing the SAT transformation ACT was eliminated as a variable for the study. In similar fashion, the data set was further adjusted by removing the records that had missing SAT, qualifying content and/or qualifying PPR exams (factors identified as three of the main variables in the study) bringing the final sample size to 385 complete records. Table 4.1 below shows the descriptive statistics results from SPSS of the original set.

Table 4.1: *Descriptive Statistics of Original Sample, n = 385*

Variables	Mean	SD	Skewness*	Kurtosis**
Median Income	43487.52	12212.038	-.086	-.985
SAT Score	906.13	150.306	.067	-.201
Overall Hours	59.77	23.917	.694	-.090
Overall GPA	3.2825	.43167	-.232	-.835
Qualifying Content Score	69.84	7.644	-.371	.973
TExES Content Score	255.55	13.274	-.716	3.460
Qualifying PPR Score	75.48	5.215	-.702	2.345
TExES PPR Score	263.15	11.922	-.395	1.341

Note. SD = standard deviation, **S.E.* = .124, ** *S.E.* = .248

The primary analysis consisted of determining if data trimming would be required to ensure the data met the univariate and multivariate normality, to this effect, an in-depth analysis of the descriptive statistics yielded for the 385 records was performed. This is an essential step, since non-normally distributed data tends to produce biased results when testing empirical data, which in turn, leads to faulty inferences between the sample data and the population from where it is drawn. Additionally the normalization of the data set will help evaluate the assumption, discussed later in this chapter, which requires most SEM models to meet multivariate normality (Kline, 2011). The opinions of scholars in the field regarding the parameters for skewness and kurtosis range of normality tend to fluctuate from highly strict ($<3*$) standard error (Hair, 2005) to highly liberal (± 10) (Kline, 2011). This study prescribed to a more moderate middle ground range of (± 2.2) as stipulated by Sposito, Hand and Skarpness (2007). According to Kline (2011), scores that fall outside of three standard deviations from the mean are potential outliers

that can exert positive or negative influence, pulling and/or compressing the group leading to non-normality issues.

In looking at the data reported in Table 4.1, it is evident that two variables (Content Score and Qualifying PPR Score) presented kurtosis values outside the desired range. The two variables displaying moderate kurtosis were addressed in the order of severity observed. The procedure to address kurtosis was performed one variable at a time beginning with Content Score, which presented the further departure from the desirable range. Table 4.2 below is a representation of the data set after the omission of Content Score outliers, which resulted in the removal of seven records. Additionally, this brought all of the variables within the desired range of (+/-) 2 in both skewness and kurtosis. At this time, the data screening process was completed and Table 4.2 below represents the final data set used in the study.

Table 4.2: *Descriptive Statistics of Final Study Sample, n = 378*

Variables	Mean	SD	Skewness*	Kurtosis**
Median Income	43490.25	12256.951	-.089	-.989
SAT Score	908.25	148.626	.086	-.210
Overall Hours	59.97	24.010	.679	-.113
Overall GPA	3.2919	.42942	-.266	-.787
Qualifying Content Score	70.02	7.380	-.255	.601
TEGES Content Score	256.29	11.330	.225	.430
Qualifying PPR Score	75.71	4.842	-.244	.414
TEGES PPR Score	263.53	11.311	.010	-.432

Note. SD = Standard Deviation, *S.E. = .125, **S.E. = .250

4.3 Multivariate Normality

Given the level of sensitivity that univariate normality test such as the Shapiro-Wilk, in particular with samples larger than fifty deriving significant results (Field, 2009; Oztuna et al., 2006; Pallant, 2007; Elliot & Woodward, 2007), the researcher opted for paying a closer attention to the multivariate normality of the sample. The multivariate normality of the final sample was investigated using the DeCarlo's macro for multivariate normality presented in DeCarlo (1997). This SPSS macro incorporates two of the widely accepted multivariate normality techniques, the Srivastava and Mardia tests of multivariate normality. With Srivastava (p-value= 0.6740) and Mardia (p-value= 0.3014), the sample variables appear to display multivariate normality.

4.4 Study Sample

According to Hatcher (1994) and Kline (2011), a ratio (10-20):1 of cases per parameter, with a minimum of 200 cases, is required to obtain meaningful results from a structural equation model. There are 21 parameters in the study and after completing data screening procedures, the final data set contains 378 cases. This indicates that the data set contains the required number of cases to conduct the study effectively and for the results to have appropriate power to make adequate inferences about the population. As mentioned previously, the study contains two control variables (gender, ethnicity) and one group variable (student type). The study has 378 unique cases representing the number of undergraduate pre-service teachers who attempted the required state certification exams at least once during the 2014-17 academic years. Each of the cases contains complete data points across the ten observed variables in the study. The set of tables below provide the complete breakdown of the study data set into each of the control variables.

Table 4.3: *Descriptive Statistics of Study Data Set by Gender*

Variable	<u>Female*</u>		<u>Male*</u>	
	Mean	SD	Mean	SD
Median Income	43718.70	12201.529	42390.17	12558.034
SAT Score	898.50	149.319	955.23	136.829
Overall Hours	60.28	24.342	58.46	22.458
Overall GPA	3.3149	.42585	3.1812	.43260
Qualifying Content Score	69.68	7.352	71.66	7.347
TEExES Content Score	255.78	10.574	258.74	14.276
Qualifying PPR Score	75.64	4.910	76.05	4.522
TEExES PPR Score	263.25	11.401	264.86	10.854

Note. SD = Standard Deviation, **n* = 313, ***n* = 65

Table 4.3 above shows that the study data set contains 313 (82.80%) cases identified as females. When compared to program data, the sample data has a similar gender segmentation to the 1405 (78.14%) females reported during the 2016-17 academic year. A similar case can be made for the ethnicity, where the study data set is comprised of 334 (89.06%) cases with Hispanic descent and the program reported 1591 (88.49%) Hispanic participants during the same period. Table 4.4 below provides the disaggregated data by ethnicity.

Table 4.4: *Descriptive Statistics of Study Data Set by Ethnicity*

Variable	<u>Hispanic*</u>		<u>Non-Hispanic**</u>	
	Mean	SD	Mean	SD
Median Income	42935.17	12222.157	48052.73	11713.697
SAT Score	905.04	147.973	934.63	153.201
Overall Hours	59.77	24.304	61.63	21.638
Overall GPA	3.2956	.43307	3.2619	.40195
Qualifying Content Score	70.14	7.432	69.02	6.941
TEExES Content Score	256.36	11.233	255.63	12.229
Qualifying PPR Score	75.69	4.830	75.88	5.001
TEExES PPR Score	263.54	11.205	263.46	12.297

Note. SD = Standard Deviation, **n* = 337, ***n* = 41

Additionally, data presented in table 4.5 below provides the complete study data broken down into the control group data (student type). As we can see, the sample is divided fairly equally, with 217 (57.87%) cases identified as native students and 158 (42.13%) identified as transfer students. This distinction will be of importance when running the path analysis, as the literature indicates a potential difference between the two groups based on the rigor of the lower-division curriculum in reference to where the student completes the coursework.

Table 4.5: *Descriptive Statistics of Study Data Set by Student Type*

Variable	<u>Native*</u>		<u>Transfer**</u>	
	Mean	SD	Mean	SD
Median Income	44870.85	12141.925	41588.66	12197.340
SAT Score	939.18	144.290	865.66	144.330
Overall Hours	69.50	25.130	46.84	14.311
Overall GPA	3.2808	.43777	3.3073	.41853
Qualifying Content Score	70.37	7.678	69.53	6.944
TEExES Content Score	257.13	12.227	255.12	9.883
Qualifying PPR Score	76.01	4.968	75.30	4.646
TEExES PPR Score	264.84	11.347	261.72	11.043

Note. SD = standard deviation, **n* = 219, ***n* = 159

4.5 Assumption Testing

Although path analysis is an extension of multiple linear regression and many of the same assumptions hold true for both statistical techniques, the study adhered to the guidelines prescribed by Garson (2014) in his electronic book titled “Path Analysis”. Herein, Garson provides a list of assumptions that need to be met in order to conduct a path analysis study. The list contains eight assumptions: linearity, interval level variables, uncorrelated error, proper specification, normally distributed error, low multicollinearity, and identification of the model, recursively and adequate sample size. Detailed discussion of all eight assumptions of path analysis follows below.

4.5.1 Linearity.

The assumption of linearity indicates that the relationships between the variables in the study are assumed linear in nature (Garson, 2014). In structural equation modeling (SEM), we can specify relationships among constructs purged of measurement error to get unbiased estimates of the effects between predictors and outcomes. After performing a curve estimation for all of the relationships in the both models, it was determined, that all bivariate relationships were sufficiently linear to be tested using a covariance based structural equation modeling algorithm such as the one used by analysis of a moment structures (AMOS).

4.5.2 Interval level variables.

In SEM models, the assumption is made that all of the variables in the study are interval in level and that dummy variables are categorical dichotomies. Additionally, these variables is what estimates the path parameters (Garson, 2014). With the exception of the three dichotomous categorical variables in the study (gender, ethnicity and student type), the remaining variables are numerical interval level in nature which satisfies the assumption that the study contains only interval level variables.

4.5.3 Uncorrelated errors.

Garson (2014) states that the residuals of the study are uncorrelated and that previous observations in the study should not predict them. This was tested by creating a scatterplot with the ZRESID in the Y access and ZPRED in the X access for each of the two dependent variables in the study. Figure 1 in appendix B illustrates the scatterplot for the TExES Content Scores, while figure 2 in the same appendix displays the results for TExES PPR Scores. A visual investigation of both scatterplots indicated errors to be uncorrelated.

4.5.4 Proper specification.

According to Garson (2014), it is assumed that the model is properly specified in order for an accurate interpretation of path coefficients. Additionally, specification errors tend to occur when a significant casual variable is omitted from the model (Garson, 2014). After long consideration and deliberation, it was determined during the planning stages that the study includes all of the possible predictors for the dependent variables. Furthermore, this also became evident while examining the regression results where .515 of the variance in the TExES Content Scores is predicted by the variables in the study with a significance level of .000 and .555 of the variance in TExES PPR Scores is predicted by the variables in the study with a significance level of .000.

4.5.5 Normally distributed errors.

Any estimation technique, such as path analysis, expects estimates and observed values to be close with small residuals. Hence, the errors should form a normal distribution line (Garson, 2014). The standardize residuals for the study were plotted against the values of the predicted variables to check for normality, after a visual investigation of the graphs and plots the data yielded no normality concerns. Tables 3-6 in appendix C contain the normality graphs and P-P plots for each of the dependent variables.

Thereon, as suggested by scholars in the field (Arbuckle, 2015; Byrne, 2016; DeCarlo, 1997; and Raykov & Marcoulides, 2000), meeting the normality assumption and ensuring that data is not multivariate kurtotic is critical when using AMOS. An additional test of normality was ran in AMOS, known as the summary of normally statistics, which uses the Mardia's test to assess the multivariate normality of the models. A visual analysis of the AMOS results concurred with the results for normality reported earlier in this chapter. Tables 7 and 8 in

appendix C show a multivariate critical ratio (c.r.) of 2.623 for TExES Content scores and .797 for TExES PPR scores respectively. The results were evaluated using the Bentler (2005) suggested critical ratio of less than 5.00 and it was determined that both models were normal at the multivariate level.

4.5.6 Multicollinearity.

In path analysis models with observed variables, low multicollinearity between variables is assumed in order to avoid inflated standard errors of path coefficients that can lead to type II errors (Garson, 2014). Hair et al. (2010) present a practical approach to measuring multicollinearity; the procedure measures the extent to which the variance of each independent variable is explained by the other independent variables in the model. The test looks at two units of measurement: 1) the variability not explained by the other variables or Tolerance, and 2) the Variance Inflation Factor (VIF) or inverse of the tolerance value (Hair et al., 2010).

The tolerance values for the data set range from 0.960 to 0.775 and the VIF range is from 1.042 to 1.290 respectively. The cutoff value for VIF suggested by Hair et al. (2010) is in the range of 3 to 5, making the corresponding range of tolerance between 0.333 and 0.2. Therefore, using the values presented in tables 4.6 and 4.7 it was determined that the data set in the study meets the multicollinearity assumption.

Table 4.6: *Collinearity Statistics TExES Content Score*

<u>Variables</u>	<u>Tolerance</u>	<u>VIF</u>
Median Income	.959	1.042
SAT Score	.792	1.263
Overall Hours	.876	1.141
Overall GPA	.812	1.231
Qualifying Content Score	.775	1.290

Note. VIF = Variance Inflation Factor

Table 4.7: *Collinearity Statistics TExES PPR Score*

<u>Variables</u>	<u>Tolerance</u>	<u>VIF</u>
Median Income	.960	1.042
SAT Score	.821	1.218
Overall Hours	.876	1.141
Overall GPA	.840	1.190
Qualifying PPR Score	.856	1.168

Note. VIF = Variance Inflation Factor

4.5.7 Identification of the model.

In path analysis, this assumption refers to the number of structural equations available to solve for the unknowns. If the model has just the amount of equations required it is said to be “just identified”. In order for the model to provide better estimates for the underlying true values, the model should have more known than unknowns or be “Overidentified” (Garson, 2014). The way to evaluate this is by subtracting the number of parameters (# of arrows + # of error terms + # of exogenous variables) in the model from the number of observations ((# of measured variables) (# of measured variables + 1) / 2) also known as degrees of freedom (*df*)

(Byrne, 2016). After evaluating the model using the formula described above $(8(8+1)/2) - 33$ it was determined that the model's $df = 3$, which means that the model is overidentified and satisfies the identification assumption.

4.5.8 Recursivity.

This assumption deals with the directionality of the arrows in the path analysis model, which should all be unidirectional with no feedback loops (Garson, 2014). As illustrated earlier in Figure 3.1, the proposed model contained no feedback loops and all of the arrows moved in the same direction. This is indicative that the model is recursive in nature and satisfied the assumption.

4.5.9 Adequate sample size.

Both Hatcher (1994) and Kline (2011) recommend that the sample size should be no less than 10 times (or ideally 20 times) as many cases as parameters, and since path analysis is a large sample technique, the sample should contain at least 200 independent records. In the case of this study, the sample used contained 375 cases, which equals approximately 18 cases per parameter observed. This means that the size of the sample is large and robust enough to yield valid results.

4.5.10 Data screening and assumption summary.

Outliers outside the $(+/-) 3.00$ SD range in the sample data were identified using a value of $(+/-) 2$ for the skewness and kurtosis indices, ten cases fell outside the range and were removed leaving 375 cases in the study. Linearity, interval-level measurement, uncorrelated error, model specification, multicollinearity, model identification, recursivity and sample size were all investigated to meet the required assumptions. Additionally, the standardize residuals

for the study were plotted along with the values of their predicted variables on the opposing axis to evaluate for normality. For the purpose of data screening only, a criterion of $p = .01$ was used with no assumption violations detected.

4.6 Multivariate Correlations

A Pearson product-moment correlation coefficient was computed to assess the relationship between the six independent variables (Median Income, SAT Score, Overall Hours, Overall GPA Qualifying Content Score and PPR Content Score) and each of the two dependent variables (TExES Content Score and TExES PPR Score) on the data set of 378 cases. Complete correlation reports are included in Appendix A. The correlational matrix indicated that there exist small to moderate bivariate correlations between the variables selected for the study. Additionally, results of the significant correlations are included below as they pertain to each group.

4.6.1 Native students.

The native group consisted of 219 cases. The results suggested that only three of the variables had a significant effect on the TExES Content Score with moderate correlations, while four variables showed to have a significant effect on the TExES PPR Score with low to moderate correlations. The results for the correlations with the TExES content score indicate that Qualifying Content Score is the strongest correlation ($r = .582, p < .01$) followed by SAT Score ($r = .423, p < .01$) and Overall GPA ($r = .296, p < .01$). Regarding the correlation with the TExES PPR score, SAT Score showed the strongest correlation ($r = .511, p < .01$) followed by Qualifying PPR Score ($r = .372, p < .01$) and Overall GPA ($r = .208, p < .01$) with the weakest correlation negatively linking the dependent variable with Overall Hours ($r = -.167, p < .05$).

4.6.2 Transfer students.

The transfer student group consisted of 159 cases, results from the correlation matrix indicated significant effects exerted on TExES Content Score by three variables with low to moderate correlations, while only two of the variables displayed a significant effect with moderate correlations on TExES PPR score. The strongest correlation with the TExES Content Score was shown by SAT Score ($r = .497, p < .01$) followed by Qualifying Content Score ($r = .490, p < .01$) and Median Income ($r = .165, p < .05$). For the TExES PPR score, the strongest correlation was displayed by SAT Score ($r = .536, p < .01$) closely followed by Qualifying PPR Score ($r = .523, p < .01$).

Further analysis of the results from the tables in Appendix A indicates that for both native and transfer students, the demographical variables (gender, ethnicity and median income) have little to no effect on either of the dependent variables. Furthermore, only SAT Score and the qualifying exams demonstrated consistent results across groups, indicating a moderate relationship between these variables and scores on the TExES exams. This topic will be explored further later in this chapter.

4.7 Path Analysis

As discussed in chapter 3, the path analysis theoretical model research design was twofold: 1) to look at causal relationships between the observed manifest variables; and 2) determine the extent to which a theoretical model accounts for the actual relationships observed (Hatcher, 1994). Having satisfied all of the assumptions associated with path analysis research, it was determined that the model proposed, see Figure 4.1 below, and was ready for testing.

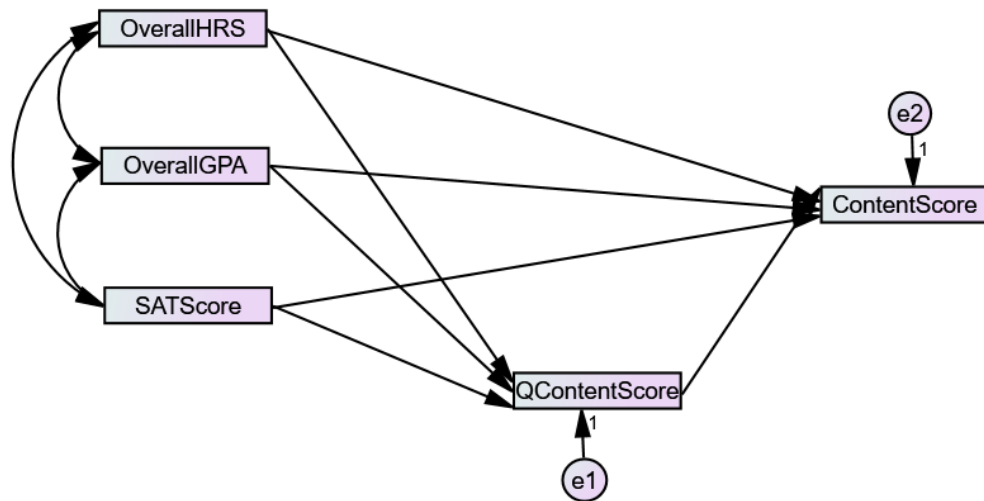


Figure 4.1. Initial theoretical model

Prior to running the path analysis, an adjustment was done to the model to include the new median income variable and better align the correlations between variables to reflect the literature and sequence of events. In the adjusted model below, two variables (median income and SAT scores) represent what the students bring with them and the first level of the model. The second level of the model contains three variables (overall hours, overall GPA and qualifying exam score) which represent their college experience. The final level of the model is the score of the TExES exams or outcome of the study. Given that the study controlled for gender and ethnicity, they appear on all three levels of the model. Figure 4.2 below contains the adjusted model used for the study. The analysis was conducted in three separate iterations: 1) first to test the interactions with the TExES content exam; 2) second, the interactions with the TExES PPR was tested; and 3) the third iteration tested the interactions across groups (native and transfer). At the completion of the third iteration, an in-depth analysis was performed in order to address each of the proposed hypothesis.

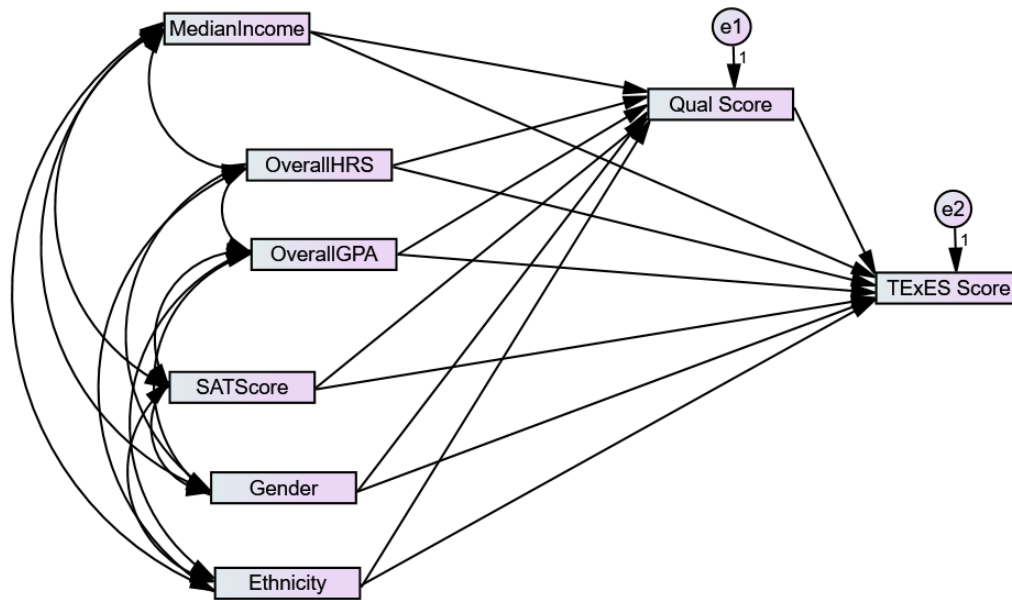


Figure 4.2. Final model

4.7.1 TExES content exam.

The path analysis was ran using AMOS version 23 to evaluate the pathways by which SAT Scores, overall hours, overall GPA, median income, gender, ethnicity and qualifying exam score variables influence the TExES content exam score. The model consisted of manifest variables tested with a maximum likelihood estimation using a covariance matrix as its input data. Additionally, the model was tested for indirect, direct and total effects to determine the full extent of the influence exerted into the outcome variable. A comprehensive picture of the association between predictors and dependent variable is provided by using this type of analysis.

Researchers like Marsh, Balla, and Hau (1996) and Jaccard and Wan (1996) recommend the utilization of a varied range of fit indices to overcome and attenuate the limitations of each individual index. The analysis of the model was conducted using ten fit and validity of measure statistics: chi-square (CMIN); degrees of freedom (df); probability value of chi-square (p); goodness of fit index (GFI); adjusted goodness of fit index (AGFI); normed fit index (NFI);

incremental index of fit (IFI); Tucker Lewis index or non-normed fit index (TLI); comparative fit index (CFI); root mean square error of approximation (RMSEA); and the close-fit hypothesis (PCLOSE). Byrne (2016) suggest the value for CMIN $p > .05$, (GFI, AGFI, NFI, IFI, TLI and CFI) values at or above 0.90, and RMSEA less than or equal to 0.05 as good model fit indicators. Presented in table 4.8 below are the results for the TExES content exam model which scored within the desired values on all of the model fit and validity of measure statistics.

Table 4.8: *Model Fit Statistics for TExES Content Exam*

	CMIN	DF	P	NFI	IFI	TLI	CFI	RMSEA
Default Model	5.716	3	0.126	0.984	0.992	0.92	0.992	0.049

Note. CMIN= Minimum Discrepancy, DF= Degrees of Freedom, P= Probability Value, NFI= Normed Fit Index, IFI= Incremental Index of Fit, TLI= Tucker-Lewis Index, CFI= Comparative Fit Index, RMSEA= Root Mean Square Error of Approximation.

Figure 4.3 below presents the standardized estimates between the predictors and the score obtained in the TExES content exam. As illustrated by the model's R-square results, the endogenous variables in the model account for 37% of the variance in the TExES Content Exam and 22% of the variance explained in the Qualifying Content Score.

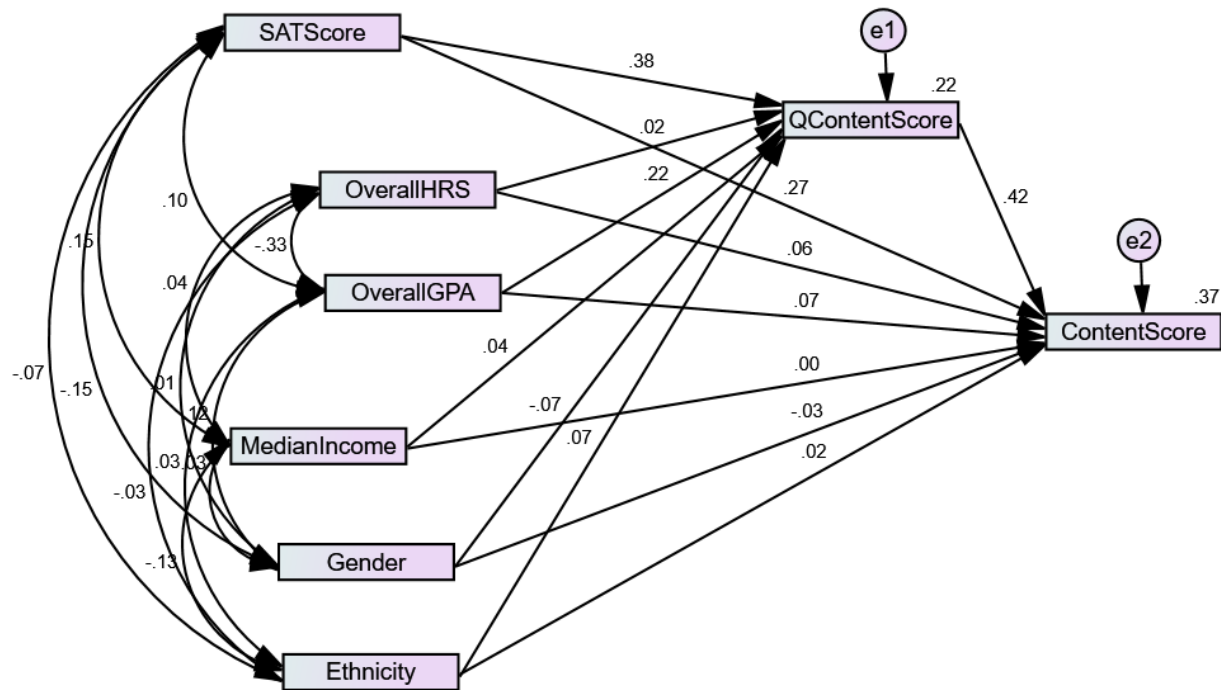


Figure 4.3. Standardize estimates for TExES content exam scores

4.7.1.1 TExES content score direct and indirect effects.

Figure 4.3 indicates that SAT Score has a significant direct and indirect effect on TExES Content Score with Qualifying Content Score as the mediating factor ($\beta = .273$ for direct effect and $\beta = .16$ for indirect effect, $p < .05$). Overall GPA also had a significant indirect effect on TExES Content Score with Qualifying Content Score as the mediator ($\beta = .091$, $p < .05$). Additionally, the strongest direct effect was identified between Qualifying Content Score and TExES Content Score ($\beta = .421$, $p < .05$). Upon examination of table 4.9 below, the results indicate that Qualifying Content Score plays a partial mediating role for SAT Score and a full mediating role for Overall GPA through.

Table 4.9: *Direct, Indirect Effects and Mediation of Model Variables on TExES Content Score*

<u>Path</u>	<u>Direct effect</u>	<u>Indirect effect</u>	<u>Result</u>
Ethnicity→Value→ContentScore	0.016 (ns)	0.028 (ns)	No Mediation
Gender→Value→ContentScore	-0.026 (ns)	-0.030 (ns)	No Mediation
OverallHRS→Value→ContentScore	0.064 (ns)	0.006 (ns)	No Mediation
OverallGPA→Value→ContentScore	0.070 (ns)	0.091*	Full Mediation
MedianIncome→Value→ContentScore	0.003 (ns)	0.015 (ns)	No Mediation
SATScore→Value→ContentScore	0.273*	0.160*	Partial Mediation
QContentScore→Value→ContentScore	0.421*		

Note. * $p < 0.001$; ns= “not significant”

4.7.1.2 TExES content score multigroup effect.

In order to determine if the effect of the exogenous variables on the outcome variable was different according to the type of student (native or transfer), a Chi-square difference test was performed where variables were freely estimated and all paths within the structural weight model were treated as equals for Native and Transfer students. Figures 4.4 and 4.5 below, respectively, present the diagrams for the variables in the model as they relate with TExES content scores.

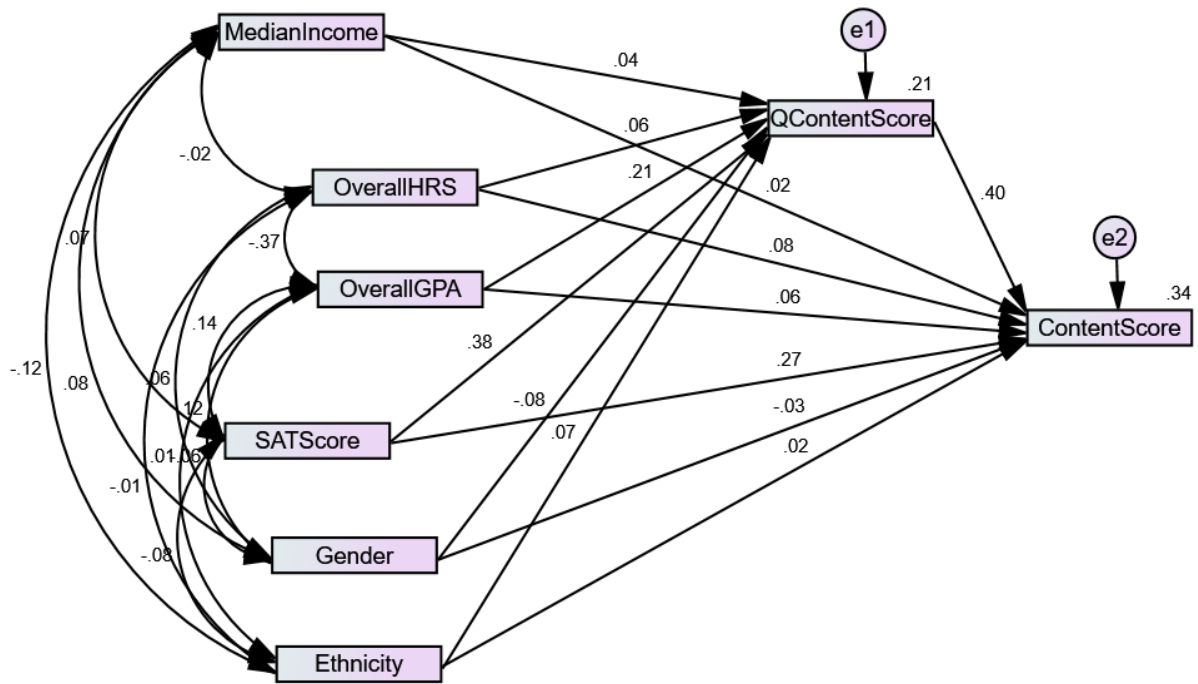


Figure 4.4. Native TExES content exam structural weights model $n = 219$

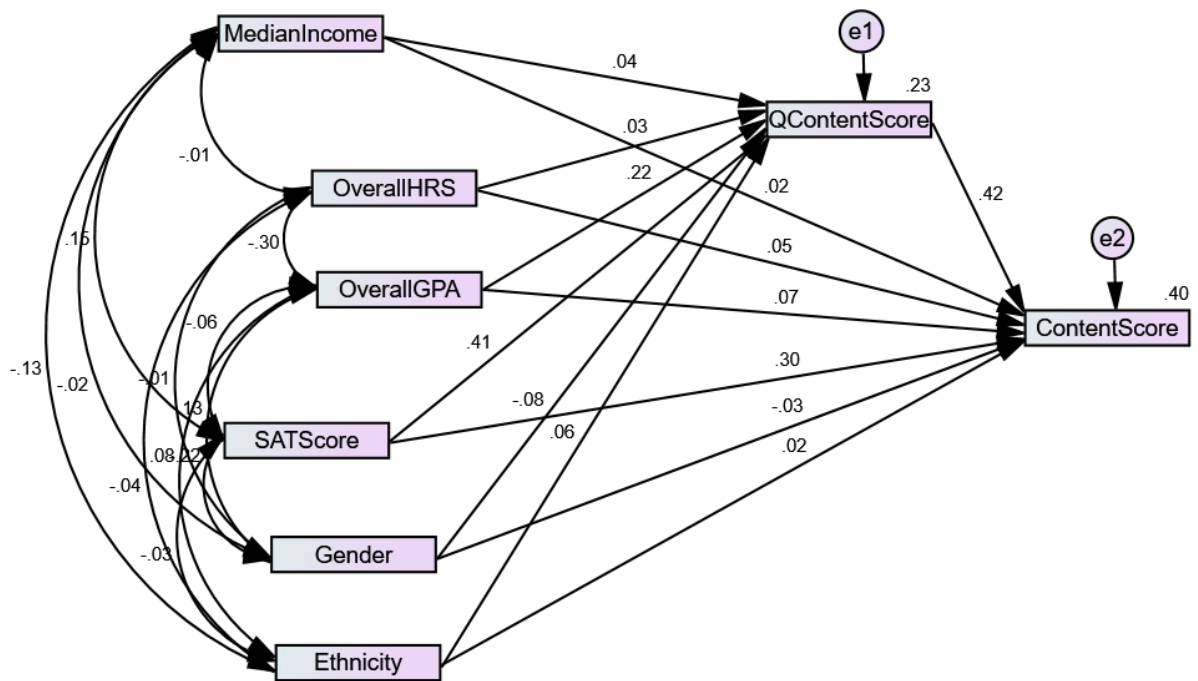


Figure 4.5. Transfer TExES content exam structural weights model $n = 159$

Results from the model comparison yielded a significant Chi-square difference test ($p=0.032$), indicating a model difference based on the groups. This means that a difference in effect exists between Native and Transfer students on the TExES content exam. Given the existence of this group difference at the model level, the focus shifted to identify the differences at the path level. The path evaluation was conducted using the group difference tab of the stat tools package created by Gaskin (2016), which determined two paths were significantly different across groups. Upon examination of Table 4.10 below, the results indicate that the paths from overall hours and qualifying content exam to content score proved significant with a $p\text{-value}<0.01$.

Table 4.10: *Path Comparison Across Groups for TExES Content Scores*

<u>Path</u>	<u>Native</u>		<u>Transfer</u>		<u>z-score</u>
	<u>Estimate</u>	<u>P</u>	<u>Estimate</u>	<u>P</u>	
QContentScore←OverallGPA	5.181	0.000	2.299	0.059	-1.716*
QContentScore←OverallHRS	0.001	0.953	0.083	0.019	2.03**
ContentScore←MedianIncome	0.000	0.317	0.000	0.104	1.85*
ContentScore←QContentScore	0.754	0.000	0.458	0.000	-2.089**

Notes. ** $p\text{-value}<0.01$; * $p\text{-value}<0.10$

4.7.2 TExES PPR exam.

The second iteration of the study consisted on using the same seven variables to evaluate the interactions with the TExES PPR score. The same parameters were used to evaluate the model and the results for the evaluated indices are presented on table 4.11 below. As presented previously in the chapter, Byrne (2016) suggest the value for CMIN $p>.05$, (GFI, AGFI, NFI, IFI, TLI and CFI) values at or above 0.90, and RMSEA less than or equal to 0.05 as good model fit indicators. The model scored within the desired ranges in all of the indices.

Table 4.11: *Model Fit Statistics for TExES PPR Exams*

	CMIN	DF	P	NFI	IFI	TLI	CFI	RMSEA
Default Model	5.716	3	0.126	0.982	0.991	0.913	0.991	0.049

Note. CMIN= Minimum Discrepancy, DF= Degrees of Freedom, P= Probability Value, NFI= Normed Fit Index, IFI= Incremental Index of Fit, TLI= Tucker-Lewis Index, CFI= Comparative Fit Index, RMSEA= Root Mean Square Error of Approximation.

Figure 4.6 below presents the standardize estimates between the predictors and the score obtained in the TExES PPR exam. As illustrated by the model's R-square results, it accounts for 36% of the variance in the TExES content exam and 14% of the variance in the Qualifying Content Score.

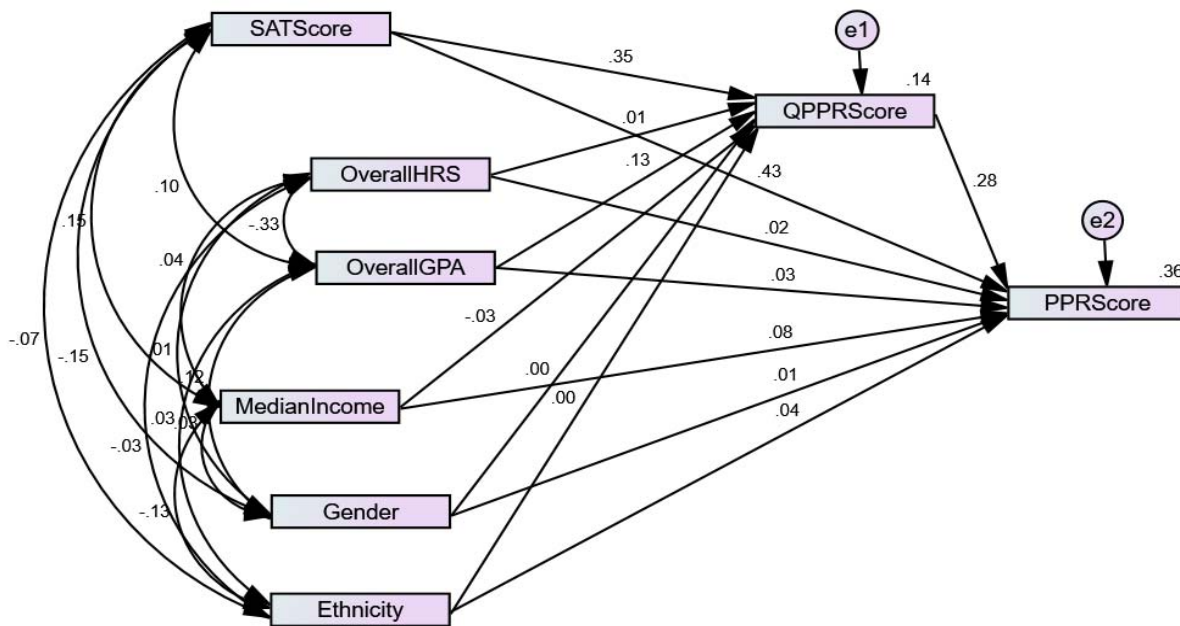


Figure 4.6. Standardize estimates for score on TExES PPR exam

4.7.2.1 TExES PPR direct and indirect effects.

As seen in table 4.12 below, SAT Score has a significant direct and indirect effect on TExES PPR Score with Qualifying PPR Score as the mediating factor ($\beta = .426$ for direct effect

and $\beta = .097$ for indirect effect, $p < .05$). Overall GPA also had a significant indirect effect on TExES PPR Score with Qualifying PPR Score as the mediator ($\beta = .036$, $p < .05$). There is also a direct effect between Qualifying PPR Score and TExES PPR Score ($\beta = .28$, $p < .05$). An analysis of table 4.12 below indicates that Qualifying PPR Score plays a partial mediation role for SAT Score and a full mediating role for Overall GPA.

Table 4.12: *Direct, Indirect Effects and Mediation of Model Variables on TExES PPR Score*

<u>Path</u>	<u>Direct effect</u>	<u>Indirect effect</u>	<u>Result</u>
Ethnicity→Value→PPRScore	0.043 (ns)	0.001 (ns)	No Mediation
Gender→Value→PPRScore	0.011 (ns)	0.001 (ns)	No Mediation
OverallHRS→Value→PPRScore	0.022 (ns)	0.003 (ns)	No Mediation
OverallGPA→Value→PPRScore	0.026 (ns)	0.036*	Full Mediation
MedianIncome→Value→PPRScore	0.079 (ns)	-0.007 (ns)	No Mediation
SATScore→Value→PPRScore	0.426*	0.097*	Partial Mediation
QPPRScore→Value→PPRScore	0.28*		

Note. * $p < 0.001$; ns= “not significant”

4.7.2.2 TExES PPR score multigroup effect.

In order to determine if the effect of the exogenous variables on the outcome variable was different according to the type of student (native or transfer), a Chi-square difference test was performed where variables were freely estimated and all paths within the structural weight model were treated as equals for Native and Transfer students. Figures 4.7 and 4.8 below, respectively, present the diagrams for the variables in the model as they relate with TExES PPR scores.

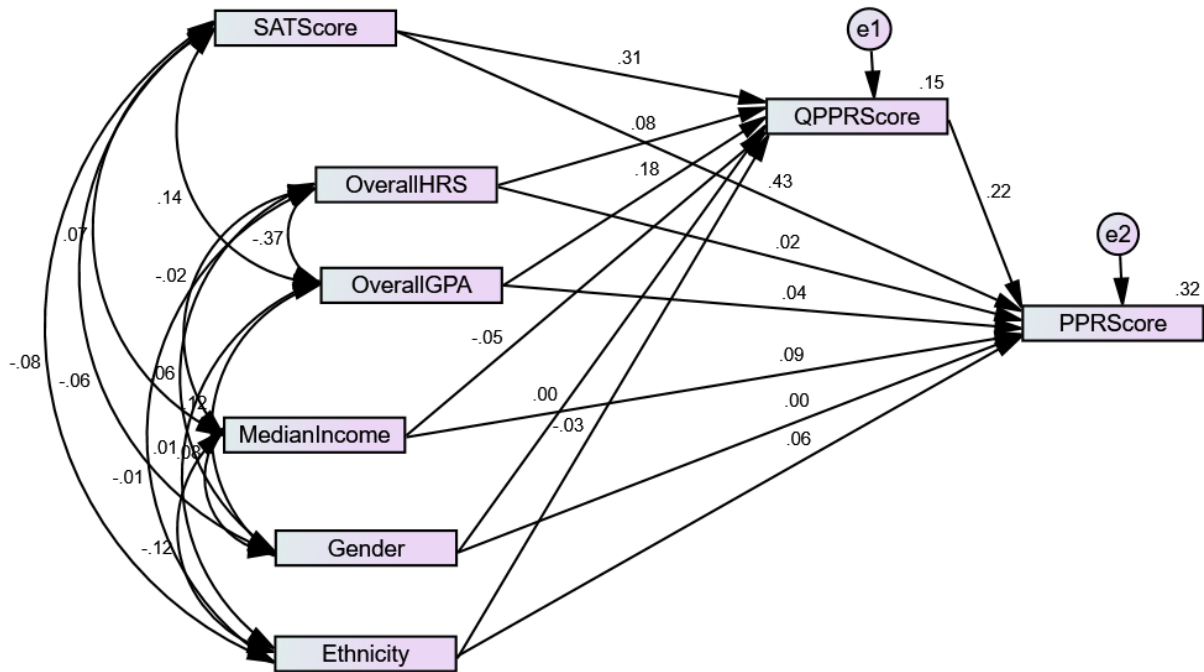


Figure 4.7. Native TExES PPR exam structural weights model $n = 219$

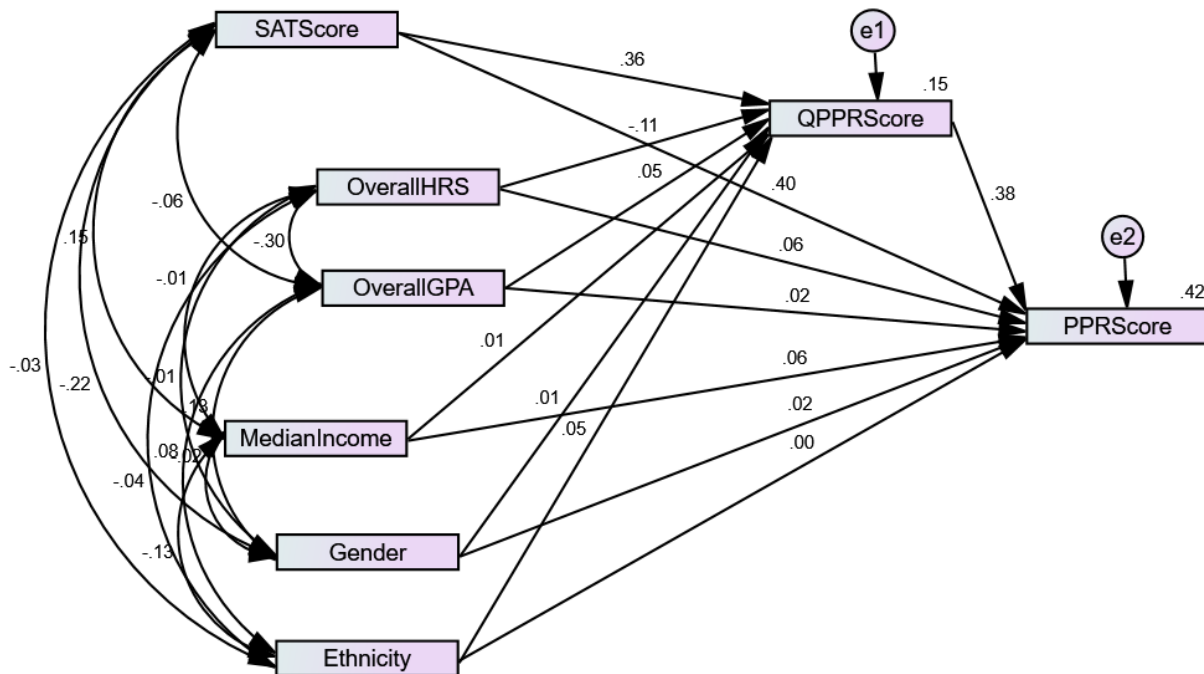


Figure 4.8. Transfer TExES PPR exam structural weights model $n = 159$

Results from the Chi-square difference test was non-significant ($p= 0.726$), indicating that there is no significant difference on the effect across groups. The results indicate that the groups are not different at the model level or invariant.

4.7.3 Final model.

A final model was generated by removing all of the variables that had no significant effect on the scores for TExES Content or PPR exams. The study contained six exogenous variables, it controlled for gender as well as ethnicity and looked at the effects across native and transfer students groups. In the final model, only SAT scores and Overall GPA showed to have a significant influence on the endogenous variables while the qualifying exams continue to play a significantly strong mediating role in the model. Figure 4.9 below shows what the Hernandez model for pre-service teacher student success looks like.

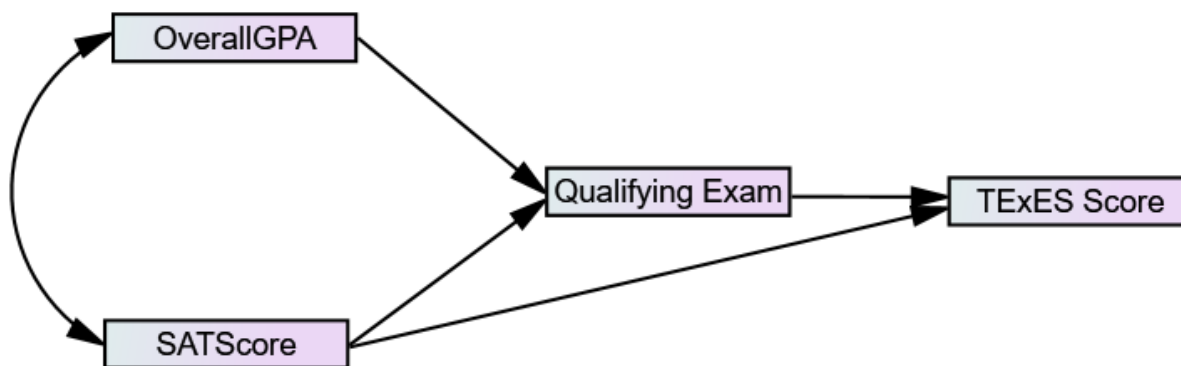


Figure 4.9. Hernández model for pre-service teacher student success

4.7.3.1 TExES content exam.

In the case of the TExES content exam, the model improved moderately after the removal of the non-significant variables, however the three predictors identified in this chapter continued to account for 37% of the variance in the TExES exam, while SAT score and overall GPA

account for 21% of the variance on the qualifying exam. It was in the β weights of the variables that the slight improvement was found, in particular the indirect effect of SAT scores and the direct effect of qualifying exam score. The direct and indirect paths for SAT Score on TExES Content Score with Qualifying Content Score as the mediating factor were ($\beta = .272$ for direct effect and $\beta = .170$ for indirect effect, $p < .05$). Overall GPA on TExES Content Score with Qualifying Content Score as the mediator ($\beta = .089$, $p < .05$). Direct effect of Qualifying Content Score on TExES Content Score ($\beta = .438$, $p < .05$). Table 4.13 and Figure 4.10 below display the results.

Table 4.13: *Final Model Direct, Indirect Effects and Mediation on TExES Content Score*

<u>Path</u>	<u>Direct effect</u>	<u>Indirect effect</u>	<u>Result</u>
OverallGPA→Value→ContentScore		.089*	Full Mediation
SATScore→Value→ContentScore	.272*	.170*	Partial Mediation
QContentScore→Value→ContentScore	.438*		

Note. * $p < 0.001$; ns= “not significant”

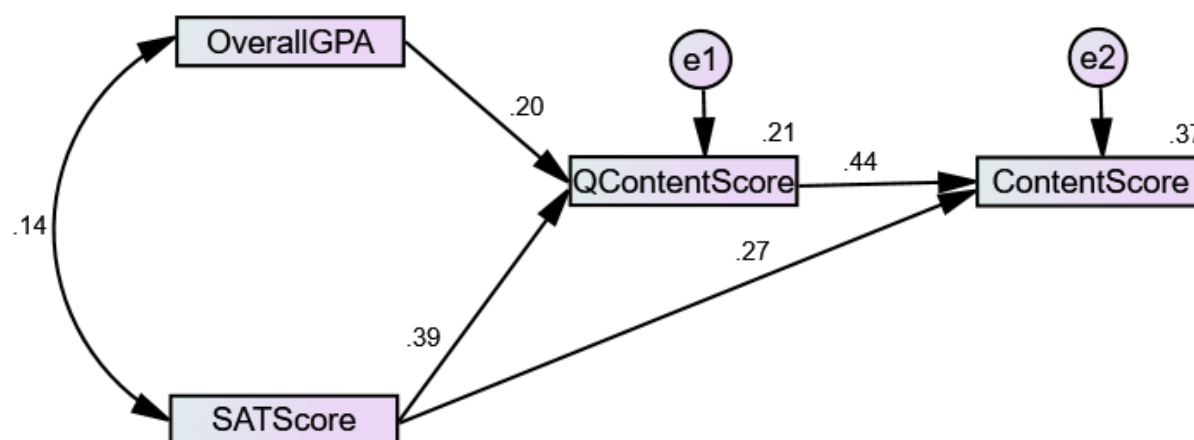


Figure 4.10. Hernández model for pre-service teacher success on TExES content exam

4.7.3.2 TExES PPR exam.

The results for the PPR final model show a slight decrease in the variance that it accounts for the TExES exam after the removal of the non-significant variables. However the predictors identified in this chapter continued to be significant accounting for 35% of the variance in the TExES exam, and 14% of the variance on the qualifying exam. The β weights of the variables maintained their levels with the exception of SAT score which showed a very slight increase and decrease on its direct and indirect effects respectively. The direct and indirect paths for SAT Score on TExES Content Score with Qualifying Content Score as the mediating factor were ($\beta = .433$ for direct effect and $\beta = .096$ for indirect effect, $p < .05$). Overall GPA on TExES Content Score with Qualifying Content Score as the mediator ($\beta = .036$, $p < .05$). Direct effect of Qualifying Content Score on TExES Content Score ($\beta = .282$, $p < .05$). Table 4.14 and Figure 4.11 below display the results.

Table 4.14: *Final Model Direct, Indirect Effects and Mediation on TExES PPR Score*

<u>Path</u>	<u>Direct effect</u>	<u>Indirect effect</u>	<u>Result</u>
OverallGPA→Value→PPRScore		.036*	Full Mediation
SATScore→Value→PPRScore	.433*	.096*	Partial Mediation
QPPRScore→Value→PPRScore	.282*		

Note. * $p < 0.001$; ns= “not significant”

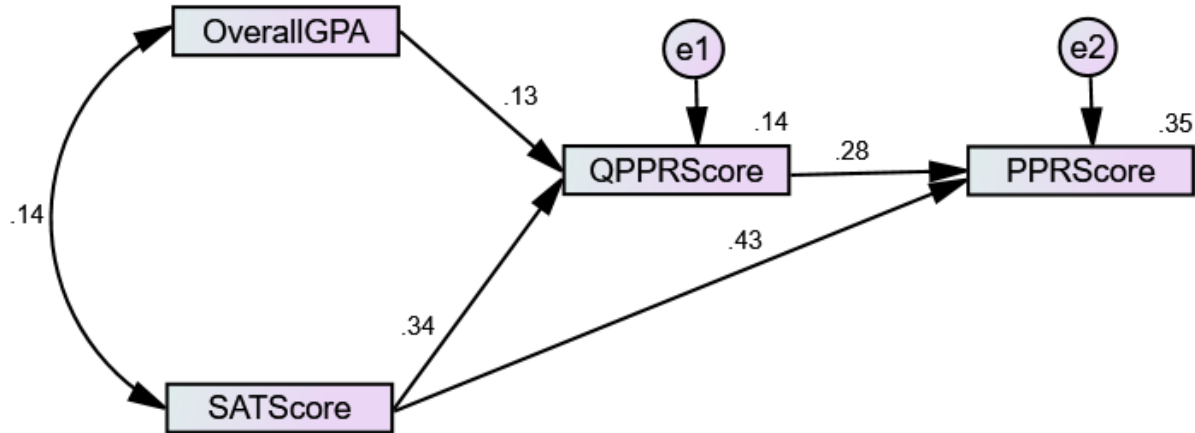


Figure 4.11. Hernández model for pre-service teacher success on TExES PPR exam

4.8 Chapter Summary

The study was designed to investigate the effect that the identified factors had on the highest achieved score by undergraduate pre-service teachers on mandated Texas teacher certification exams. Specifically, this study compared student background and educational attainment as exogenous factors to determine the level of effect exerted on the endogenous factors of TExES Content and PPR scores attained. Furthermore, the study also looked at the role that the qualifying exams played as a mediating factor in the model and how it influenced or attenuated indirect effects. Path analysis was used to generate the final model, determining that in the case of the pre-service teachers at Border University included in the study factors such as gender, ethnicity, student type and number of overall hours were inconsequential in predicting performance on the state mandated teacher certification exams. The study also looked at the effect that the model had on Native and Transfer students. The results of the study indicate an invariant treatment of the groups on the TExES content exam model, while an equivariant treatment was present for the groups in the TExES PPR exam. The final model was found to be

statistically significant and sound for the empirical evaluation of the data. The next chapter will provide a full summary of findings, conclusion and implications for future research.

Chapter 5: Summary and Conclusions

Attaining teacher certification is an exciting proposition for pre-service teachers with the imbedded promise of financial stability and the opportunity of upward social mobility. For some students, this process can prove to be a testament of their tenacity and ability to conquer adversity. Others falter under the weight of high stakes exams and the fear of facing the possibility of not conquering them, leaving the university failing to fulfill their dreams and unable to reach their full potential. That is why the timely examination of policies and practices with the potential to inhibit student success is essential to scaffold support systems to ensure their academic success. The early detection of areas of opportunity in student performance, is paramount to further advance our understanding of the support systems needed for students to keep pace with the accountability demands placed on pre-service teachers in the state of Texas. To this effect, educator preparation programs must effectively assess the abilities and dispositions of their applicants in order to offer a robust experience and place them in track to succeed.

In the State of Texas, in addition to obtaining a bachelor's degree and completing an educator preparation program, pre-service teachers are required to pass mandated certification exams to receive their teaching certificate. On the other hand, the educator preparation programs are held accountable for the performance of their candidates in the TExES certification exams.

The remainder of the chapter will be spent unpacking and exploring the implications of the findings from the study and conclusions reached as they relate to the impact on current practices. Additionally, the chapter will discuss a post-hoc evaluation of data performed to further inform the educator preparation program at Border University. Finally, the chapter

concludes with a discussion of recommendation for further research that originated from the study.

5.1 Findings and Conclusions

The study aimed to determine which of the variables found in the secondary database could be used as predictors of success for pre-service teachers in the Texas mandated high stakes teacher certification exams. The holistic approach to evaluate performance introduced by Donald Elger in his Theory of Performance (2017), proved to be fundamental for the study in the proper identification of the best predictors of success. In borrowing from his model, we can see how levels of skill (i.e., overall GPA and qualifying exams) and level of knowledge (i.e., Coursework performances (GPA), qualifying exams and SAT scores) drive the context of high-stake exam performances (i.e., scores on TExES exams). Additionally, the study wanted to investigate how these emerging factors impacted Native and Transfer students, which represent the personal and fixed factors in Elger's theory. Uses of this combination of variables appears to support this important framework to examine performance by pre-service teachers in the context of certification requirements. Overall, the researcher is satisfied with the way the study fit the theory. After conducting the study, three distinct conclusions emerged in the findings.

Through the use of correlation and covariance matrices, this path analysis study managed to identify not only the best predictors of success, but also how the predictors interact with the presence of a mediating factor. From the variables in the study, SAT scores and overall GPA proved their value in the predicting model for both TExES content and PPR exams.

Additionally, the model also identified Qualifying Exams to be a true mediators for both TExES state certification exams. As discussed in chapter 4, overall GPA has an indirect effect playing a fully mediated role through the qualifying score while SAT score is only partially mediated

factor given that it has both direct and indirect effects on the TExES exams. The results of the study also confirmed the findings presented in Harrell (2009) regarding GPA as a predictor of performance on TExES exams. However, this study also expanded on their original predicting model adding two new factors as successful predictors (SAT and Qualifying exams) not discussed or used in her study. Additionally, the study findings differed from Harrell's regarding content hours. In her study she found this variable to be an important predictor where in this study the variable did not play a significant role.

The study identified two emerging conclusions regarding predictors of success for pre-service teachers on the TExES certification exams.

The first conclusion drawn from the study is that there are three major elements in the preparation of pre-service teachers which can't be ignored as predictors of performance on the TExES exams. The study revealed that from the seven variables obtained from the secondary database (gender, ethnicity, median income, overall GPA, overall hours, SAT score and qualifying exam score) only three (SAT score, overall GPA and qualifying exam score) showed not just significance in helping answer the question but practical importance in the current understanding of how teachers become certified. Furthermore, a post hoc analysis discussed in detail later in this chapter, confirmed the original belief that no one factor could effectively predict results if used on their own. This lead the research to conclude that the use of all three factors is preferred when predicting success on the certification exams. Additionally, in the event that not all three of the variables are present, the analysis showed that the combined use of GPA and Qualifying Exams it's the second most effective set of predictors. The study also showed that in the absence of SAT scores and an acceptable GPA, as a last resort, Qualifying Exam scores could potentially be used on their own.

The second conclusion drawn from the study is that the results indicate a variance across groups on the TExES content exam model, while an invariance was present between the groups on the TExES PPR exam. It is stipulated that the results obtained from the group comparison could be linked to the fact that content mastery for the PPR exam is typically achieved institutionally after admission to the program, thus essentially moving all candidates into the native group. Unlike the mastery of the PPR standards, content mastery for the TExES content exam is typically articulated across institutions and spans over more years than that of the PPR.

5.2 Post hoc Analysis of Data

Upon the identification of the factors with the potential to predict performance on TExES exams (SAT scores, overall GPA and qualifying exams) further evaluation of the data sought to validate the model at a greater scale and to provide the Educator Preparation Program additional data about their performance. Making use of the original sample of 883 records, dichotomies were created for each of the variables based on the observed results for each of them: 1) the results for SAT were either yes or no depending on whether the candidate took the exam; 2) the Overall GPA mean was used to determine above or below average performance; 3) for Qualifying Exams the mean score was used to determine whether the candidate passed or failed; and 4) for the TExES exams it was twofold, pass or failed based on the best overall score achieved and pass or fail based on the best score based on the first two attempts. Given that Qualifying Exams contained missing values, a missing qualifying exam value was equated to a failing score. Hence there was no differentiation between not taking the qualifying exam and scoring below the group average. Overall GPA had a mean value of 3.16, while the qualifying content mean score was 76 and the qualifying PPR mean score was 79. Table 5.1 below illustrates the complete dichotomous breakdown for each of the variables.

Table 5.1: *Dichotomous Value Assignment for Post hoc Variables*

Variable	<u>Assigned Value</u>	
	0	1
SAT Score	No SAT Score	SAT Score
Overall GPA	GPA < 3.16	GPA >= 3.16
Qualifying exam score	Content < 76, PPR < 79	Content >= 76, PPR >= 79
TEExES Exam	Failed Exam	Passed Exam

Next, 8 subsets were generated (All Predictors, SAT score and Overall GPA, SAT score and Qualifying exam, Overall GPA and Qualifying Exam, SAT score, Overall GPA, Qualifying exam, No Predictors) to identify each possible combination of variables to evaluate the results for each of the TEExES exams. Using Excel I created filtered lists to activate or deactivate the attributes according to the subset matrix previously discussed. Additionally, I used the subsets to create two separate tables. The first one with the overall passing score on the TEExES exams and the second one with the pass rate associated with the first two attempts on the exams, which allowed for an additional level of evaluation and comparison to the new accountability standards.

5.3 Post hoc Results

As predicted by the path analysis study, the best results came from the set containing all three of the predictors regardless of the accountability parameters used. This subset predicted a 100% pass rate on both exams for the overall test score, while 96.35% and 99.30% for the content and PPR respectively for the first two attempts. The Overall GPA and Qualifying exam subset came in on second place, also doing great job in predicting positive results in both accountability models. This subset had a 97.29% and 100% content and PPR pass rate respectively for the overall exam performance with a 90.54% and 100% pass rate by the second attempt. The single

variable subset that showed the most promise as predictive value for past and current accountability requirements was Qualifying exam. On its own, it had a passing rate on the TExES exams of 92.68% for the content and 100% for the PPR in the overall score group. Additionally, it also displayed a passing rate of 73.17% for the content and 96.88% for the PPR when accounting for only the first two attempts at the exams. Full results of the post hoc analysis are located in Appendix D. Full discussion of the programmatic implications of the Post hoc results will follow later in this chapter.

Finally, a defining emerging conclusion from the data indicates that a complete disregard of all three of the identified factors (SAT, GPA and Qualifying exams) will not only be detrimental for the student but also the program. Results from the null subset, the one containing the results associated with the absence of all three factors, were dismal and fell well below the desired results. This is indicative of the need for a strict and closely monitor approval process for the TExES exams.

5.4 Discussion

Although literature on the field speaks of the cultural bias and challenges faced by minorities on standardize exams (Contreras, 2005, 2011; Gándara, 2010; Gándara & Contreras, 2009; Gándara & Lopez, 1998), pre-service teachers at Border University did not seem to fit this mold. With over 80% of the program population being of Hispanic descent, one could expect program performance on the TExES exams to be subpar. Surprisingly, nothing could have been further from the truth, given that almost 87% of the 883 records in the full sample passed the TExES content exams while over 93% passed the TExES PPR exam. According to the cultural bias literature these results could have been consider to be favorable, given the population comprised in the sample, however recent changes enacted to the Texas Administrative Code

accountability requirements by the Texas state legislature drives us to take a deeper look at the results attained later on this chapter.

Texas Administrative Code calls for the completion of a minimum of 60 credit hours prior to entering an undergraduate educator preparation program. In a university setting, the 60 hours would equate to fulfilling the core requirement or sophomore year. The study found that this somewhat arbitrary number used by the state to be accurate. The secondary data contained information on course credit hours for the pre-service teachers in the program. The observed variable overall hours was generated by combining all of the courses associated with the certification field sought by the student and the completed education courses designed to prepare teachers for the profession. The study did not use the courses taken not align with the certification exam, however they are typically taken into consideration for admission to the program. As evident by the results of the study, overall number of hours was found to be not significant in the prediction of TExES scores and hence was eliminated from the final model. Despite not fully understanding the rationale use by the Texas legislation to arrive to the 60 hour rule, I thought that there might be some merit to the requirement. This lead to the surprising conclusion that as long as the candidate has reached at least 60 credit hours (typically covering most of the content required for the TExES content exam), having additional hours did not help nor hinder the pre-service teachers in attempting the required teacher certification exam for their certificate.

Following the suggestion of a committee member, an income variable was added to the study to examine its possible relationship with the results on the TExES exams. The secondary database did not include the reported student income, therefore each of the records were linked to a median income using a table to assign a value based on the recorded permanent address zip

code included in the secondary data. Using the framework found on the literature regarding cultural bias and the variability that existed in the values entered as income, it was expected to see a high relationship between median income and results on TExES exams. It could be argued that the results obtained were due to the use of a pseudo income instead of a true measure of income for each record, however the variable did not play a significant role on the results of either of the TExES exams and the researcher could not see using the actual income making any difference. This is to say that income does not play a role in determining the score on TExES exams which is the reason for its removal from the final model.

From the inception of the study it was determined that gender was only to be used as a control variable. Given the homogeneity found in the program, it was expected that the sample would reflect similar characteristics. The secondary data did in fact follow suit as expected with over 80% of the records belonging to females in the program. That is the reason why it was no surprise to find out that it played no effect whatsoever on the other variables in the study, in fact, overall gender had the lowest β weights displayed for both TExES exams amongst all of the variables. Needless to say, the variable was excluded from the final model.

Overall GPA was one of the variables that was expected to be a good predictor of the results on the TExES exams. So much so, that it felt short of its expectations by being fully moderated and having no direct effect on either of the exams. Regardless of having no direct effect, overall GPA proved to hold true to the discourse in the literature regarding its correlation with standardize exams (Decker et al., 2004; Kane et al., 2008; Levine, 2006; Rice, 2003). Although it could be argued that results could be skewed due to the inflation of grades in higher education, in the end, GPA continues to be the most accepted representation of student overall academic achievement. The study also added to the body of knowledge on the topic by

demonstrating that despite the perceived grade inflation, the variable maintained its place as an important factor to be considered when evaluating student performance on the TExES exams.

Although SAT scores are not factored in the admission criterion of most open enrollment universities, such as the one where this study took place, its predictive value in the model can't go ignored. As indicated by the results of the study, SAT score was one of the three factors that demonstrated significance in the prediction of TExES scores. This came as no surprise, given that both the SAT and the TExES are standardized exams developed and managed by the Educational Testing Service. Both the SAT and TExES are also considered to be high stakes exams, given that one is used as an indicator of college success and the others represent future classroom success as an educator. Additionally, they both have the potential to either make or break the scholastic attainment and aspirational capital of the candidate. It is important to note, that the study suggests the importance of the SAT being derived not from the score attained, but rather on whether the student attempted the test.

The last of the variables in the model, qualifying exams, also proved to be a strong singular predictor and in the models. They do such a great job as precursors to the TExES exams, given that they are representative forms of the actual TExES exams developed by ETS using released and/or surplus items. This is why it was not surprising to see it play such a pivotal part in the study. Although the researcher expected it to be the strongest predictor in the model, it shared the leading role with SAT scores.

The second question that the study aimed to answer was if the emergent model displayed bias based on the type of student. This question was linked to the literature in the topic indicating that students who start their higher education at a community or junior college record lower levels of performance once they enter upper division courses (Buhagiar & Potter, 2014).

This was of particular interest, since deficiencies in the core curriculum could translate to low performance in the TExES content exams. This has also been a point of contention, not only between colleges of education and the institutions from where the students transfer from, but also as a form of intercampus interdisciplinary discourse since secondary education students in Texas are prepared for content knowledge by academic units outside of the colleges or schools of education. Results from the study indicate that performance on the TExES exams are influenced by the type of student, specifically when talking about the TExES content exams. It is important to note that the variance was only observed between the groups for the content exam and results for the PPR were invariant. Hence, overall the exams do tend to challenge both student types unequally. The findings will be of particular interest to programs such as the one at Border University, where the majority of students transfer from other institutions after completing their core curriculum at a two-year college.

Beginning with the 2017-18 academic year, the Texas legislature enacted changes to the accountability system used to evaluate educator preparation programs operating in the state. Under the new rules, programs are accountable for candidates passing all of the mandated teacher certification exams for a given teaching certificate no later than by their second attempt. Additionally, pre-service teachers will also be held to a higher standard by being required to pass the exams no later than the fifth attempt. A quick evaluation of the results for the sample, applying these new standards, showed a decrease in performance on the content exam from an 87% to a 69%, once the same data was evaluated using the new accountability requirements. A less drastic but equally significant reduction takes place with the PPR, drooping performance from a 93% to an 86% passing rate by the second attempt. This would not only be a significant

drop in performance for the program, but it would also mitigate or eliminate the proven resilience and imperviousness demonstrated by Hispanic students against standardized tests.

One last concern is that by restricting the number of attempts for each exam, it could be argued that the state has actuated the exams bias previously attenuated by the previously used highest score achieved, unlimited number of attempts policy. This is of particular interest for the program, since the data indicates that the average number of attempts were 2.42 for the content exam and 1.57 for the PPR exam.

5.5 Recommendations for Future Research and Professional Practice

The purpose of the study was to identify predictors of success for pre-service teachers on the TExES teacher certification exams. Additionally, the study was also interested in evaluating if these predictors applied equally to both native and transfer students. The primary reason for investigating these questions was to identify ways to improve the overall success of pre-service teachers on the exams while at the same time effectively manage program state accountability. The educator preparation program has had an excellent track record in the preparation of educators and in particular new teachers. The program is a leader in the preparation of teachers in many of the certification fields it offers and in particular in the preparation of Bilingual teachers. In this role, it is important that the program continues to inform their understanding of success factors for pre-service teachers of the 21st century demographic. With this in mind, herewith are presented several recommendations for future research and professional practice.

It is important for the program to further expand their understanding of the full effects that each identified factor has on the results of the TExES exams. The emphasis of this study was not to identify a particular score but rather the factors with the most potential to predict positive results on the TExES exams. To that effect and armed with the findings from the study,

a follow up investigation could be conducted to disaggregate the data of each variable and pinpoint precise cut scores with the most predictive power for each certification field. This could lead to a more effective test approval process and identification of possible support systems to guide and scaffold student success.

In a similar vein, it is important for researchers and scholars associated with the program to collaborate with institutions across the state with similar populations to evaluate if findings in the study are replicated or the effect on the program is due to regional effects. The geographical location, the closed loop system and the relative isolation of the region from the rest of the state leads to graduates from the program staying within the region. This means that they in turn build and support the K-12 pipeline, whose graduates enter the university and the program repeating the cycle. Unofficial estimates from school districts indicate that up to 80% of the teachers in the region could potentially be locally grown. This is not a surprise given the size of the program and the needs of the local school districts.

Finally, in the area of professional practice, it is suggested for the program to convene an ad hoc committee comprised of current classroom teachers and school administrators tasked with helping the program further develop the professional identity of pre-service teachers in the program. This would be a committee to compliment the efforts of faculty and staff serving the program. This new committee could target the required professional practices observed in the field in need for improvement and shorten the feedback loop by keeping key stakeholders directly engaged with a common purpose.

Similarly, as the accountability standards of Educator Preparation Programs continue to be a moving target, program administrators must contend with the challenging task of finding a balance between testing standards and testing requirements. This is not to say that faculty

responsible for the preparation of future educators should only focus on tested content, but rather that a true inclusion of all required state mandated standards takes place through curriculum alignment. It is not enough to list the standards covered by the required course in the syllabus, the responsibility for truly understanding the standards and creating student learning outcomes for them lies squarely on the faculty teaching the course. Thus should be evident, that the symbiotic relationship that exists between state-mandated standards and course curriculum cannot be substituted with test preparation.

The objective of this dissertation was to add to the body of literature on the topic and help inform policies, procedures and practices designed to enhance student support and success of pre-service teachers. It is important to stay engaged with emerging trends and research opportunities, to help the program meet its student success goals and accountability objectives. Failing to maintain this focus could lead to program ineffectiveness and failure to effectively serve and prepare the future leaders of the 21st century demographic.

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Appendix A

Table 1. *Correlations Table by TExES Content Native Students n = 219*

		<u>Median Income</u>	<u>SAT Score</u>	<u>Overall Hours</u>	<u>Overall GPA</u>	<u>QContent Score</u>	<u>Content Score</u>
Median Income	Pearson Correlation	1.00					
	Sig. (2-tailed)						
SAT Score	Pearson Correlation	.090	1.00				
	Sig. (2-tailed)	.183					
Overall Hrs	Pearson Correlation	-.074	-.329**	1.00			
	Sig. (2-tailed)	.273	.000				
Overall GPA	Pearson Correlation	.089	.265**	-.408**	1.00		
	Sig. (2-tailed)	.189	.000	.000			
QContent Score	Pearson Correlation	.082	.406**	-.230**	.376**	1.00	
	Sig. (2-tailed)	.229	.000	.001	.000		
Content Score	Pearson Correlation	.008	.423**	-.102	.296**	.582**	1.00
	Sig. (2-tailed)	.905	.000	.131	.000	.000	

** . Correlation is significant at the 0.01 level.

* . Correlation is significant at the 0.05 level.

Table 2. *Correlations Table by TExES PPR Native Students n = 219*

		<u>Median Income</u>	<u>SAT Score</u>	<u>Overall Hours</u>	<u>Overall GPA</u>	<u>QPPR Score</u>	<u>PPR Score</u>
Median Income	Pearson Correlation	1.00					
	Sig. (2-tailed)						
SAT Score	Pearson Correlation	.090	1.00				
	Sig. (2-tailed)	.183					
Overall Hrs	Pearson Correlation	-.074	-.329**	1.00			
	Sig. (2-tailed)	.273	.000				
Overall GPA	Pearson Correlation	.089	.265**	-.408**	1.00		
	Sig. (2-tailed)	.189	.000	.000			
QPPR Score	Pearson Correlation	-.010	.336**	-.100	.236**	1.00	
	Sig. (2-tailed)	.887	.000	.140	.000		
PPR Score	Pearson Correlation	.119	.511**	-.167*	.208**	.372**	1.00
	Sig. (2-tailed)	.080	.000	.014	.002	.000	

** . Correlation is significant at the 0.01 level.

* . Correlation is significant at the 0.05 level.

Table 3. *Correlations Table by TExES Content Score Transfer Students n = 159*

		<u>Median Income</u>	<u>SAT Score</u>	<u>Overall Hours</u>	<u>Overall GPA</u>	<u>QContent Score</u>	<u>Content Score</u>
Median Income	Pearson Correlation	1.00					
	Sig. (2-tailed)						
SAT Score	Pearson Correlation	.151	1.00				
	Sig. (2-tailed)	.057					
Overall Hrs	Pearson Correlation	-.005	-.138	1.00			
	Sig. (2-tailed)	.946	.082				
Overall GPA	Pearson Correlation	-.068	-.022	-.297**	1.00		
	Sig. (2-tailed)	.396	.782	.000			
QContent Score	Pearson Correlation	.067	.433**	.064	.072	1.00	
	Sig. (2-tailed)	.402	.000	.424	.366		
Content Score	Pearson Correlation	.165*	.497**	-.047	.017	.490**	1.00
	Sig. (2-tailed)	.038	.000	.559	.828	.000	

** . Correlation is significant at the 0.01 level.

* . Correlation is significant at the 0.05 level.

Table 4. *Correlations Table by TExES PPR Score Transfer Students n = 159*

		<u>Median Income</u>	<u>SAT Score</u>	<u>Overall Hours</u>	<u>Overall GPA</u>	<u>QPPR Score</u>	<u>PPR Score</u>
Median Income	Pearson Correlation	1.00					
	Sig. (2-tailed)						
SAT Score	Pearson Correlation	.151	1.00				
	Sig. (2-tailed)	.057					
Overall Hrs	Pearson Correlation	-.005	-.138	1.00			
	Sig. (2-tailed)	.946	.082				
Overall GPA	Pearson Correlation	-.068	-.022	-.297**	1.00		
	Sig. (2-tailed)	.396	.782	.000			
QContent Score	Pearson Correlation	.057	.373**	-.179*	.082	1.00	
	Sig. (2-tailed)	.478	.000	.024	.306		
Content Score	Pearson Correlation	.141	.536**	-.071	.025	.523**	1.00
	Sig. (2-tailed)	.076	.000	.375	.750	.000	

** . Correlation is significant at the 0.01 level.

* . Correlation is significant at the 0.05 level.

Appendix B

Scatterplot

Dependent Variable: ContentScore

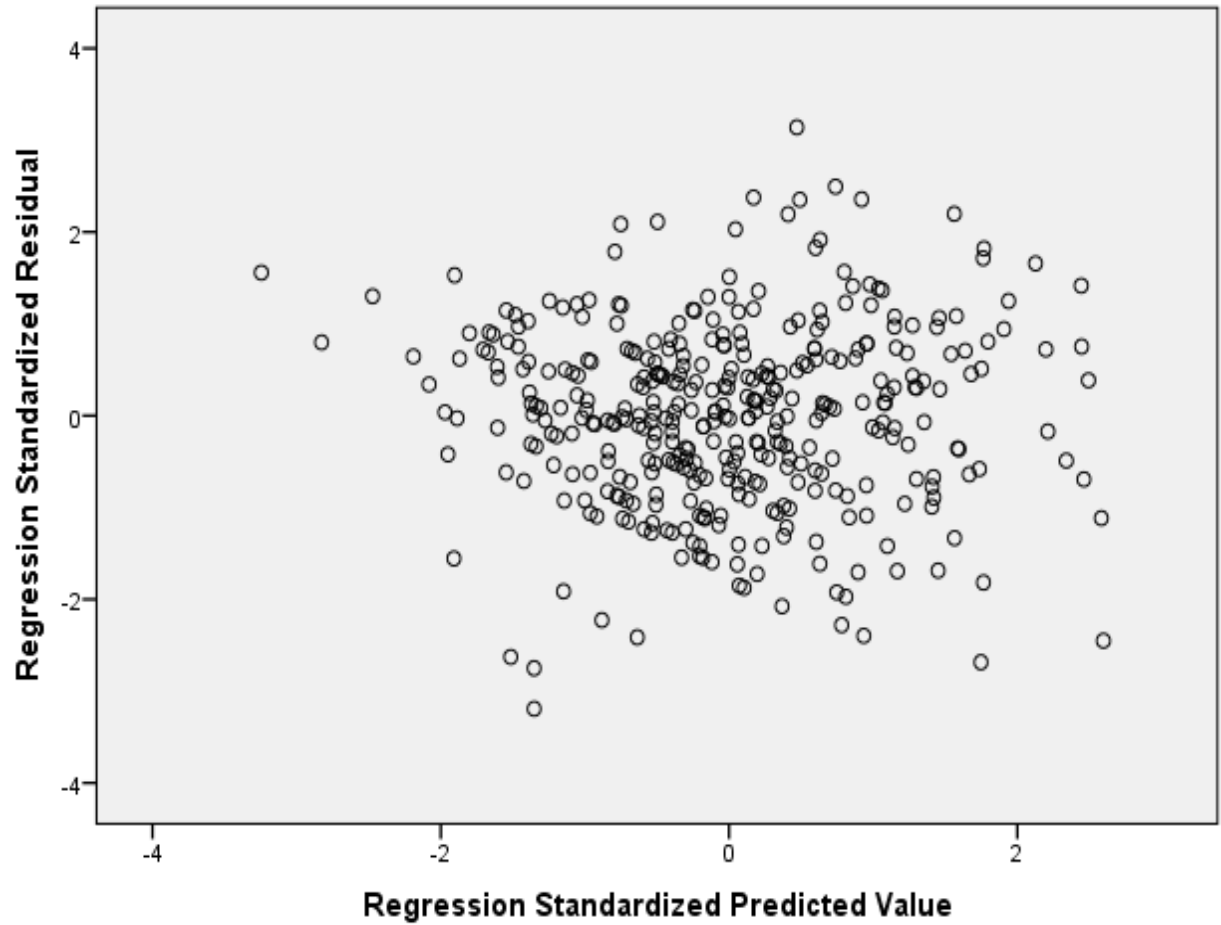


Figure 1. Error distribution for TExES Content Scores.

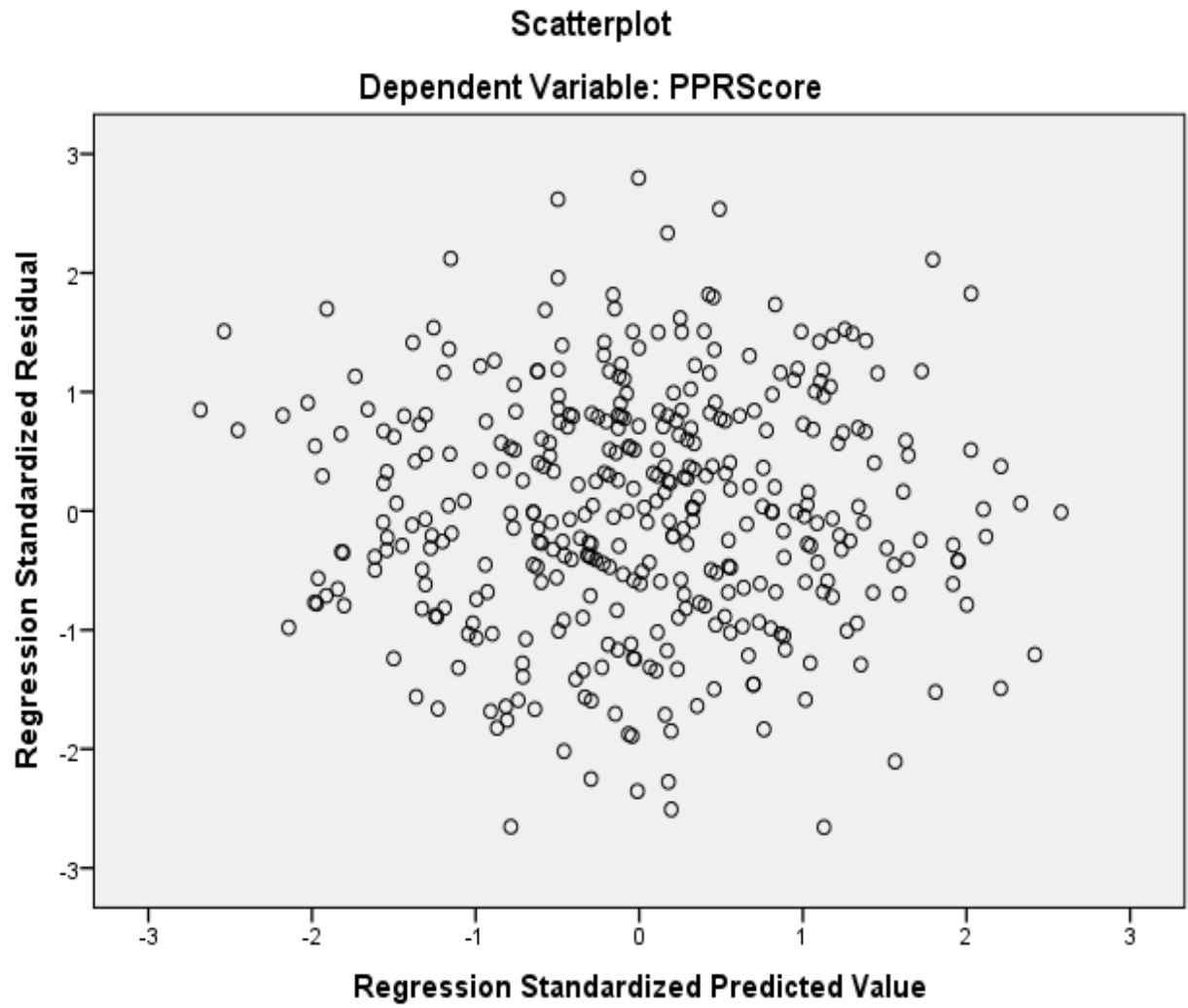


Figure 2. Error distribution for TExES PPR Scores.

Appendix C

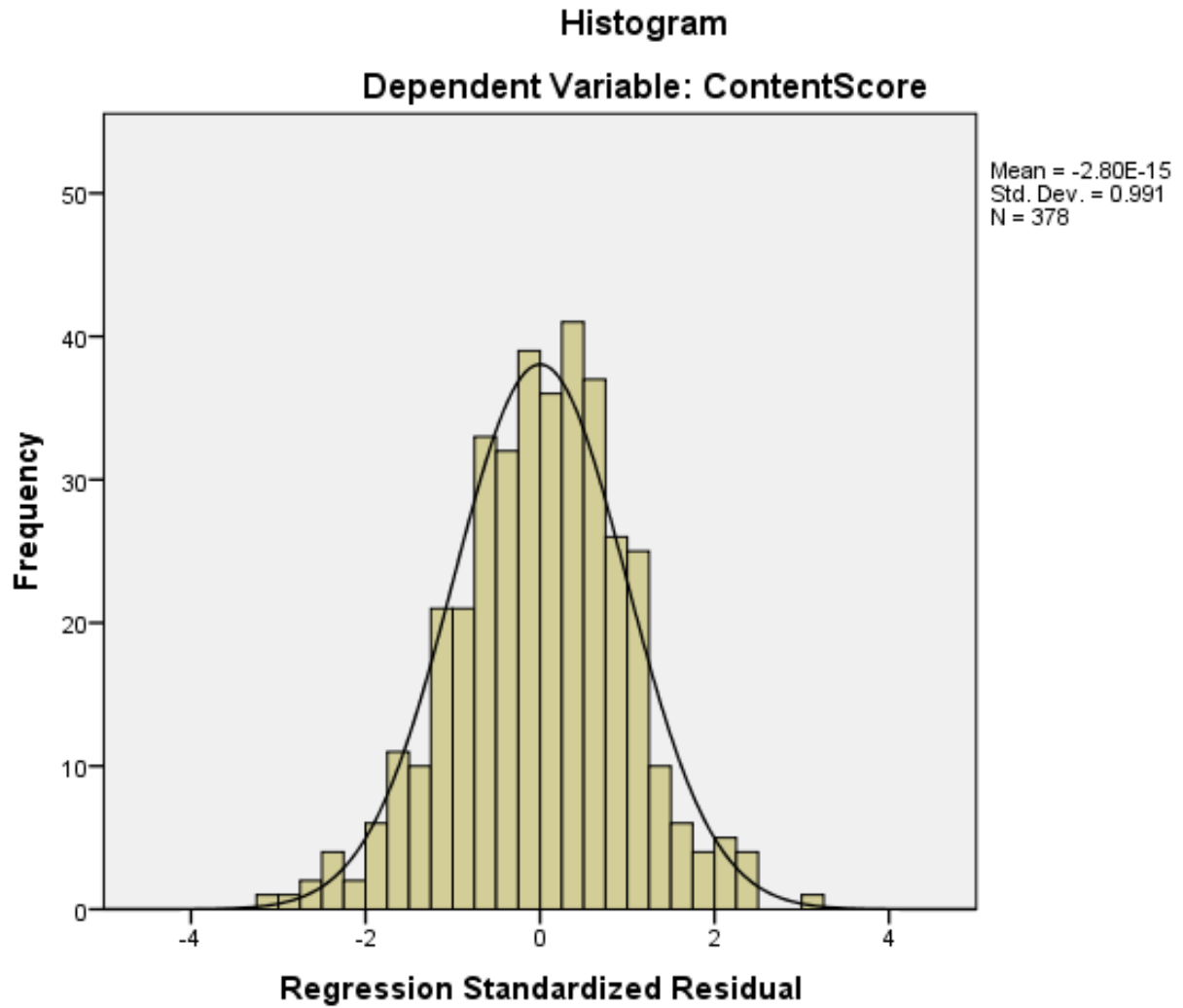


Figure 1. Normality histogram for TExES content score residuals.

Normal P-P Plot of Regression Standardized Residual

Dependent Variable: ContentScore

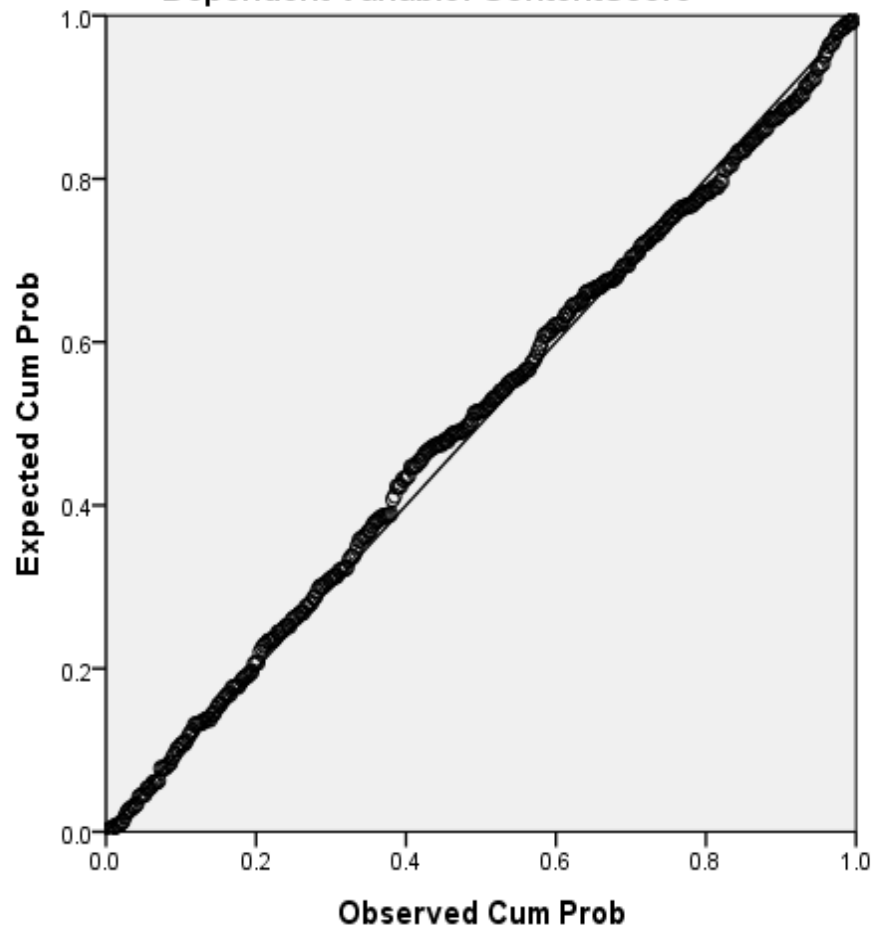


Figure 2. P-P Plot for TExES Content Score residuals

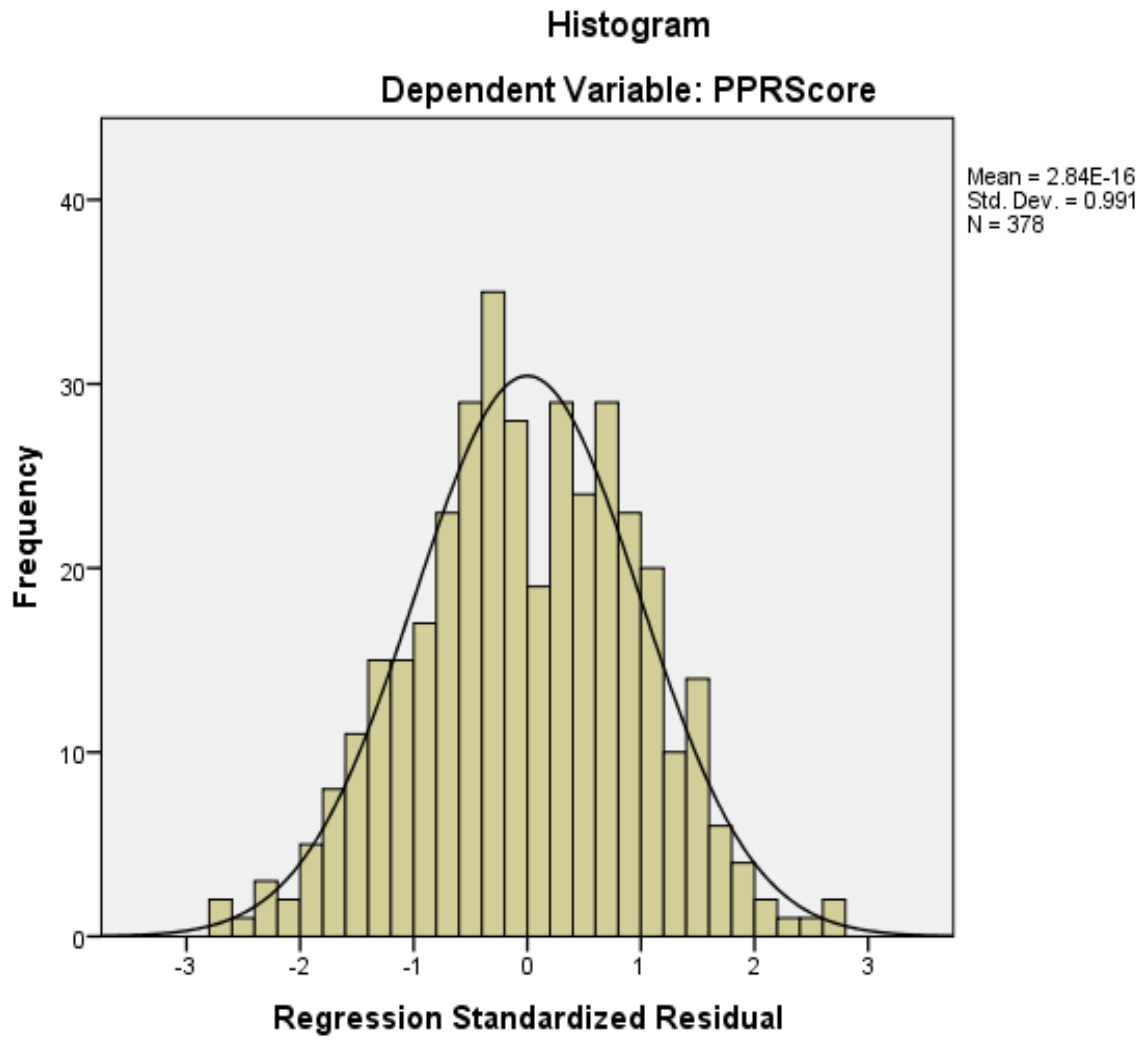


Figure 3. Normality histogram for TExES PPR Score residuals.

Normal P-P Plot of Regression Standardized Residual

Dependent Variable: PPRScore

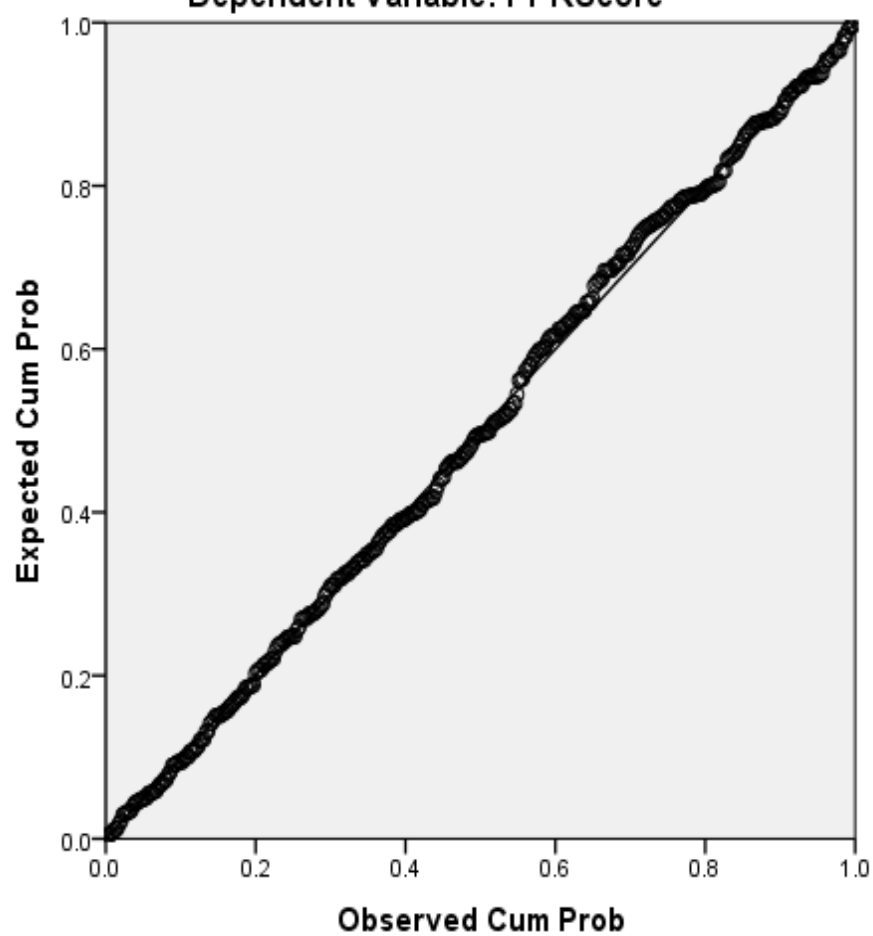


Figure 4. P-P Plot for TExES PPR Score residuals.

Table 1. *Assessment of Normality for TExES Content Scores*

<u>Variable</u>	<u>min</u>	<u>max</u>	<u>skew</u>	<u>c.r.</u>	<u>kurtosis</u>	<u>c.r.</u>
OverallHRS	12	139	0.676	5.365	-0.128	-0.507
OverallGPA	2.192	4	-0.265	-2.103	-0.792	-3.143
SATScore	520	1320	0.086	0.681	-0.223	-0.886
MedianIncome	13110	83889	-0.089	-0.707	-0.991	-3.934
QContScore	42	92	-0.254	-2.015	0.577	2.29
ContentScore	218	288	0.224	1.778	0.409	1.622
Multivariate					3.413	2.623

Note. Amos Graphics: Summary normality statistics for TExES Content Scores.

Table 2. *Assessment of Normality for TExES PPR Scores*

<u>Variable</u>	<u>min</u>	<u>max</u>	<u>skew</u>	<u>c.r.</u>	<u>kurtosis</u>	<u>c.r.</u>
OverallHRS	12	139	0.676	5.365	-0.128	-0.507
OverallGPA	2.192	4	-0.265	-2.103	-0.792	-3.143
SATScore	520	1320	0.086	0.681	-0.223	-0.886
MedianIncome	13110	83889	-0.089	-0.707	-0.991	-3.934
QPPRScore	60	90	-0.243	-1.928	0.393	1.56
PPRScore	234	295	0.01	0.078	-0.442	-1.756
Multivariate					1.037	0.797

Note. Amos Graphics: Summary normality statistics for TExES PPR Scores.

Appendix D

Table 1. Overall TExES Pass Rate for SAT Score + GPA* + Qualifying Exam Score**

	All	SAT and GPA	SAT and Qualifying	GPA and Qualifying	SAT	GPA	Qualifying	None
Content Pass Rate	100% (n= 137)	92.36% (n= 144)	92.72% (n = 110)	97.29% (n = 74)	74.37% (n= 160)	85.58% (n= 111)	92.68% (n= 41)	67.92% (n= 106)
PPR Pass Rate	100% (n= 143)	98.55% (n= 138)	100% (n= 102)	100% (n= 60)	88.69% (n= 168)	92.00% (n= 125)	100% (n= 32)	78.26% (n= 115)

Note. *GPA Mean = 3.16; **Qualifying content Score Mean = 76, Qualifying PPR Score Mean = 79

Table 2. First Two Attempts TExES Pass Rate for SAT Score + GPA* + Qualifying Exam Score**

	All	SAT and GPA	SAT and Qualifying	GPA and Qualifying	SAT	GPA	Qualifying	None
Content Pass Rate	96.35% (n= 137)	77.08% (n= 144)	82.72% (n= 110)	90.54% (n= 74)	50.62% (n= 160)	55.85% (n= 111)	73.17% (n= 41)	35.84% (n= 106)
PPR Pass Rate	99.30% (n= 143)	92.75% (n= 138)	99.02% (n= 102)	100% (n= 60)	80.95% (n= 168)	82.40% (n= 125)	96.88% (n= 32)	54.78% (n= 115)

Note. *GPA Mean = 3.16; **Qualifying content Score Mean = 76, Qualifying PPR Score Mean = 79

Vita

Héctor Hernández Jr. was born in El Paso, Texas to Héctor Hernández and Elida Casillas. He spent his formative years living with his family in northern México primarily along the U.S./Mexico border in the states of Chihuahua, Sonora and Tamaulipas. At the age of 17, he returned to the U.S. and moved with his family to San Antonio, Texas. Here he learned the English language while completing his junior year at Clark High School, graduating from Eastwood High School in El Paso, Texas the following year. As a first generation college student, he earned his Bachelor of Science in Social Psychology from Park University in 2007 and received his Masters of Arts in Education from the Teacher Education Department at the University of Texas at El Paso in 2011. He joined the Doctor of Education program in Educational Leadership and Administration at the same institution in the summer of 2012.

Over the last decade, Mr. Hernández has served the University of Texas at El Paso in several capacities, the last of which and current position, as the Certification Officer for the College of Education where he is involved in the preparation and certification of future educators.

Mr. Hernández has presented his work at the American Educational Research Association (AERA) conference, the American Association of Hispanics in Higher Education (AAHHE) conference and participated as an emerging scholar in the Inter-University Program for Latino Research (IUPLR) Workshop on Higher Education: Research on the Condition of Latinos in U.S. Colleges and Universities at the University of Notre Dame.

Mr. Hernández plans to continue his work and expand his research agenda with a specific focus on student success.

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