A CRITICAL EXAMINATION OF TEXAS MATHEMATICS ACHIEVEMENT IN GRADES THREE THROUGH EIGHT BY MATHEMATICAL OBJECTIVE ACROSS RACE/ETHNICITY, GENDER, AND SOCIOECONOMIC STATUS

A Dissertation

by

BRANDON LEROY FOX

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

December 2011

Major Subject: Curriculum and Instruction

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December 2011

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ABSTRACT

A Critical Examination of Texas Mathematics Achievement in Grades Three through
Eight by Mathematical Objective across Race/Ethnicity, Gender, and Socioeconomic
Status. (December 2011)

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M.Ed., Stephen F. Austin State University
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The purpose of this quantitative study was to identify performance differences on the TAKS mathematics assessments in grades three through eight across race/ethnicity, gender, and socioeconomic status in the years 2004, 2007, and 2010. The guiding research question was: “What are the differences in mathematics achievement by mathematical objective as depicted by the Texas achievement tests during the years 2004, 2007, and 2010. To respond to the guiding research question, three independent studies were performed to examine race/ethnicity, gender, and socioeconomic status individually by mathematical objective. Statistical analysis of variance (ANOVA) tests were performed for race/ethnicity and socioeconomic status at a .05 level of significance. Independent samples *t* tests were administered to determine differences across gender.

For study one, statistically significant differences of objective means were identified across every grade and objective with the exception of objective five (probability and statistics) in grade seven between Asian American students and African

American students. Study two examined gender and found that no statistically significant differences exist between male and female students. The findings of study two identified that male students were scoring slightly higher across most objectives in 2004, but by 2010 scores between male and female students were more equivalent with male students scoring slightly higher in grades three through five and female students scoring slightly higher in grades six through eight. Study three examined TAKS mathematics data across socioeconomic identifiers and found that significant differences were mostly found in grade three across all objectives between students not identified as economically disadvantaged and students receiving free meals. After grade three, the number of significant differences drastically decreases with all objectives except for objective six (mathematical processes and tools). Significant differences were present across race/ethnicity and across socioeconomic status, but not across gender. An examination of within group data did not identify any statistical significance.

DEDICATION

I dedicate this dissertation to each of the following:

to Christy for your love, care, guidance, and the many sacrifices;

to Dr. Patricia J. Larke for your amazing support and guidance;

to Momma for instilling in me the importance of education;

to Daddy for instilling in me the importance of being attentive;

to Kayla for your endless hours of critique;

to Granny for always encouraging me;

to Pawpaw for instilling in me the importance of persistence;

to Dr. Neil Armstrong for making the world visible to me.

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CHAPTER I

INTRODUCTION: OVERVIEW AND GUIDING QUESTIONS

While high-stakes testing has been a contested issue in educational and political arenas, the results have identified differences in academic performances among gender and ethnic groups. The topic has reached national attention with *The Race to the Top Program* and President Obama's emphasis on educational reform (Obama, 2010). The achievement gaps—or, what some term the receivement gaps (Vanzant-Chambers, 2009)—are a continuous concern amongst those interested in the United States' educational system. Nieto and Bode (2008) identify achievement gaps as a term used "to describe the circumstances in which some students, primarily those from racially, culturally, and linguistically marginalized and poor families achieve less than other students" (p. 12). When achievement is analyzed by race/ethnicity, gender, and socioeconomic status there is a consistent disparity that produces negative outcomes for children living in economically disadvantaged situations and children of color (Roberts, 2010). As the student demographics become more and more diverse, there is a need to conduct a critical examination of achievement data.

Researchers have provided a long list of correlations linked to the achievement gaps concerning students of color (Howard, 2010; Orfield, 2004). Students of color are more likely to be expelled, suspended, or drop-out than other students. They are also overrepresented in special education and underrepresented in courses with access to

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This dissertation follows the style of *The Journal of Educational Researcher*.

advanced curricula. In turn, men and women of color are represented disproportionately in the judicial correctional system (Orfield, 2004). Students who drop-out are less likely to attend college. The rigor of climbing the ladder of social mobility increases without a college degree and/or a high school diploma. Educational attainment is directly correlated to personal financial success as well as economic condition both nationally and internationally. Jencks and Phillips (1998) found that achievement gaps go beyond just socioeconomic status. These findings situate culture, race, and power at the forefront of discussion. Howard (2010) states:

> The future prosperity, safety, economic infrastructure, technological competitiveness, and political vitality of the country rely heavily on the manner in which we prepare all citizens, but have increased importance for those individuals who will make up the nation's core in the decades to come—culturally, racially, and linguistically diverse students (p. 149).

In Texas, students are assessed by the Texas Assessment of Knowledge and Skills (TAKS) test in grades three through eleven. Students are assessed in reading and mathematics each year beginning with the third grade through the exit level examination. Writing, science, and social studies are given at select grade levels. The Texas Education Agency (TEA) uses TAKS data in attempt to assess what students have learned and to determine district and campus accountability ratings. TAKS data are used to determine if and where achievement differences occur. This study examined TAKS test score data to determine similarities and differences in mathematics in grades three through eight. The study analyzed the results through critical race lens.

Statement of the Problem

The intent of the study is to provide a critical analysis of TAKS data in grades three through eight by mathematical objective across race/ethnicity, gender, and socioeconomic status. This analysis provides valuable information to assist educators in understanding the intersections of race/ethnicity, gender, socioeconomic status, and mathematics. Research by Lubienski and Bowen (2000) and more recently by Lim (2008) identified that there is limited research focusing on race/ethnicity, socioeconomic status, gender and/or (various)ability as it relates to mathematics. Also, a large amount of research published is very generic and lacks specificity. Researchers need to look critically at the differences in mathematics achievement data as it relates to specific objectives across race/ethnicity, gender, and socioeconomic status to better understand *why* differences are there.

Purpose of the Study

The objective of this research was to identify the differences in mathematics achievement of Texas students in grades three through eight. The focus of this study is to critically examine the disparity of achievement in third through eighth grade mathematics in Texas between the years 2004, 2007, and 2010 as determined by the Texas Assessment of Knowledge and Skills (TAKS). The years 2004, 2007, and 2010 were chosen so that the most recently available TAKS data were used and the data were selected in three year increments. This study also explores the commonalities of data across race/ethnicity, gender, socioeconomic status, *and* mathematical objective. This critical analysis provides specific data sets for further research studies examining the *intersectionality* of sociocultural variables in relation to mathematics achievement.

Research Questions

The guiding research question for this study was: What are the differences in mathematics achievement by mathematical objective as depicted by the Texas achievement tests during the years 2004, 2007, and 2010? Specifically, the questions guiding this study are:

1. What are the differences in TAKS scores of students in grades three through eight during the years 2004, 2007, and 2010 by mathematical objective categorized by race/ethnicity?
2. What are the differences in TAKS scores of students in grades three through eight during the years 2004, 2007, and 2010 by mathematical objective categorized by gender?
3. What are the differences in TAKS scores of students in grades three through eight during the years 2004, 2007, and 2010 by mathematical objective categorized by socioeconomic status?

Significance of the Study

School districts are provided data for the intersections of socio-cultural intersections of content-specific achievement test data. However, research is needed to explore the data from the state as a whole to determine space for future research. This research provides a foundation for future research to build upon as it relates to the intersections of race/ethnicity, culture, and mathematics. This research also provides a thorough analysis of mathematics data to build theory and practice that will improve academic achievement in mathematics classrooms in Texas. The results of this study provide school administrators and classroom teachers with a data set to assist in the decision-making process on mathematics classroom instruction.

Definitions of Terms

For the purpose of this dissertation, we will assume the following definitions.

Achievement Gaps: Achievement gaps occur when there is a difference between the scores of at least two student subgroups on a standardized assessment. The differences are typically identified across race/ethnicity, gender, and socioeconomic status, but other variables could be included (NCES, 2011).

Ethnicity: Students that identify or have been identified as being African American, Asian/Pacific Islander, Hispanic/Latino/Latina, Native American, or European American/White for demographic purposes on Texas state achievement tests (TAKS) (TEA, 2009b).

Gender: Students that identify or have been identified as male or female for demographic purposes on Texas state achievement tests (TAKS) (TEA, 2009b).

Race: A social construction by groups to differentiate themselves from other groups based on physical descriptors (Banks, 1995).

Socioeconomic Status (SES): Socioeconomic status is determined by whether or not a student receives free lunch, reduced fee lunch, or no fee reduction. A student that is identified from a low-SES receives free or reduced lunch. The specific categories for TAKS identification are Economically Disadvantaged (Free lunch), Economically

Disadvantaged (Reduced lunch), Economically Disadvantaged (Other), and Not Economically Disadvantaged (TEA, 2009a).

Texas Assessment of Knowledge and Skills (TAKS): Texas standardized test administered from 2003-present in the content areas of reading, mathematics, science, social studies, and writing (TEA, 2002b).

Assumptions

For the purpose of this study, the assumption is made that TAKS data are accurate and have not been manipulated or compromised. From a *critical race perspective*, the study assumes that environmental influence on race, gender, and socioeconomic status affects student assessment outcomes.

Delimitations

This study has the following delimitations. First, the scope of this research is only to identify similarities and differences across test-score data. This study does not seek to identify *why* the data are similar or different; future research will be expected to explore the *why*. Secondly, the study used data collected by TEA that may not include all students in the State of Texas

Organization of Study

For this dissertation, the study utilizes the three-article journal dissertation format. The dissertation has five chapters. Chapter I provides an introductory overview of the study. Chapter II is manuscript one, which is guided by the research question: "What are the differences in TAKS scores of students in grades three through eight during the years 2004, 2007, and 2010 by mathematical objective categorized by race/ethnicity?” Chapter III is manuscript two, which is guided by the research question: “What are the differences in TAKS scores of students in grades three through eight during the years 2004, 2007, and 2010 by mathematical objective categorized by gender?” Chapter IV is manuscript three, which is guided by the research question: “What are the differences in TAKS scores of students in grades three through eight during the years 2004, 2007, and 2010 by mathematical objective categorized by socioeconomic status?” Chapter V is the concluding chapter that includes a summary of the study and implications from the study.

CHAPTER II

A CRITICAL EXAMINATION OF TEXAS MATHEMATICS ACHIEVEMENT IN GRADES THREE THROUGH EIGHT BY MATHEMATICAL OBJECTIVE ACROSS RACE/ETHNICITY

Introduction

In the concluding remarks of the 2010 *Condition of Education Report* (COE) (National Center for Education Statistics [NCES], 2011), Deputy Commissioner Stuart Kerachsky noted that "significant achievement gaps remain among racial/ethnic groups" (NCES, 2011). The COE identified that European American students have scored higher on average on all fourth grade NAEP mathematics assessments administered since 1990 (NCES, 2011). The difference in assessment outcomes between European American students and African American students has remained a constant 26 point disparity since 2007 and the overall difference since 1990 has only reduced six points from the original 32 point disparity. The difference between European American students and Hispanic/Latino/Latina American students has also remained fairly unchanged at 21 points.

In regards to the eighth grade assessment, it is important to note that all racial/ethnic groups' assessment averages were higher than any previous assessment since 1990. However, the disparity between average scores of European American students and African American and Hispanic/Latino/Latina American students are not measurably different from corresponding disparities in 1990. Mathematics assessment data in Texas provides similar results. Asian American and European American students as a whole are performing at a higher percentage rate of the Texas Assessment of Knowledge and Skills (TAKS) than Native American, African American, and Hispanic/Latino/Latina American students. The aforementioned disparities are commonly identified as the performance or achievement gaps.

Achievement gaps occur when there is a difference between the scores of at least two student subgroups on a standardized assessment (NCES, 2011). The differences are typically identified across race/ethnicity, gender, and socioeconomic status, but other variables could be included. Researchers and scholars often view the disparity in achievement or performance across student subgroups in different ways, resulting in a variety of terms that represent a certain product. Ladson-Billings (2006) identify the performance gaps as being a product of social variables and uses the term *education debt*. Darling-Hammond (2007) refers to the disparity in test scores as the *opportunity gap*, while Vanzant Chambers (2009) articulates the disparity as a product of the *receivement gaps*.

Mathematical performance data often are disaggregated according to race/ethnicity, gender, *or* socioeconomic status, but detailed studies related to large scaled data that takes into account multiple intersections across socio-cultural constructs are difficult to locate. Lim (2008) confirms this by stating “research focusing on socio-cultural issues in mathematics education has not yet flourished either in the United States or in other international contexts. The field of mathematics education has been dominated by psychological approaches emphasizing the cognitive process of learning in individual minds” (p. 304). Lubienski and Bowen (2000) examined over 3000 published articles concerning mathematics in 48 different journals. Their research focused on the prevalence of literature consisting of race/ethnicity, socioeconomic status, gender, and/or (various)ability as it relates to mathematics. Their study suggested that there is more available research concerning gender and mathematics over the other variables. The intersectionality of race/ethnicity, gender, and mathematics was very limited. Lubienski and Bowen (2000) stated that in mathematics, "the majority of research seemed to focus on student cognition and outcomes, with less attention to contextual or cultural issues" (p. 626).

A significant point made by Lim (2008) and Lubienski and Bowen (2000) is the lack of literature and data as it relates to race/ethnicity, gender, socioeconomic status and mathematics. To take this further, research analyzing data within content area is not readily available. For example, researchers can easily find data regarding race/ethnicity and mathematics achievement, but what about specific objectives within mathematics?

The objective of this research was to identify the differences in mathematics achievement of Texas public school students in grades three through eight. The focus of this study was to critically examine the disparity of achievement in third through eighth grade mathematics in Texas between the years 2004, 2007, and 2010 across race/ethnicity as determined by the Texas Assessment of Knowledge and Skills (TAKS) standardized test. The intent of this study is to provide a critical analysis of TAKS data in grades three through eight by mathematical objective across race/ethnicity through a critical race lens. The critical analysis provides a foundational data set for future research to build theory and practice as it relates to mathematics instruction, assessment, and experience.

This chapter explores the history of mathematics education in the United States, the history of Texas assessment programs, and a brief overview of TAKS mathematics objectives before focusing on the issue of race/ethnicity in achievement and education. The author follows the discussion of race/ethnicity with a review of critical race theory. The author then discusses the methodology of the research study, findings, and offers final remarks.

Mathematics Education in the United States

A review of the history of mathematics education in the United States can easily be separated into six sections. The first section is Math Education before 1950, followed by the New Math Movement (1950s – 1970s). The third section is titled Back-to-Basics of the 1970s and is followed by the fourth section, Problem-Solving Movement of the 1980s. The fifth section covers the Standards Movement of the 1990s and the final section is The New Millennium.

Math Education before 1950

The committee of ten, appointed by the National Education Association (NEA), published reports in 1893 and 1894 that recommended that curriculums should focus on mental discipline and college preparation (Hertzberg, 1988). The committee of ten suggested that schools should move away from rote memorization and encouraged the development of critical thinking skills. Following these recommendations, the NEA appointed a committee—Committee on College Entrance Requirements—that recommended that students needed less drill and more emphasis on making connections, structure, and problem solving (Cushing, 1937). During the early 1900s several committees and organizations emerged. The College Entrance Examination Board was formed in 1901 in attempt to validate one's ability to succeed in college. Emerging in 1926 was the Scholastic Aptitude Test (SAT). The Mathematical Association of America was created in 1915 and quickly created a committee to examine mathematics requirements. Their report, published in 1923 provided a conceptualization and emphasis on functions and proposed that algebra should be offered to every educated person (Klein, 2003). The National Council of Teachers of Mathematics emerged in 1920 as a group of teachers eager to research, examine, and influence the mathematics curriculum. The NCTM was also created to counter the progressive educational agenda in mathematics (Klein, 2003).

Math education in the early to mid-1900s was influenced heavily by the work of progressive educators such as John Dewey and William Kilpatrick (Klein, 2003). Many progressive educators believed that mathematics education in K-12 schools should emphasize practical applications such as purchasing, budgeting, or calculating taxes. The progressive movement heightened in the 1930s. By the 1940s, there became a concern in the military because army recruits struggled with basic mathematics. The 1940s were known as the Life Adjustment Movement and secondary schools (Klein, 2003). In mathematics, students would be expected to focus on practical problems as suggested by progressive educators instead of algebra, trigonometry, or geometry. With major scientific and technological advances the progressive movement began to diminish as the close of the 1940s came (Klein, 2003).

New Math Movement (1950s – 1970s)

Stemming from the influx of atomic weapons of the 1940s and the launch of the Soviet's *Sputnik* in 1957, the United States answered by pouring funds into research and education in the mathematical sciences. During this time, universities were concerned about the lack of enrollment in mathematics courses as well as the students computational and conceptual understanding of mathematics once enrolled in mathematics courses (Kilpatrick, 1992). According to Lagemann (2000), low achievement in K-12 mathematics was the driving force behind the excellence in education movement. The "New Math" curricula in mathematics emerged as a primary agent in mathematics education which emphasized abstract mathematical concepts in elementary grades that included the topics operations and place value across different base systems, alternative algorithms, and set theory (Jones & Coxford, 1970). A goal of new math was for students to conceptualize why mathematical problems produce the products that it produces instead of standard computations. The new math movement deteriorated due to the lack of professional development and the need of teachers to revisit the way that they understand mathematics (Moon, 1986). Also, there was societal pressure in the 1970s to move "back to the basics", where schools re-emphasized the importance of reading, writing, and mathematics.

Back-to-Basics of the 1970s

This movement was fueled by the idea that the new math was not preparing students for the workforce or college. The back-to-basics movement redirected the emphasis of mathematics to include concrete understanding before the more abstract conceptualization of mathematics as suggested by the work of Piaget (Adler, 1963). "The curriculum returned to what it had been before: arithmetic in the 1st through 8th grades, algebra in the 9th grade, geometry in the 10th grade, a 2nd year of algebra and sometimes trigonometry in the 11th grade, and precalculus in the 12th grade" (Schoenfeld, 2004, p. 258). During this era of math education, textbooks relied heavily on large number of computational problems. Testing was based on the computational fluency. Students were often grouped by a predetermined mathematical ability.

Problem-Solving Movement of the 1980s

The problem-solving movement was pioneered by NCTM's (1980) publication *Agenda for the 80s* that claimed that computational fluency was not sufficient for college and/or workforce bound students. Also highlighted in the report was that students needed to be able to connect to problems. There needed to be a realistic undertone to the mathematics problems students were to solve. Emerging during this time was Polya's problem-solving approach that included four steps (Schoenfeld, 2004). These steps are to understand, plan, solve, and check. In 1983, two major publications influenced mathematics education. One publication was *A Nation at Risk* (1983), which was a beginning push toward the standards movement (Ravitch, 2010). *A Nation At Risk* was a call to attention of educational outcomes and stated that "between 1975 and 1980, remedial mathematics courses in public 4-year colleges increased by 72 percent [and] business and military leaders complain that they are required to spend millions of dollars on costly remedial education and training programs" (Klein, 2003, p. 199). The College Board followed by publishing the basic competencies for mathematics.

"In 1985, the National Research Council (NRC) established the Mathematical Sciences Educational Board as a mechanism for devoting sustained attention to issues of mathematics instruction" (Schoenfeld, 2004, p. 264). In 1989, the NRC published the document *Everybody Counts* which provided a warning of divisiveness within the United States. On page 14, the report states that:

> We are at risk of becoming a divided nation in which knowledge of mathematics supports a productive, technologocically powerful elite while a dependent, semiliterated majority, disproportionately Hispanic and [B]lack, find economic and political power beyond reach. Unless corrected, innumeracy and illiteracy will drive America apart (NRC, 1989).

The report also suggested that all students should study a common core of mathematics and that "America needs to reach consensus on national standards for school mathematics" (p. 46). This provided the path for the NCTM to publish the *Curriculum and Evaluation Standards for School Mathematics* (1989). These two publications and the arrival of the graphing calculator put the standards movement in full gear.

Standards Movement of the 1990s

NCTM (1989) standards included a statement of goals for society. They would include: mathematically literate workers, lifelong learning, opportunity for all, and an informed electorate (p. 3). The guiding principles on the 1989 NCTM mathematics standards were: equity, curriculum, teaching, learning, assessment, and technology. There were five content standards: numbers and operations, algebra, geometry, measurement, and data analysis and probability. The process standards included problem solving, reasoning and proof, communication, connections, and representation. These standards were created as a collective effort of teachers, parents, business leaders, and mathematics professors. NCTM based the standards on the idea that the recommendations are geared toward all students and were supported by research. The NRC published *A Challenge of Numbers* in 1990 that magnified that the attrition rate for students of color was significantly larger than attrition of White students (Madison & Hart, 1990). Schoenfeld (2004) states that "a major point of the volume was that the nation's preeminence in mathematics and science was in jeopardy because of declining numbers and interest" (p. 264).

The 1990s saw more publications of standards. In 1991, the *Professional Standards for Teaching Mathematics* was published and in 1995, the *Assessment Standards for School Mathematics* was published. The new standards worried many mathematical traditionalists who were concerned with the decreased attention to paper/pencil computation, rote practice, rote memorization, long division, teaching by telling, reliance on an outside authority, memorizing rules, memorizing algorithms, manipulating symbols, memorizing facts and relationships, factoring, proofs, and graphing functions by hand (Schoenfeld, 2004). This was not only the beginning of the standards movement, but was the beginning of what would be termed the math wars.

Schoenfeld (2004) describes the math wars as the struggle between proponents of traditional mathematics and the post-1989 standards approach to mathematics.

The New Millennium

The math wars continue with the turn of the new millennium. In 2000, NCTM published the *Principles and Standards for School Mathematics*. The 2000 standards combine curriculum, teaching, and assessment into one publication. The 2000 standards have the same guiding principles of the 1989 standards but the new standards provide specific expectations in four distinct age groups (pre-K – 2nd grades, 3rd -5th grades, 6th – 8th grades, and 9th-12th grades). The *No Child Left Behind Act of 2001* provided the standards movement with another push that increased emphasis on standards and accountability. Following the 2000 standards, NCTM (2006) published a document titled *Curriculum Focal Points* which emphasizes the importance of early arithmetic skill development and offers insight into critical areas in each grade from pre-K through eighth grade. The next moment in mathematics appears to be the common core standards in mathematics.

History of Texas Achievement Tests

According to the Texas Education Agency (TEA, 2002a), students have been required to participate in statewide student assessment of reading, mathematics, and writing since 1980. Stemming from a bill passed by the state legislature in 1979, the first assessment was the Texas Assessment of Basic Skills (TABS) test. This was a criterion-referenced assessment in reading, mathematics, and science that was administered from 1980 through 1984 in grades three, five, and nine (Cruse & Twing, 2000). It is important to note that when TABS was developed, there were not mandated statewide learning objectives. Learning objectives were created by committees of educators in Texas. In 1983, Texas legislature amended the Texas Education Code to “require Grade 9 students failing to pass the TABS test to retake the exam each year thereafter” (Cruse & Twing, 2000, p. 328). However, if students did not meet minimum expectations on TABS, they were not denied diplomas. Results from the TABS tests were published and made available to the public, initiating high stakes testing.

Evolving from TABS was the Texas Educational Assessment of Minimal Skills (TEAMS) which was administered from 1985 through 1989. TEAMS was a product of the change in terminology set forth by the Texas legislature. TEAMS moved “from ‘basic skills competencies’ to ‘minimum’ basic skills” (Cruse & Twing, 2000, p. 328). This was another criterion-referenced achievement in reading, mathematics, and writing that was administered across grades, one, three, five, seven, nine, and eleven. It was an attempt to increase rigor and “assess curriculum specific minimum skills” (p. 329). The eleventh grade exam was considered an “exit level” assessment. In 1987, all students attempting to graduate were required to pass the exit level exam to receive a diploma.

The next criterion-reference program to be implemented in Texas was the Texas Assessment of Academic Skills (TAAS) test. TAAS was administered from 1990 through 2002. According to TEA (2002b), the TAAS test was a shift away from *minimum skills* to emphasizing *academic skills*. There was an emphasis on *higher-order thinking* skills and *problem-solving* in reading, mathematics, and writing across grades three, five, seven, nine, and eleven. The TAAS was also a shift from just collecting information regarding curriculum and skill to a system of school accountability of student performance on assessment. There were at least four ways that the TAAS attempted to distinguish itself from TEAMS. TAAS included a broader focus on the essential elements (EE); it was more difficult; it provided more in-depth information regarding student scores, campus scores, and district scores; and it imposed consequences upon students, campuses, and districts.

The Texas Assessment of Knowledge and Skills (TAKS) stemmed from state legislature in 1999 that desired to create a more rigorous assessment program while also eliminating social promotion. The new law provided a mandate that students meet certain criteria to exit certain grade levels. Students must pass TAKS grade three reading assessment as well as receive passing grades to be promoted to the fourth grade. In grades five and eight, students must meet state requirements on TAKS mathematics and reading assessments and maintain passing grades. In the eleventh grade, students must pass TAKS reading, mathematics, science, social studies, and writing while earning enough high school credits to be eligible to receive a high school diploma. The TAKS assessment program began testing in 2003 and is the current assessment program (see Table 2.1). Since its implementation, TAKS has seen many changes. According to TEA (2002a), reading assessment is administered in grades three through nine; English-language arts are assessed at grades ten and eleven; writing is assessed in grades four and seven; mathematics is assessed in grades three through eleven; science is assessed at grades five, eight, ten, and eleven; and social studies is assessed at grades eight, ten, and eleven. There are certain Spanish-version TAKS tests that are administered to select students in grades three through five in reading and mathematics, grade four writing assessment, and grade five science assessments. Beginning in 2010, grade three students will not be required to pass TAKS reading to be promoted to the fourth grade. However, grade five and eight students still must pass TAKS reading and mathematics to be promoted.

The most recent amendment to Texas assessment is the State of Texas Assessments of Academic Readiness (STAAR) which will utilize End of Course (EOC). According to TEA (2010), the freshman classes entering the 2011 academic year will be required to take twelve EOC assessments as partial requirement to graduate. Students are expected to pass EOC's in Algebra I, Algebra II, Biology, Chemistry, English I, English II, English III, Geometry, Physics, US History, World Geography, and World History. The STAAR assessment is expected to be more rigorous than prior assessments. The new accountability system is being developed and is expected to begin in 2013.

Table 2.1 The History of Texas Assessments

Years	Test Name	Abbreviation
1980 – 1984	Texas Assessment of Basic Skills	TABS
1985 – 1989	Texas Educational Assessment of Minimal Skills	TEAMS
1990 – 2002	Texas Assessment of Academic Skills	TAAS
2003 – 2011	Texas Assessment of Knowledge and Skills	TAKS
Beginning 2012	State of Texas Assessments of Academic Readiness	STAAR

TAKS Mathematics Objectives

According to TEA's *TAKS Blueprint for Grades 3-8 Mathematics* (2002a), there are six objectives tested in mathematics. The objectives are as follows: Objective 1—Numbers, operations, and quantitative reasoning; Objective 2—Patterns, relationships, and algebraic reasoning; Objective 3—Geometry and spatial reasoning; Objective 4—Measurement; Objective 5—Probability and statistics; and Objective 6—Mathematical processes and tools. All six objectives are tested at each grade from three through eight, but there is more emphasis on objective one to focus on foundational knowledge of mathematics. Objective two receives more emphasis in grades six through eight as students are beginning to prepare for Algebra I. The emphasis on objectives three, four and five is pretty constant across grade levels. Objective six receives more emphasis in the middle grades six through eight. The third grade assessment begins with forty questions and increases by two questions per grade level through the eighth grade. Refer to Table 2.2 for a description of TAKS mathematics objectives.

Table 2.2 Description of TAKS Mathematics Objectives (TEA, 2002a)

Objective	Label	Skills Emphasized
1	Numbers, operations, and quantitative reasoning	addition; subtraction; multiplication; division; estimation; number comparison; and place value
2	Patterns, relationships, and algebraic reasoning	identify numeric and geometric patterns; use patterns to solve problems, interpret data, and make generalizations; generate formulas; and formulate equations and inequalities
3	Geometry and spatial reasoning	geometric vocabulary; angles; congruence; parallel and perpendicular lines; symmetry; transformations; circle relationships; point location on number lines; and point location on coordinate grids
4	Measurement	angle measurement; linear measurement; standard measures; time; temperature; capacity; conversions; area; and volume
5	Probability and statistics	read and interpret graphs and data; make predictions; complete probability experiments; and find mean, median, mode, and range
6	Mathematical processes and tools	links knowledge and skills from the other five objectives; emphasizes critical thinking and problem solving

Race/Ethnicity

Differences in achievement across groups have been a hot topic of conversation since at least the *Coleman Report* (Coleman et al., 1966). Jencks and Phillips's (1998) study identified that there are considerable differences in achievement across racial lines even when socioeconomic status is held at a constant. Research such as this has led to scholars critically examining the education system to find causal effects that lead to gaps in achievement as well as prescriptive solutions to eradicate gaps in achievement. Kailan (1999), Grant, (2009), and Howard (2010) among others have centralized race as being a critical variable in the achievement gaps. Kailan's (1999) study highlighted a racial disconnect between a Midwestern school and its students of color. Kailan's "findings indicate that most White teachers operated from an impaired consciousness about racism; that a majority blamed the victim" (p. 725). Teachers that take the stance of *blaming the victim* (Ryan, 1971) are pulling from a deficit ideology.

Darling-Hammond expands on the differences in achievement among students of color and European American students by drawing attention to specific structures associated with differences in access. Darling-Hammond (2004) states:

> In addition to being taught by less qualified teachers than their White counterparts, students of color face dramatic differences in courses, curriculum materials, and equipment. Unequal access to high-level courses and challenging curriculum explains another substantial component of the difference in achievement between [students of color] and White students….Tracking exacerbates differential access to knowledge. (p. 221-222).

Another reason for the difference in scores could be due to peer influence. Often students of color will not enroll in more rigorous mathematics courses due to wanting to be in courses with their friends (Walker, 1997). "Allegiance to peers, particularly in a predominantly [W]hite setting, may trump students' academic interests" (Walker, 1997, p. 52). Other peer influences may include *stereotype threat* (Steele & Aronson, 1995). Stereotype threat refers to a person's fear of confirming a negative stereotype that one group places upon another group.

Fordham and Ogbu (1986) suggest that some peer influences that negatively influence African American achievement is the perception of "acting White." After years of critical controversy on the “acting White” phenomenon, Ogbu (2004) provided a statement in attempt to clarify the meaning of “acting White.” Ogbu (2004) states:

> Many critics have misinterpreted the joint article and even constructed a different thesis of oppositional culture than the one we proposed in the joint article. The thesis is that Black students do not aspire to or strive to get good grades because it is perceived as ‘‘acting White’’ (p. 1).

Ogbu (2004) proceeds to describe that in most cases he has observed, African American students desire to get good grades. He states:

> I have generally found that there are relatively few students who reject good grades because it is ‘‘White.’’ On the contrary, they want to make good grades and many report that they are well received by their close friends when they get good grades…What [African American] students reject that hurt their academic performance are ‘‘White’’ attitudes and behaviors conducive to making good grades (p. 29).

Ogbu describes that the attitudes and behaviors may include taking mathematics and science courses, taking advanced curricular courses (i.e. Advanced Placement Coursework), talking “proper”, having White friends, reading, and doing daily homework. The notion of “acting White” has been refuted by many (Harpalani, 2002; Hollins, King, & Hayman, 1994). Harpalani (2002) points out that Fordham and Ogbu (1986) made a major error when discussing identity. According to Harpalani, “Fordham and Ogbu completely fail to consider identity formation processes, particularly with regard to race. Thus, they miss the meaning of ‘acting White’ references entirely” (p. 5).

Harpalani's conclusion of Fordham and Ogbu's phenomena of "acting White" is that "acting White" is not responsible for African American academic performance or in any sense reflective of a cultural frame of reference. Harpalani describes the phenomena as "one of many possible coping responses to feelings of devaluation that Black youth encounter" (p. 9).

Mead (2006) suggests that the gaps across ethnicity and social class are critical and wider than those across gender. Ikegulu (2009) explored this further by critically examining the fourth grade mathematics achievement of 220 students in southeast Texas. Ikegulu compared whether or not students scored higher when their teachers shared the same or different ethnic backgrounds producing very interesting results. Overall, students who received mathematics instruction from teachers with the same ethnic background scored higher than students who received instruction from teachers with different ethnic backgrounds. He concluded that African American students taught by African American teachers, regardless of the teacher's experience, scored the highest on their fourth grade TAKS test. The highest score reported from students whose ethnic identity was different than their teacher were the Asian American students who received instruction from European American teachers.

Lim's (2008) research provided evidence that suggested race/ethnicity influenced the mathematical outcomes of African American females. Lim states "the profound impact of ethnicity and class upon African-American girls' motivation and identity in school mathematics, poignantly revealing the existence of inequity deeply embedded in the current structure and practice of teaching and learning school mathematics in the

United States" (p. 304). Riegle-Crumb (2006) examined "high school math patterns for students of different race-ethnicity and gender" (p. 101) and found that African American males "receive less benefit from high math grades" (p. 101) when compared to White students. Lower returns for African American females were not determined.

Attempting to move away from cultural and genetic deficit theories, some scholars subscribe to the cultural mismatch theory to explain differences in achievement between diverse groups of students (Boykin, 1994; Lee, 2007). Cultural mismatch occurs when the cultural capital of the student—or in some cases a group of students—works in opposition of the cultural features of the school and educational structures. Ellison et al. (2000) identified at least five dimensions within the classroom experiences of students. They are: 1) social/psychological relations, 2) technical core of instruction, 3) physical structure and organizational routines, 4) discipline and classroom management, and 5) attitudes, perceptions, and expectations. Ellison et al. (2000) found that the mainstream cultural themes—individualism, competition, and bureaucracy—identified in the classroom structure were more prevalent than the cultural themes commonly identified with African American students (i.e. communalism, movement, and verve). "Cultural mismatch proponents argue that students of color experience cultural discontinuity in their classroom settings, and for teachers to use cultural responsive teaching strategies" (Howard, 2010, p. 31).

Critical Race Theory (CRT)

Critical Race Theory (CRT) provides an opportunity to situate race at the epicenter of examining social and educational issues in the United States (Delgado & Stefancic, 2001). CRT has evolved from its early foundations in legal studies examining race and racism “to examining how issues related to the law, immigration, national origin, language, globalization, and colonization are related to race” (Lynn & Parker, 2006, p. 263). There are notably five tenets of CRT identified by Delgado and Stefancic (2001) as: racism is ordinary, not aberrational; interest convergence (Bell, 1980); race is socially constructed; differential racialization; and unique voice of color (see Appendix A for a more in-depth description of CRT).

Gloria Ladson-Billings (1998) calls for CRT as a foundational lens when examining educational issues. “Critical Race Theory (CRT) is about deploying race and racial theory as a challenge to traditional notions of diversity and social hierarchy” (p. 57). Ladson-Billings and Tate (1995) provide three propositions in their call for critical race theory as a framework of analyzing issues in education: “1) race continues to be a significant factor in determining inequity in the United States, 2) U.S. society is based on property rights, and 3) the intersection of race and property creates an analytic tool through which we can understand social (and, consequently, school) inequity” (p. 48).

Viewing through a CRT lens, curricula are strongly influenced by the dominant culture and are situated to “maintain the current social order” (Ladson-Billings, 2004, p. 59). Instruction is considered racialized and selectively offered. Pedagogy must be analyzed through a CRT framework to remove oppressive and suppressive instruction.

Assessment is often considered to be a vehicle to legitimize deficiencies of children of color, children living in poverty, immigrant children, and limited-English speaking children (Ladson-Billings, 2004). Ladson-Billings states that "the entire history of standardized testing has been one of exclusion and social ranking rather than diagnosis and school improvement" (p. 60).

Methodology

This research study was guided by the research question: What are the differences in TAKS scores of students in grades three through eight during the years 2004, 2007, 2010 by mathematical objective categorized by race/ethnicity? Descriptive statistics were used to investigate the differences in mathematics achievement across groups. The population included all students who took the mathematics TAKS in grades three through eight during the years 2004 (N = 1,691,357), 2007 (N = 1,771,591), and 2010 (N = 1,982,604).

The instrument used for this research study was the Texas Assessment of Knowledge and Skills (TAKS) test which is developed and scored by Pearson Educational Measurement. This study examined archived data available electronically from the Texas Education Agency (TEA). *Statistical Package for Social Studies* (SPSS) 16.0 Graduate Pack was used to analyze objective specific means through a series of one-way analysis of variance (ANOVA; $p < 0.05$) trials for each dependent variable. Once differences between means were identified Bonferroni *post hoc* procedures were performed to locate specific differences between groups. To examine within-group data, the one-way ANOVAs were performed across the years 2004, 2007, and 2010 by objective to identify if any statistically significant differences were present. Where statistical significance could not be determined, the study relied on practical significance to discuss the differences between groups and within groups.

Findings

To critically examine the mean scores between racial/ethnic groups, one-way ANOVAs were performed to compare means ($p < .05$). The results of each one-way ANOVA between racial/ethnic groups across grade level by objective were very similar. The comparison of means identified that mean differences were present across each objective in grades three through eight with the exception of objective five in grade seven. An ANOVA table for between group data for race/ethnicity is provided to show ANOVA results (see Table 2.3). To determine where specific differences occurred, Bonferroni *post hoc* tests were administered.

Post hoc multiple comparisons results identified many differences. Statistically significant mean differences were identified when African American students' were compared to Asian American students' in all grades and across all objectives except for objective five (probability and statistics) in grade seven (see Table 2.4). The highest occurrences of statistically significant differences were visible in grades three, five, and eight across all objectives. Asian American students' mean scores by objective were significantly higher than African American and Latino/Latina/Hispanic American students' and in many cases higher than Native American students' (see Table 2.4). European American students' mean scores by objective were consistently higher than African American students' in grades three, five, and eight (see Table 2.4).

Table 2.3 One-way ANOVA Results Between Groups by Race/Ethnicity

Grade	Objective	F	p-value
3	1	F(4, 10) = 15.47	p < .001***
	2	F(4, 10) = 12.03	p = .001***
	3	F(4, 10) = 60.30	p < .001***
	4	F(4, 10) = 25.50	p < .001***
	5	F(4, 10) = 36.50	p < .001***
	6	F(4, 10) = 78.80	p < .001***
4	1	F(4, 10) = 15.68	p < .001***
	2	F(4, 10) = 11.86	p = .001***
	3	F(4, 10) = 10.81	p = .001***
	4	F(4, 10) = 5.98	p = .010**
	5	F(4, 10) = 5.42	p = .014*
	6	F(4, 10) = 12.10	p = .001***
5	1	F(4, 10) = 6.76	p = .007**
	2	F(4, 10) = 8.58	p = .003**
	3	F(4, 10) = 14.56	p < .001***
	4	F(4, 10) = 9.97	p = .002**
	5	F(4, 10) = 13.77	p < .001***
	6	F(4, 10) = 17.28	p < .001***
6	1	F(4, 10) = 8.08	p = .004**
	2	F(4, 10) = 4.85	p = .020*
	3	F(4, 10) = 4.47	p = .025*
	4	F(4, 10) = 4.96	p = .018*
	5	F(4, 10) = 14.77	p < .001***
	6	F(4, 10) = 15.49	p < .001***
7	1	F(4, 10) = 8.70	p = .003**
	2	F(4, 10) = 6.72	p = .007**
	3	F(4, 10) = 6.01	p = .010**
	4	F(4, 10) = 16.40	p < .001***
	5	F(4, 10) = 1.97	p = .176
	6	F(4, 10) = 17.80	p < .001***
8	1	F(4, 10) = 6.12	p = .009**
	2	F(4, 10) = 21.70	p < .001***
	3	F(4, 10) = 14.78	p < .001***
	4	F(4, 10) = 7.53	p = .005**
	5	F(4, 10) = 4.83	p = .020*
	6	F(4, 10) = 11.05	p < .001***

Note: This table addresses statistical significance at $p < 0.05$: $^{*}p < 0.05$; $^{**}p \leq 0.01$; $^{***}p \leq 0.001$.

Table 2.4 Statistically Significant Differences across Grades by Race/Ethnicity

Grade 3	Race/Ethnicity	Mean	MD	Sig.
Objective 1	Asian American	9.00		
	Native American	8.23	-0.77	p = .043*
	African American	7.50	-1.50	p < .001***
	Latino/Latina/Hispanic American	7.93	-1.07	p = .005**
	European American	8.60		
	African American	7.50	-1.10	p = .004**
Objective 2	Asian American	5.43		
	Native American	4.93	-0.50	p = .023*
	African American	4.63	-0.80	p = .001***
	Latino/Latina/Hispanic American	4.83	-0.60	p = .006**
	European American	5.10		
	African American	4.63	-0.47	p = .035*
Objective 3	Native American	5.07		
	African American	4.77	-0.30	p = .001***
	Asian American	5.47		
	Native American	5.07	-0.40	p < .001***
	African American	4.77	-0.70	p < .001***
	Latino/Latina/Hispanic American	5.03	-0.43	p < .001***
	European American	5.23	-0.23	p = .006**
	Latino/Latina/Hispanic American	5.03		
	African American	4.77	-0.27	p = .002**
	European American	5.23		
	African American	4.77	-0.47	p < .001***
	Latino/Latina/Hispanic American	5.03	-0.20	p = .017*
Objective 4	Native American	4.93		
	African American	4.37	-0.57	p = .014*
	Asian American	5.30		
	African American	4.37	-0.93	p < .001***
	Latino/Latina/Hispanic American	4.70	-0.60	p = .010**
	European American	5.10		
	African American	4.37	-0.73	p = .002**
Objective 5	Native American	3.47		
	African American	3.23	-0.23	p = .002**
	Asian American	3.67		
	Native American	3.47	-0.20	p = .008**
	African American	3.23	-0.43	p < .001***
	Latino/Latina/Hispanic American	3.33	-0.33	p < .001***
	European American	3.60		
	African American	3.23	-0.37	p < .001***
	Latino/Latina/Hispanic American	3.33	-0.27	p = .001***
Objective 6	Native American	5.73		
	African American	5.10	-0.63	p = .001***
	Latino/Latina/Hispanic American	5.33	-0.40	p = .023*
	Asian American	6.63		
	Native American	5.73	-0.90	p < .001***
	African American	5.10	-1.53	p < .001***
	Latino/Latina/Hispanic American	5.33	-1.30	p < .001***
	European American	6.17	-0.47	p = .008**
	European American	6.17		
	Native American	5.73	-0.43	p = .014*

Table 2.4 Continued

Grade 3	**Race/Ethnicity**	**Mean**	**MD**	**Sig.**
	African American	5.10	-1.67	p < .001***
	Latino/Latina/Hispanic American	5.33	-0.83	p < .001***
Grade 4				
Objective 1	Asian American	10.20		
	Native American	9.33	-0.87	p = .017*
	African American	8.70	-1.50	p < .001***
	Latino/Latina/Hispanic American	9.17	-1.03	p = .005**
	European American	9.73		
	African American	8.70	-1.03	p = .005**
Objective 2	Asian American	6.47		
	Native American	5.87	-0.60	p = .023*
	African American	5.53	-0.93	p = .001***
	Latino/Latina/Hispanic American	5.73	-0.73	p = .006**
	European American	6.10		
	African American	5.53	-0.57	p = .035*
Objective 3	Asian American	5.37		
	African American	4.50	-0.87	p = .001***
	Latino/Latina/Hispanic American	4.80	-0.57	p = .025*
	European American	5.13		
	African American	4.50	-0.63	p = .012*
Objective 4	Asian American	5.27		
	African American	4.23	-1.03	p = .012*
Objective 5	Asian American	3.57		
	African American	2.90	-0.60	p = .031*
Objective 6	Asian American	6.93		
	African American	5.37	-1.57	p = .001***
	Latino/Latina/Hispanic American	5.70	-1.23	p = .006**
	European American	6.47		
	African American	5.37	-1.10	p = .014*
Grade 5				
Objective 1	Asian American	10.07		
	African American	8.43	-1.63	p = .008**
	Latino/Latina/Hispanic American	8.80	-1.27	p = .043*
Objective 2	Asian American	6.13		
	African American	4.93	-1.20	p = .004**
	Latino/Latina/Hispanic American	5.13	-1.00	p = .016*
	European American	5.77		
	African American	4.43	-0.57	p = .033*
Objective 3	Native American	6.10		
	African American	5.57	-0.53	p = .018*
	Asian American	6.47		
	African American	5.57	-0.90	p < .001***
	Latino/Latina/Hispanic American	5.90	-0.57	p = .012*
	European American	6.23		
	African American	5.57	-0.67	p = .004**
Objective 4	Asian American	6.23		

Table 2.4 Continued

Grade 5	**Race/Ethnicity**	**Mean**	**MD**	**Sig.**
	African American	4.87	-1.37	p = .002**
	Latino/Latina/Hispanic American	5.23	-1.00	p = .019*
	European American	5.87		
	African American	4.87	-1.00	p = .019*
Objective 5	Asian American	3.57		
	Native American	3.23	-0.33	p = .033*
	African American	2.97	-0.60	p < .001***
	Latino/Latina/Hispanic American	3.13	-0.43	p = .005**
	European American	3.37		
	African American	2.97	-0.40	p = .010**
Objective 6	Native American	6.27		
	African American	5.53	-0.73	p = .038*
	Asian American	7.00		
	Native American	6.27	-0.73	p = .038*
	African American	5.53	-1.47	p < .001***
	Latino/Latina/Hispanic American	5.90	-1.10	p = .002**
	European American	6.60		
	African American	5.53	-1.07	p = .003**
Grade 6				
Objective 1	Asian American	8.63		
	African American	6.63	-2.00	p = .004**
	Latino/Latina/Hispanic American	6.97	-1.67	p = .016*
Objective 2	Asian American	7.70		
	African American	5.77	-1.93	p = .026*
Objective 3	Asian American	6.30		
	African American	5.13	-1.17	p = .035*
Objective 4	Asian American	4.07		
	African American	2.90	-1.17	p = .023*
Objective 5	Asian American	5.33		
	Native American	4.70	-0.63	p = .016*
	African American	4.33	-1.00	p < .001***
	Latino/Latina/Hispanic American	4.46	-0.87	p = .002**
	European American	4.97		
	African American	4.33	-0.63	p = .016*
Objective 6	Asian American	7.77		
	Native American	6.80	-0.97	p = .027*
	African American	6.03	-1.73	p < .001***
	Latino/Latina/Hispanic American	6.40	-1.37	p = .002**
	European American	7.23		
	African American	6.03	-1.20	p = .006**
Grade 7				
Objective 1	Asian American	8.37		
	African American	6.37	-2.00	p = .004**
	Latino/Latina/Hispanic American	6.70	-1.67	p = .014**
Objective 2	Asian American	8.00		
	African American	5.67	-2.33	p = .009**

Table 2.4 Continued

Grade 7	**Race/Ethnicity**	**Mean**	**MD**	**Sig.**
	Latino/Latina/Hispanic American	6.00	-2.00	p = .027*
Objective 3	Asian American	5.94		
	African American	4.57	-1.37	p = .013*
Objective 4	Asian American	3.97		
	Native American	3.07	-0.90	p = .009**
	African American	2.57	-1.40	p < .001***
	Latino/Latina/Hispanic American	2.83	-1.13	p = .002**
	European American	3.47		
	African American	2.57	-0.90	p = .009**
Objective 6	Asian American	7.67		
	Native American	6.57	-1.10	p = .012*
	African American	5.80	-1.87	p < .001***
	Latino/Latina/Hispanic American	6.23	-1.43	p = .002**
	European American	7.10		
	African American	5.80	-1.30	p = .003**
Grade 8				
Objective 1	Asian American	10.07		
	African American	8.43	-2.30	p = .013*
	Latino/Latina/Hispanic American	8.80	-1.93	p = .041*
Objective 2	Asian American	6.13		
	Native American	3.23	-1.43	p = .003**
	African American	4.93	-2.23	p < .001***
	Latino/Latina/Hispanic American	5.13	-1.83	p < .001***
	European American	5.77		
	African American	4.43	-1.37	p = .034*
	Latino/Latina/Hispanic American	5.13	-0.97	p = .045*
Objective 3	Native American	6.10		
	African American	5.57	-0.77	p = .042*
	Asian American	6.47		
	African American	5.57	-1.43	p < .001***
	Latino/Latina/Hispanic American	5.90	-1.03	p = .006**
	European American	6.23		
	African American	5.57	-1.10	p = .003**
Objective 4	Asian American	6.23		
	African American	4.87	-1.30	p = .006**
	Latino/Latina/Hispanic American	5.90	-1.10	p = .019*
Objective 5	Asian American	3.57		
	African American	2.97	-1.33	p = .038*
Objective 6	Asian American	7.00		
	Native American	6.27	-1.33	p = .038*
	African American	5.53	-2.07	p = .002**
	Latino/Latina/Hispanic American	5.90	-1.77	p = .006**
	European American	6.60		
	African American	5.53	-1.40	p = .028*
	Latino/Latina/Hispanic American	5.90	-0.83	p < .001***

Note: This table addresses statistical significance at $p < 0.05$: *$p < 0.05$; **$p \leq 0.01$; ***$p \leq 0.001$.

Statistically significant differences in objective one (numbers, operations, and quantitative reasoning) are more prevalent in grades three and four than the other grades (see Table 2.5). The mean score differences between Asian American students' and African American and Latino/Latina/Hispanic American students' are significantly different across all grades three through eight (see Table 2.5). In grade three the mean score of Asian American students' (M = 9.00) is significantly higher than Native American students' (M = 8.23, p = .043), African American students' (M = 7.50, p < .001), and Latino/Latina/Hispanic American students' (M = 7.93, p=.005). In grade three, European American students' (M= 8.60) were also scoring significantly higher than African American students' (M = 7.50, p = .004). Similar results were present in grade four. The mean score of Asian American students' (M = 10.20) is significantly higher than Native American students' (M = 9.33, p = .017), African American students' (M = 8.70, p < .001), and Latino/Latina/Hispanic American students' (M = 9.17, p=.005). European American students' (M = 9.73) mean scores were significantly higher than African American students' (M = 8.70, p =.005). In grades five through eight, Asian American students' mean scores were significantly higher than African American students' and Latino/Latina/Hispanic American students' (see Table 2.5).

Table 2.5 Statistically Significant Differences across Objective 1 by Race/Ethnicity

Objective 1	Race/Ethnicity	Mean	MD	Sig.
Grade 3	Asian American	9.00		
	Native American	8.23	-0.77	p = .043*
	African American	7.50	-1.50	p < .001***
	Latino/Latina/Hispanic American	7.93	-1.07	p = .005**
	European American	8.60		
	African American	7.50	-1.10	p = .004**
Grade 4	Asian American	10.20		
	Native American	9.33	-0.87	p = .017*
	African American	8.70	-1.50	p < .001***
	Latino/Latina/Hispanic American	9.17	-1.03	p = .005**
	European American	9.73		
	African American	8.70	-1.03	p = .005**
Grade 5	Asian American	10.07		
	African American	8.43	-1.63	p = .008**
	Latino/Latina/Hispanic American	8.80	-1.27	p = .043*
Grade 6	Asian American	8.63		
	African American	6.63	-2.00	p = .004**
	Latino/Latina/Hispanic American	6.97	-1.67	p = .016*
Grade 7	Asian American	8.37		
	African American	6.37	-2.00	p = .004**
	Latino/Latina/Hispanic American	6.70	-1.67	p = .014*
Grade 8	Asian American	10.07		
	African American	8.43	-2.30	p = .013*
	Latino/Latina/Hispanic American	8.80	-1.93	p = .041*

Note: This table addresses statistical significance at $p < 0.05$: $*p < 0.05$; $**p \leq 0.01$; $***p \leq 0.001$.

ANOVA results for objective two identified significant differences when the mean scores of Asian American students' were compared to Native American (grades three, four, and eight), Latino/Latina/Hispanic American (all grades except sixth grade) students' (see Table 2.6). Statistically significant differences were observed also between European American students' and African American students' in grades three through five and eight.

Table 2.6 Statistically Significant Differences across Objective 2 by Race/Ethnicity

Objective 2	Race/Ethnicity	Mean	MD	Sig.
Grade 3	Asian American	5.43		
	Native American	4.93	-0.50	p = .023*
	African American	4.63	-0.80	p = .001***
	Latino/Latina/Hispanic American	4.83	-0.60	p = .006**
	European American	5.10		
	African American	4.63	-0.47	p = .035*
Grade 4	Asian American	6.47		
	Native American	5.87	-0.60	p = .023*
	African American	5.53	-0.93	p = .001***
	Latino/Latina/Hispanic American	5.73	-0.73	p = .006**
	European American	6.10		
	African American	5.53	-0.57	p = .035*
Grade 5	Asian American	6.13		
	African American	4.93	-1.20	p = .004**
	Latino/Latina/Hispanic American	5.13	-1.00	p = .016*
	European American	5.77		
	African American	4.43	-0.57	p = .033*
Grade 6	Asian American	7.70		
	African American	5.77	-1.93	p = .026*
Grade 7	Asian American	8.00		
	African American	5.67	-2.33	p = .009**
	Latino/Latina/Hispanic American	6.00	-2.00	p = .027*
Grade 8	Asian American	6.13		
	Native American	3.23	-1.43	p = .003**
	African American	4.93	-2.23	p < .001***
	Latino/Latina/Hispanic American	5.13	-1.83	p < .001***
	European American	5.77		
	African American	4.43	-1.37	p = .034*
	Latino/Latina/Hispanic American	5.13	-0.97	p = .045*

Note: This table addresses statistical significance at $p < 0.05$: $*p < 0.05$; $**p \leq 0.01$; $***p \leq 0.001$.

The most notable differences in objective three (geometry and spatial reasoning) were in grade three in which Asian American students' (M = 5.47) are scoring significantly higher than Native American students' (5.07, p < .001), African American students' (4.77, p < .001), Latino/Latina/Hispanic American students' (M = 5.03, p < .001), and European American students' (M = 5.23, p = .006). Also in grade three, Native American students' (M = 5.07) mean score was significantly higher than African American students' (M = 4.77, p = .001). Latino/Latina/Hispanic American students' (M = 5.03) mean score was also significantly higher than African American students' (M = 4.77, p = .002) mean score. European American students' (M = 5.23) are scoring significantly higher than African American students' (M = 4.77, p < .001) and Latino/Latina/Hispanic American students' (M = 5.03, p = .017). There were not as many differences observed in grades four through eight. However, in grades four through eight, Asian American students' mean scores for objective three were significantly higher than African American students' (see Table 2.7).

Table 2.7 Statistically Significant Differences across Objective 3 by Race/Ethnicity

Objective 3	Race/Ethnicity	Mean	MD	Sig.
Grade 3	Native American	5.07		
	African American	4.77	-0.30	p = .001***
	Asian American	5.47		
	Native American	5.07	-0.40	p < .001***
	African American	4.77	-0.70	p < .001***
	Latino/Latina/Hispanic American	5.03	-0.43	p < .001***
	European American	5.23	-0.23	p = .006**
	Latino/Latina/Hispanic American	5.03		
	African American	4.77	-0.27	p = .002**
	European American	5.23		
	African American	4.77	-0.47	p < .001***
	Latino/Latina/Hispanic American	5.03	-0.20	p = .017*
Grade 4	Asian American	5.37		
	African American	4.50	-0.87	p = .001***
	Latino/Latina/Hispanic American	4.80	-0.57	p = .025*
	European American	5.13		
	African American	4.50	-0.63	p = .012*
Grade 5	Native American	6.10		
	African American	5.57	-0.53	p = .018*
	Asian American	6.47		
	African American	5.57	-0.90	p < .001***
	Latino/Latina/Hispanic American	5.90	-0.57	p = .012*
	European American	6.23		
	African American	5.57	-0.67	p = .004**
Grade 6	Asian American	6.30		
	African American	5.13	-1.17	p = .035*
Grade 7	Asian American	5.94		
	African American	4.57	-1.37	p = .013*
Grade 8	Native American	6.10		
	African American	5.57	-0.77	p = .042*
	Asian American	6.47		
	African American	5.57	-1.43	p < .001***
	Latino/Latina/Hispanic American	5.90	-1.03	p = .006**
	European American	6.23		
	African American	5.57	-1.10	p = .003***

Note: This table addresses statistical significance at $p < 0.05$: $*p < 0.05$; $**p \leq 0.01$; $***p \leq 0.001$.

Objective four (measurement) differences are very similar to differences identified in objective one. Asian American students' mean scores are higher than African American students' in grades three through eight (see Table 2.8). Asian American students' mean scores were also significantly higher than Latino/Latina/Hispanic

American students’ in grades three, five, seven, and eight (see Table 2.8). European American students’ are scoring higher than African American students’ in grades three, five, and seven.

Table 2.8 Statistically Significant Differences across Objective 4 by Race/Ethnicity

Objective 4	Race/Ethnicity	Mean	MD	Sig.
Grade 3	Native American	4.93		
	African American	4.37	-0.57	p = .014*
	Asian American	5.30		
	African American	4.37	-0.93	p < .001***
	Latino/Latina/Hispanic American	4.70	-0.60	p = .010**
	European American	5.10		
	African American	4.37	-0.73	p = .002**
Grade 4	Asian American	5.27		
	African American	4.23	-1.03	p =.012*
Grade 5	Asian American	6.23		
	African American	4.87	-1.37	p = .002**
	Latino/Latina/Hispanic American	5.23	-1.00	p = .019*
	European American	5.87		
	African American	4.87	-1.00	p = .019*
Grade 6	Asian American	5.27		
	African American	2.90	-1.17	p = .023*
Grade 7	Asian American	3.97		
	Native American	3.07	-0.90	p = .009**
	African American	2.57	-1.40	p < .001***
	Latino/Latina/Hispanic American	2.83	-1.13	p = .002**
	European American	3.47		
	African American	2.57	-0.90	p = .009**
Grade 8	Asian American	6.23		
	African American	4.87	-1.30	p = .006**
	Latino/Latina/Hispanic American	5.90	-1.10	p = .019*

Note: This table addresses statistical significance at $p < 0.05$: $*p < 0.05$; $**p \leq 0.01$; $***p \leq 0.001$.

Objective five (probability and statistics) is interesting because no statistically significant differences were present in grade seven (see Table 2.9). However, significant differences were present in all other grades. In grade three, Asian American students' (M = 3.67) mean scores were significantly higher than Native American (3.47, p = .008), African American (M = 3.23, p < .001), and Latino/Latina/Hispanic American students' (M = 3.33, p < .001) mean scores. European American students' (M = 3.60) are also scoring higher than African American students' (M = 3.23, p < .001) and Latino/Latina/Hispanic American students' (M 3.33, p = .001) in grade three.

Table 2.9 Statistically Significant Differences across Objective 5 by Race/Ethnicity

Objective 5	Race/Ethnicity	Mean	MD	Sig.
Grade 3	Native American	3.47		
	African American	3.23	-0.23	p = .002**
	Asian American	3.67		
	Native American	3.47	-0.20	p = .008**
	African American	3.23	-0.43	p < .001***
	Latino/Latina/Hispanic American	3.33	-0.33	p < .001***
	European American	3.60		
	African American	3.23	-0.37	p < .001***
	Latino/Latina/Hispanic American	3.33	-0.27	p = .001***
Grade 4	Asian American	3.57		
	African American	2.90	-0.60	p = .031*
Grade 5	Asian American	3.57		
	Native American	3.23	-0.33	p = .033*
	African American	2.97	-0.60	p < .001***
	Latino/Latina/Hispanic American	3.13	-0.43	p = .005**
	European American	3.37		
	African American	2.97	-0.40	p = .010**
Grade 6	Asian American	5.33		
	Native American	4.70	-0.63	p = .016*
	African American	4.33	-1.00	p < .001***
	Latino/Latina/Hispanic American	4.46	-0.87	p = .002***
	European American	4.97		
	African American	4.33	-0.63	p = .016*
Grade 8	Asian American	3.57		
	African American	2.97	-1.33	p = .038*

Note: This table addresses statistical significance at $p < 0.05$: $*p < 0.05$; $**p \leq 0.01$; $***p \leq 0.001$.

Objective six (mathematical processes and tools) hosts the highest quantity of significant differences which are most quantified in grades three and five (see Table 2.10). Native American students’ are scoring higher than African American students’ in grades three and five and Latino/Latina/Hispanic American students’ in grade three (see Table 2.10). Asian American students’ mean scores were significantly higher than Native American students’ in grades three and five through eight, African American and Latino/Latina/Hispanic American students’ in grades three through eight, and European American students’ in grade three. European American students’ mean scores were significantly higher that Native American students’ in grade three, African American students’ in grades three through eight, and Latino/Latina/Hispanic American students’ in grades three and eight. For a more comprehensive review of data, please refer to Table 2.10.

Table 2.10 Statistically Significant Differences across Objective 6 by Race/Ethnicity

Objective 6	Race/Ethnicity	Mean	MD	Sig.
Grade 3	Native American	5.73		
	African American	5.10	-0.63	p = .001***
	Latino/Latina/Hispanic American	5.33	-0.40	p = .023*
	Asian American	6.63		
	Native American	5.73	-0.90	p < .001***
	African American	5.10	-1.53	p < .001***
	Latino/Latina/Hispanic American	5.33	-1.30	p < .001***
	European American	6.17	-0.47	p = .008**
	European American	6.17		
	Native American	5.73	-0.43	p = .014*
	African American	5.10	-1.67	p < .001***
	Latino/Latina/Hispanic American	5.33	-0.83	p < .001***
Grade 4	Asian American	6.93		
	African American	5.37	-1.57	p = .001***
	Latino/Latina/Hispanic American	5.70	-1.23	p = .006**
	European American	6.47		
	African American	5.37	-1.10	p = .014*
Grade 5	Native American	6.27		
	African American	5.53	-0.73	p = .038*
	Asian American	7.00		
	Native American	6.27	-0.73	p = .038*
	African American	5.53	-1.47	p < .001***
	Latino/Latina/Hispanic American	5.90	-1.10	p = .002**
	European American	6.60		
	African American	5.53	-1.07	p = .003**
Grade 6	Asian American	7.77		
	Native American	6.80	-0.97	p = .027*
	African American	6.03	-1.73	p < .001***
	Latino/Latina/Hispanic American	6.40	-1.37	p = .002**
	European American	7.23		
	African American	6.03	-1.20	p = .006**
Grade 7	Asian American	7.67		
	Native American	6.57	-1.10	p = .012*
	African American	5.80	-1.87	p < .001***
	Latino/Latina/Hispanic American	6.23	-1.43	p = .002**
	European American	7.10		
	African American	5.80	-1.30	p = .003**
Grade 8	Asian American	7.00		
	Native American	6.27	-1.33	p = .038*
	African American	5.53	-2.07	p = .002**
	Latino/Latina/Hispanic American	5.90	-1.77	p = .006**
	European American	6.60		
	African American	5.53	-1.40	p = .028*
	Latino/Latina/Hispanic American	5.90	-0.83	p < .001***

Note: This table addresses statistical significance at $p < 0.05$: *$p < 0.05$; **$p \leq 0.01$; ***$p \leq 0.001$.

This study also explored data within each racial/ethnic group by specific objective across the years 2004, 2007, and 2010. In most situations, each group either scored the same mean score or slightly increased between 2004, 2007, and 2010. There were no statistically significant differences across years identified by any of the one-way ANOVAs. However, a closer critical analysis did identify themes of practical significance (see Table 2.11)

Table 2.11 List of Critical Observations

Racial/Ethnic Group	Critical Examination (Year)	Critical Examination (Objective)
Native American	a) Slight decrease between 2004 (M = 5.1) and 2007 (M = 4.9) on objective 2 in grade 3. b) Scores are consistently increasing across most grades and objectives between 2004, 2007, and 2010.	a) Scored better on objectives 1, 2, and 3 in grades 3-5 than in grades 6-8. b) Scored better on objective 3 in grades 5-6 than in other grades. c) Scored lower on objective 4 in grades 7-8 than in other grades.
Asian American	a) Slight decrease between 2004 (M = 5.5) and 2007 (M = 5.4) on objective 2 in grade 3. b) Scores are consistently increasing across most grades and objectives between 2004, 2007, and 2010.	a) Scored better on objective 1 in grades 3-5 than in grades 6-8.
African American	a) Slight decrease between 2007 and 2010 across objective 1 (M = 8.8; M = 8.6), objective 4 (M = 2.8; M = 2.6), and objective 6 (M = 5.8; M = 5.5) in grade 5. b) Slight decrease in mean score between 2004 (M =4.9) and 2010 (M = 4.5) across objective 2 in grade 3.	a) Scored better on objectives 1 and 2 in grades 3-5 than in grades 6-8. b) Scored better on objective 3 in grades 5-6 than in other grades. c) Scored lower on objective 4 in grades 6-8 than in other grades.
Latino/Latina/ Hispanic American	a) Slight decrease in mean score between each year 2004 (M = 5), 2007 (M = 4.8), and 2010 (M = 4.7) on objective 2 in grade 3. b) Slight decrease in mean score between 2007 (M = 3.1) and 2010 (M = 2.8) on objective 4 in grade 7.	a) Scored better on objectives 1 and 2 in grades 3-5 than in grades 6-8. b) Scored better on objective 3 in grades 5-6 than in other grades. c) Scored lower on objective 4 in grades 7-8 than grades 3-6.
European American	a) Slight decrease in mean score between each year 2004 (M = 5.2), 2007 (M = 5.1), and 2010 (5.2) on objective 2 in grade 3. b) Slight decrease in mean score between 2007 and 2010 on objective 1 (M = 9.9; M = 9.5) in grade 5; objective 3 (M = 5.3; M = 5.2) in grade 3; objective 4 (M = 3.7; M = 3.4) in grade 7; objective 6 (M = 7.5; M = 7.2) in grade 6.	a) Scored better on objectives 1 in grades 3-5 than in grades 6-8. b) Scored better on objective 2 in grades 6-8 than other grades. c) Scored better on objective 3 in grades 5-6 than other grades.

Table 2.4 provides a synopsis of critical observations of practical significance from examining within group TAKS mathematical data. Most groups scored slightly lower on objective two (patterns, relationships, and algebraic reasoning) in grade three between 2004 and 2007. Also, each group seemed to score better on objective one (numbers, operations, and quantitative reasoning) in grades three through five than in grades six through eight. Native American, African American, Latino/Latina/Hispanic American, and European American students' scored slightly better on objective three (geometry and spatial reasoning) in grades five and six.

Conclusion

The purpose of this study was to critically examine TAKS mathematics data in grades three through eight by objective across race/ethnicity. The intent of the study is not to create a data set to exclude groups or use as a basis for social ranking, but instead should be utilized as a data set to improve the academic experiences of students (Ladson-Billings, 2004). The study explored both similarities and differences between performance means of identified racial/ethnic groups and within the groups to identify any characteristics that may be of practical or statistical significance. The results of this study that explored performance differences across race/ethnicity resembled the NAEP results discussed in the 2010 *Condition of Education Report* (COE) (NCES, 2011) that significant performance differences persist across race/ethnicity in mathematics achievement.

According to the 2004, 2007, and 2010 TAKS data, Asian American students' are scoring significantly higher than African American students' on every mathematical objective in grades three through eight except for one: objective five (probability and statistics) in grade seven (see Table 2.4). The mean scores of Asian American students' across all objectives were higher than all other racial/ethnic groups and in many cases significantly higher. European American students' mean scores across all objectives were higher than Native American, African American, and Latino/Latina/Hispanic American students' and held statistical significance in many grades. Statistically significant differences were observed in all grades when European American students' mean scores across objective six (mathematical processes and tools) were compared to African American students'.

The areas where statistical significance was observed the most were in grades three, five, and eight. Grades three, five, and eight are sometimes referred to as *gatekeepers* because students have been required to pass reading and mathematics TAKS to be eligible for grade promotion. The areas where statistical significance was least observed was in grades six and seven across objectives one through five. There were many instances of statistical significance in objective six (mathematical processes and tools) across grades three through eight when Asian American and European American student means are compared to Native American, African American, and Latino/Latina/Hispanic American student means.

Even though statistical significance was not observed from within group data, several interesting trends prevailed. Each racial/ethnic group seemed to score higher on objective one (numbers, operations, and quantitative reasoning) in grades three through five than in grades six through eight. Native American, African American, Latino/Latina/Hispanic American, and European American students' all seem to score better on objective three (geometry and spatial reasoning) in grades five and six than in grades three, four, seven, and eight. African American and Latino/Latina/Hispanic American students' seem to lower on objective four (measurement) in the middle grades than in elementary school. Each racial/ethnic group also had a decrease in mean score on objective two (patterns, relationships, and algebraic reasoning) in grade three between 2004 and 2007. While most groups mean score by objective stayed the same or slightly increased, there were a few instances where a groups' score decreased between years. However, there were not any instances where a statistically significant increase across years occurred by specific objective.

This purpose of this research study was to identify differences in mathematics achievement to develop a data set for research and praxis to build upon. The results of this study identify that significant differences are prevalent across grades three through eight with the most prevalence in grades three, five, and eight. Objectives two (patterns, relationships, and algebraic reasoning), three (geometry and spatial reasoning), four (measurement), and six (mathematical processes and tools) seem to be the space where high quantities of difference exist. Performance differences between racial/ethnic groups are prevalent and have been consistent across 2004, 2007, and 2010 suggesting that race must be a critical variable in the performance gap formula.

The social construction of race must be considered when examining the performance gaps across racial groups. This study was conducted through a critical race lens acknowledging that racism is deeply entrenched in the social structures of the United States and is constantly at work within society and education, including the TAKS assessment program (Ladson-Billings, 1998). Curriculum and instruction are racialized and selectively offered to maintain the current social order (Ladson-Billings, 2004). Teachers' acceptance, expectations, and patience with students are strongly influenced by race therefore contributing enormously to the classroom experiences of students. Sullivan (2007) highlights that students of color in Texas are more likely to be expelled or suspended than European American students' for "trivial transgressions" (p. 145) which is directly related to the attitudes that teachers have toward students of color (Howard, 2010; Kailen, 1999)

The persistent differences in TAKS performance, access to curriculum, teacher attitudes toward students of color, and disproportionate disciplinary referrals (Sullivan, 2007) suggest that *differential racialization* (Delgado & Stefancic, 2001) is at play. A student's mathematical achievement in grades three through eight influences future academic opportunities and career opportunities. Students who do not experience academic success have an increased likelihood of living in difficult socioeconomic situations, dropping out or being pushed out of school, and/or being incarcerated (Howard, 2010; Orfield, 2004; Sullivan, 2007). Why the highest numbers of statistically significant differences are present in the grades that students' must pass the mathematics TAKS assessment to be eligible for grade promotion is an important question that must be addressed. The TAKS assessment program provides a direct opportunity for *differential racialization* to play out. The results of this study suggest that students of color, specifically Native American, African American, Latino/Latina/Hispanic American students, are not receiving the same opportunities as Asian American and European American students.

CHAPTER III

A CRITICAL EXAMINATION OF TEXAS MATHEMATICS ACHIEVEMENT IN GRADES THREE THROUGH EIGHT BY MATHEMATICAL OBJECTIVE ACROSS GENDER

Introduction

According to the National Education Association (NEA, 2008), “America’s future economic success and national security depend upon a technologically literate society that is well versed in mathematics and science” (p. 1). Unequal gender participation in mathematics and science courses paralleled with unequal gender representation in Science, Technology, Engineering, and Mathematics (STEM) raise concern for gender equity as well as prosperity (Dey & Hill, 2008; NEA, 2008; Sadker & Zittleman, 2010). Female students are participating in more mathematics and science coursework than ever before and are producing higher grades than male students in K-12 mathematics and science, but still are not scoring as high as male students on college entrance exams (Sadker & Zittleman, 2004). The American Association of University Women (AAUW) (2010) states that “thirty years ago there were 13 boys for every girl who scored above 700 on the SAT math exam at age 13; today that ratio has shrunk to about 3:1” (p. xiv). NEA (2008) acknowledges that the passage of Title IX legislation in 1972 has contributed tremendously to the increased participation in STEM courses by female students. NEA also acknowledges that “traditional gender-based stereotypes and inequities still exist and are still limiting the academic and social development of both females and males. For girls, this bias remains prevalent” (p. 1) in STEM subjects. “To diversify the STEM fields we must take a hard look at the stereotypes and biases that still pervade our culture" (AAUW, 2010, p. xvi).

Numerous reports in the 1990s highlighted male dominated sexism in STEM fields and gender bias in schools and society (AAUW, 1992; Oakes, 1990; Sadker & Sadker, 1994). Following the girl crisis were the claims of a boy crisis (Rivers & Barnett, 2006; Sax, 2005; Sommers, 2000; Tyre, 2006). Sadker, Sadker, and Zittleman (2009) argue that the crisis facing our youth would be most appropriately identified as "the some boys (and girls) crisis" (p. 149). While female students, students of color, and students living in challenging economic situations continue to be shortchanged in STEM content areas, European American male, middle-class students are not (Sadker & Zittleman, 2010). Missing from the argument is the *invisibility* (Delgado & Stefancic, 2001) of intersex students. Gender data often are disaggregated categorically as only male or female omitting more accurate data analysis across gender. The *some boys (and girls) crisis* may be more appropriately referred to as the *gendered crisis*.

What is the relevance of STEM participation? "Workforce projections for 2018 by the U.S. Department of Labor show that nine of the 10 fastest growing occupations will require significant science or mathematical training" (AAUW, 2010, p. 2). Estimations suggest that primary areas of impact may be in the computer-related and engineering-related fields. Currently women hold less than 25 percent of the occupied positions within these fields (AAUW, 2010; Lacey & Wright, 2009; National Science Board, 2010). STEM careers often entertain higher salaries which inevitably contribute to gendered income wage gap (Corbett, Hill, & St. Rose, 2007). Mathematical skills are perceived to be essential in STEM areas (AAUW, 2010). The emphasis of mathematics in STEM areas directly increases the stakes for equitable representation in mathematics education and achievement.

According to the US Department of Education 2009's *The Nation's Report Card* (National Center for Educational Statistics [NCES], 2009) male students are still slightly outperforming female students in fourth and eighth grade mathematics achievement nationwide. Male performance data at both the fourth and eighth grade assessments are slightly higher than females. According to 2010 data retrieved from the Texas Education Association (TEA), male students are performing slightly higher in TAKS mathematics in grades three, five, and seven. Female students are performing slightly higher in grades six and eight. Male and female students are performing at the same level in fourth grade mathematics. Further data analysis is needed to examine specifically where differences occur by mathematical objective to improve mathematics achievement for all students. Improving achievement is one step of a complex equation to increase life chances and life choices (Howard, 2010).

Gender-specific performance gaps have been a concern for researchers, educators, and society for decades. Critical research that examines the intersections of race/ethnicity, gender, socioeconomic status, and other variables are needed to respond to and eradicate performance gaps (Lim, 2008; Lubienski & Bowen, 2000; Tate, 2005). Tate (2005) describes the importance of specific assessment data:

> While many states, schools districts, and schools disaggregate data to help provide a more accurate picture of student performance, many educational

> leaders do not have insight into student mathematical performance by demographic group. This is problematic in that student achievement patterns and trends are potentially overlooked; thus, opportunities for instructional intervention are lost, and future student performance is hampered (p.9).

The lack of accessible data, literature, and research fuels a difficult challenge in eradicating mathematics performance gaps. Research is needed to identify exactly where performance gaps occur to inform future research to explore why the gaps exists (Lubienski, 2002).

The objective of this study was to determine if there are significant differences in mathematics achievement of male and female students in grades three through eight. The study critically examined the disparity of achievement in TAKS mathematics in grades three through eight between the years 2004, 2007, and 2010 across gender. The years 2004, 2007, and 2010 were chosen to analyze the most recent data and to have equal increments between years examined. This critical analysis provides a large-scaled foundational data set for future research to build both theory and practice as it relates to mathematics education. The guiding research question for this study was: What are the differences in TAKS scores of students in grades three through eight during the years 2004, 2007, and 2010 by mathematical objective categorized by gender?

This chapter explores the current Texas state assessment program and mathematical objectives before moving into the issue of sex and gender. Once sex and gender are clearly defined, the discussion moves to gender bias followed by a discussion about the emergence single-sex education. Following the discussion of single-sex education is a brief description of the intersections of race/ethnicity and gender and performance gaps across gender. The focus then shifts to the guiding research methodology, findings, and concluding remarks.

Texas Assessment Program

Texas students currently participate in the Texas Assessment of Knowledge and Skills (TAKS) assessment program in grades three through exit-level in various subjects across grades. Mathematics and reading are administered beginning in third grade through at-least eighth grade. The TAKS program succeeds prior assessment programs such as TABS, TEAMS, and TAAS and precedes the STAAR assessment program (see Figure 3-1).

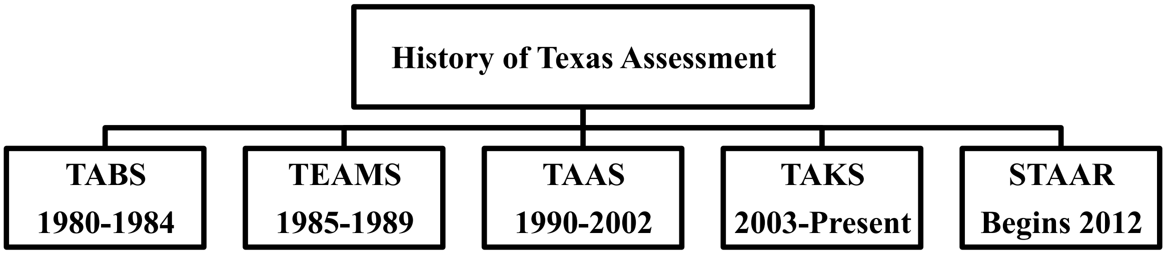

Figure 3-1. History of Texas Assessments

The mathematics TAKS assessment is driven by six mathematical objectives (see Figure 3-2). The complexity of each objective increases per grade level, but the emphasis varies across grade levels. Objective one is heavily emphasized in all grade levels because it is perceived to consist of the foundational mathematics knowledge and skills to prepare students for a successful algebra experience. Objectives two, three, and five are emphasized more heavily at each grade level through the eighth grade. Objective four is emphasized most in the fifth grade assessment. Objective six receives heavy emphasis in all grades, but is assessed slightly more in the middle grades than in grades three through five.

TAKS Mathematics Objectives

Objective 1	• **Numbers, Operations, and Quantitative Reasoning** • Skills: +, -, /, x, estimation, number comparison, and place value
Objective 2	• **Patterns, Relationships, and Algebraic Reasoning** • Skills: identify numeric patterns, identify geometric patterns, generate formulas
Objective 3	• **Geometry and Spatial Reasoning** • Skills: angles, congruence, parallel lines, perpendicular lines, symmetry, point location
Objective 4	• **Measurement** • Skills: linear measurement, angle measurement, standard measures, time, area, volume
Objective 5	• **Probability and statistics** • Skills: read graphs, interpret graphs, make predictions, probability experiments, mean, median, mode, and range
Objective 6	• **Mathematical processes and tools** • Skills: links all five objectives, problem solving, critical thinking

Figure 3-2. Overview of TAKS Mathematics Objectives (TEA, 2002a)

Sex and Gender

The terms sex and gender have multiple meanings and are carelessly used interchangeably. It is important to carefully distinguish between the meanings of sex and gender. For sex, the study relies on the biological form of sex; the discussion of gender will include both gender identity and gender roles.

Many times the biological sex of a person heavily influences the person's lived experiences due to forced and/or voluntary membership of the socially constructed gender. For the purpose of this article, sex (biological) refers to the classification of humans based on physical features such as genitalia, chromosomes, and/or hormones (O'Malley, Hoyt, & Slattery, 2009). Moving away from the dichotomy of male/female, biological sex should include at least male, female, and intersex. Male categorization should include individuals that have an XY chromosome pattern with "standard" male genitalia and hormones while female categorization should include individuals that have an XX chromosome pattern with "standard" female genitalia and hormones. Categorization as intersex is more dynamic and complex than male or female, but it should be noted that some estimates suggest that one out of every 100 persons (Fausto-Sterling, 2000; O'Malley, Hoyt, & Slattery, 2009) fall into the category of intersex.

Intersex may include people that are identified biologically as Congenital Adrenal Hyperplasia (CAH), Androgen Insensitivity Syndrome (AIS), ovotestes, hypospadias, Klinefelter (XXY), or Turner Syndrome (Fausto-Sterling, 2000; O'Malley, Hoyt, & Slattery, 2009). According to the Intersex Society of North America (ISNA, 2011), CAH occurs when the adrenal glands make unusually high levels of hormones other than cortisone (ISNA). AIS is a genetic condition where the body’s cells does not respond to androgen or has androgen insensitivity. An infant identified with AIS may have genitalia of normal female appearance, but may also have undescended or partially descended testes (ISNA). Ovotestes, also known as “true hermaphroditism”, occur when the sex glands contain both ovarian and testicular tissue (ISNA). Hypospadias occurs when the urethra is located on the underside of the penis or may not be present at all (ISNA). Klinefelter occurs when a person inherits an X, Y, and another X chromosome (ISNA). Turner syndrome occurs when a person only has one chromosome, an X-chromosome (ISNA). In many of the various intersex conditions identified, a person’s physical appearance would be very similar to a typical male or female. Emerging from biological sex are the socially constructed gender identities and gender roles.

Gender identity (or sexual identity) in some transgendered circles refer to “how we identify our bodies and our gendered selves or our sexual selves” (O’Malley, Hoyt, & Slattery, 2009, p. 100). O’Malley, Hoyt, and Slattery use the following categories to identify a person’s gender/sexual identity: woman, man, androgynous, transgender, gender queer, two-spirited, brain sex/sexual identity, transwoman (male-to-female), and transman (female-to-male). On page 100, O’Malley, Hoyt, and Slattery provide a description for each category.

- Woman: biological “birth sex” as a female corresponds to gender identity as a woman.
- Man: biological “birth sex” as a male corresponds to gender identity as a man.

- Androgynous: identifies as neither woman nor man, or identifies as both woman and man.
- Transgender: gender identity as woman or man does not match biological “birth sex” of female or male.
- Gender queer: rejects categories of woman and man, or identifies as “between” woman and man.
- Two-spirited: some Native persons who have attributes of both male and female and a distinct social role in the tribe. They dress with male and female articles and are considered a separate or third gender.
- Brain sex/sexual identity: what sex a person knows they are inside rather than outside.
- Male to female transsexual: transwoman – biological males whose sexual identity is female.
- Female to male transsexual: transman – biological females whose sexual identity is male.

The gender/sexual identity that a person subscribes to influences the life choices and chances that one may incur. Gender role can be described as the “social scripts, norms, and performances that we play out as man/woman, mother/father, boy/girl, partner/spouse; these scripts are cultural and vary across time and place for individuals and societies” (O’Malley, Hoyt, & Slattery, 2009, p. 101). The gender role that a person undertakes can be influenced externally by positive and negative social interactions. A person may move in and out or use multiple gender roles while others perform consistently within one membership. Some gender roles include: feminine, masculine, both feminine and masculine, unisex, gender diverse, metrosexual, menergy, drag queen, drag king, and/or cross-dressing. Gender roles and expectations are emphasized through media outlets and social interactions and may vary across time, geography, and culture. What does it mean to be feminine? What are the characteristics of masculinity? What are the gender norms associated with various gender identities? From birth, each person assumes a biological sexual identity that in most situations influences the socially constructed gender expectations from specific gender identities. The roles that a person performs ultimately influence the life chances and choices that one has access to.

Gender Bias

The 1992 *AAUW Report: How Schools Shortchange Girls* followed by Myra and David Sadker's (1994) publication, *Failing at Fairness: How Our Schools Cheat Girls,* brought attention to sexism and discrimination in education. Studies identified that male students received more attention, were asked better questions, and were provide more informative feedback in educational settings (AAUW, 1992; Sadker & Sadker, 1994). With teachers providing more "time, energy, attention, and talent" to male students, female students often face "loss of self-esteem, a decline in achievement, and elimination of career options" (Sadker & Sadker, 1994, p. 1). Banks (1988) defines gender bias in education as any "verbal or physical conduct that denigrates any person or group of persons on the grounds of gender and is likely to interfere with the ability of students to participate equally in the pursuit of an education" (p. 146). Sadker and

Zittleman (2010) identify two outlets that gender bias can be observed in schools: social interactions and the curriculum.

Gender bias through social interactions often goes unnoticed due to embedded structural sexism (Sadker & Sadker, 1994; Sadker, Sadker, & Zittleman, 2009). Male students often call out answers, while female students are more likely to enter "girl pause" (Meehan, 2007) and proceed to raise their hand to answer. Male students often dominate classroom conversation, receive the more attention, and receive more instructional time than female students, students of color, and shy male students (Sadker & Zittleman, 2010). Gender bias is often present in the curriculum, texts, and academic resources.

The National Education Association (2008) reports that by the third grade, 51 percent of male students compared to 37 percent of female students have used a microscope in class. "Children's science programs feature three times as many male characters as female characters and twice as many male scientists as female scientists" (NEA, 2008, p. 1). More female students are enrolling in math and science courses than in the past, but male students are still represented more frequently in physics, calculus, and other advanced courses (NEA, 2008). Gender bias and stereotypes are often visible in classroom texts. Sadker and Zittleman (2010) provide seven forms of bias for educators, parents, and students to identify when critically examining texts. They are: invisibility, stereotyping, imbalance and selectivity, unreality, fragmentation, linguistic, and cosmetic.

Invisibility occurs when groups, events, or significant contributions are omitted. An example of invisibility is when women's and people of color's current and historical contributions are omitted from the curriculum. Stereotyping occurs when "rigid roles or traits [are] assigned to all members of a group" (p. 144). There are numerous examples of stereotyping. You may hear that men are tough and aggressive while women are more sensitive and caring. Imbalance and selectivity is demonstrated when only one perspective is offered to describe an occurrence. The curriculum is often selected by a group in power and mirrors the perceived accomplishments of that group, by that group. Unreality occurs when the curriculum includes "romanticized and sanitized narratives that omits the information [needed] to confront and resolve real social challenges" (p. 144). A common occurrence in the curriculum is the perception of the nuclear family being described as a father, mother, and children. Fragmentation occurs when the text is divided into sections to express various points of views or topics. Linguistic bias is deeply embedded in the English language and is observed when masculine terms and pronouns are exclusively used (Sadker & Zittleman, 2010). The final form of bias is cosmetic and occurs when there is a perception of gender or racial/ethnic equity, but a closer examination identifies that women and people of color are not equitably included in the text.

Gender stereotypes evolve from gender bias perceptions that may be socially positive or socially negative. Gender stereotypes can influence life chances and life choices in many different ways, often times without notice. Generally speaking, women are viewed as being expressive and caring while men are viewed more instrumental and assertive (Kite, Deux, & Haines, 2008). Gender stereotypes often take shape in the form of expected social roles; many times men are viewed as leaders, providers, and dominant while women are expected to being the caregiver, shopper, house caretaker, and a support base for males (Cejka & Eagly, 1999; Deaux & Lewis, 1984; Kite, Deux, & Haines, 2008). Educationally, "parents and educators are told that boys learn best through physical games, tough competition, harsh discipline, and shorter lessons" (Sadker & Zittleman, 2010, p. 151). Male students are identified as being more abstract and deductive. In regards to female students, parents and educators are told that "girls are genetically more placid conforming, relational, and collaborative in nature and prefer a calmer learning atmosphere" (p. 151). Girls are identified as being more concrete and inductive. Many times, reading and writing are viewed as being more feminine and threatening to masculinity while mathematics and science are viewed to be more masculine (Sadker & Zittleman, 2010).

Gender bias and stereotypes influence the social and educational experiences of female, intersex, and male students. Overall, female students appear to do very well in school—they receive higher grades, have less discipline problems, and are more often class valedictorians than male students (Sadker & Zittleman, 2010). However, female students "have fallen behind boys on high-stakes tests such as the SAT, ACT, MCAT, LSAT, and GRE, all key exams needed to gain entrance (and scholarships) to the most prestigious colleges and graduate schools" (p. 141). The National Women's Law Center (NWLC) identified that approximately 50 percent of Native American female students, 40 percent of African American, and 40 percent of Latina/Hispanic female students are either pushed-out or drop-out each year (NWLC, 2007; Sadker & Zittleman, 2010). Orfield (2004) acknowledge that almost 50 percent of male students of color drop-out or are pushed out before graduation. Sexual harassment, bullying, and self-esteem are also factors that are often products of bias and stereotypes. Boys and girls are almost equally victimized by sexual harassment (AAUW, 2004; Sadker & Zittleman, 2004; Zittleman, 2007). The number of students affected by bullying is unknown. Some estimates suggest at least 30 percent of students are bullied and identify males with initiating physical bullying while females are most closely associated with verbal and psychological bullying (Sadker & Zittleman, 2010). Self-esteem is also a result of bias, stereotypes, and social expectations. Both girls and boys experience higher chances of depression, eating disorders, body image issues, and drug abuse due to a compromised self-esteem (Bisaga et al., 2005; Sadker & Zittleman, 2010).

Single-Sex Schools

Proponents for single-sex education received a gift with the 2006 provision to the *No Child Left Behind Act* (2001). The provision clearly provided a pathway for single-sex education based on the premise that the school offered a rationale for offering single-sex classes. Between 2002 and 2009, the number of public schools in the United States offering single-sex classes grew from 11 to 524 (Jackson, 2010; National Association for Single Sex Public Education [NASSPE], 2011) with at least 103 identifying as single-sex schools (NASSPE, 2011).

Supporters of single-sex education proposes that biological differences between males and females is a rationale for segregation by gender (Sadker, Sadker, & Zittleman, 2009). Sadker and Sadker (1994) were very optimistic that single-sex education could provide the support and structure necessary to model highly effective educational practices across gender. After a decade of implementation and research, Sadker, Sadker, and Zittleman (2009) are not so optimistic, citing that contradictory research on single-sex education, segregation of sexes, and the prevalence of sexism and bullying as rationale for being less optimistic. Single-sex education relies on several assumptions. The first obvious assumption is that there are only two sexes, two gender identities, and only two gender roles. Another assumption is that male and female brains develop at different sequences and male and female students learn differently (Gurian, Henley, & Trueman, 2001; NASSPE, 2011; Sax, 2005). Simply stated, subscribers to single-sex education typically believe that sexes are “different by nature and that those differences are honored and nurtured in single-sex schools” (Sadker, Sadker & Zittleman, 2009, p. 256).

Sadker, Sadker, and Zittleman (2009) state that the late 1990s and early 2000s witnessed socio-political trends that created a perfect storm to support and encourage the rebirth of single-sex education. They identify eight trends and identify them as “edutrends” (p. 259). The edutrends are as follows: broken coeducation, the backlash, brain differences and biology, distraction-free learning, the testing culture, an educational civil right, making it legal, and the wonders of single-sex education. Broken coeducation was fueled by the perception of an education crisis in the late 1990’s. Students in the United States were not scoring high on international tests and schools were failing at gender fairness (Sadker & Sadker, 1994; Sadker, Sadker, & Zittleman, 2009). Orfield (2004) highlighted horrifying numbers of students dropping out or being pushed out of schools. This era was also home to the attack on school violence where zero-tolerance polices became more prevalent and the overall perception was that the education system was failing the students (Heitzeg, 2009; Sadker, Sadker, & Zittleman, 2009; Sullivan, 2007).

The backlash *edutrend* was supported heavily by the work of Leonard Sax (2005). Sax claimed that feminism was detrimental to the education of boys. He suggested that "schools needed to change to fit boys' learning styles: stronger discipline, more competitions, greater emphasis on physicality, and a curriculum that would feature male characters and war poetry" (Sadker, Sadker, & Zittleman, 2009 p. 260; Sax, 2005). This backlash was an attempt for a more traditional education structure instead of the reemergence of the progressive influence.

The brain differences and biology *edutrend* was also heavily supported by Leonard Sax. Sax (2005) argued that boys' and girls' learn differently and that "boys' hearing was not as good as girls, and thus boys should be placed closer to the teacher" (Sadker, Sadker, & Zittleman, 2009, p. 260). Michael Gurian was also very influential in discussing the suggested biological differences between male and female students. Gurian, Henley, and Trueman (2001) suggest that boys success in math is due to surges in testosterone and that "boys are born with the skills to excel in philosophy and engineering" Sadker & Zittleman, 2009, p. 261). Gurian, Henley, and Trueman (2001) also suggest that girls should not be given stressful time limits and can only compete with boys in math during estrogen surges. Janet Hyde (2005) initiated an in-depth study to examine the differences suggested by researchers such as Sax and Gurian finding that there are more similarities than dissimilarities between male and female cognition. Hyde identified this as the gender similarities hypothesis. Hyde's (2005) research supported that "males demonstrated greater aggression and activity level, had stronger math problem solving skills beginning in high school, and a better ability to rotate objects mentally" (Sadker, Sadker, & Zittleman, 2009, p. 277). The research by Gurian, Henley, and Trueman (2001), Hyde (2005), and Sax (2005) does not clearly articulate that the observable behavioral differences between males and females are biological rather than environmental.

The next *edutrend* is distraction-free learning. Single-sex education advocates often believe that social issues, such as dating and harassment, interfere with learning. "Removing the opposite sex from the classroom would redirect the adolescent sex drive to an off-ramp, and academic focus would return to the classroom" (Sadker, Sadker, & Zittleman, 2009, p. 261). Jackson (2010) warns that taking a stance that single-sex classrooms create distraction-free learning is naive and presumes heteronormativity.

The next *edutrend* is the testing culture. NCLB (2001) paved the way for the birth of the testing era. NCLB pressured many administrators, teachers, parents, and students to retreat to survival mode (Sadker, Sadker, & Zittleman, 2009). Many schools attempted single-sex programs to increase test scores. Some schools used single sex programs as a method to control discipline issues.

The next e*dutrend* is single-sex schools as an educational civil right. Many feel that parents should have a choice about where their student attends school and that choice is a fundamental civil right (Ravitch, 2011). The seventh *edutrend* is actually making single-sex education legal. Civil rights laws such as *Title IX* and *Brown v. Board of Education* suggested that separate is not equal and that students should not be limited access due to race and/or gender. In 2006, there was an amendment to Title IX to allow segregation of students by gender.

The last *edutrend* suggested by Sadker, Sadker, and Zittleman (2009) is the wonders of single-sex education. Single-sex education has many alumni that support and praise single-sex education. Sadker and Sadker (1994) also provide optimistic support in their publication *Failing at Fairness*. The testimonies of alumni and various publications created more curiosity about single-sex education. Sadker, Sadker, and Zittleman (2009) state that these eight *edutrends* working together created the *perfect storm* for the single-sex education push.

Single-sex education has become very prevalent in the United States educational system. There are compelling arguments both for and against single-sex education. Single-sex education seems to allow segregation by an assumed physical characteristic. Civil rights activists have fought desperately for desegregation, equal rights, equity, and to destruct power structures. Sadker, Sadker, and Zittleman (2009) pose an extremely thought-provoking question when they ask whether or not society would be supporting of separated education by race or religious/no religious affiliation. Some researchers suggest that single-sex education provides a path to avoid dealing with the social issues of sexism, bullying, patriarchal structures, and male dominance (Jackson, 2010; Sadker, Sadker, & Zittleman, 2009).

Race/Ethnicity and Gender

Race/ethnicity, gender, and socioeconomic status allows for students to be organized and generalized at the convenience of the observer. The location of an individual within multiple-group memberships influences educational access, life chances, and life choices (Henry, 2010). Although, the scope of this research is limited to data that only examines gender, it is acknowledged that gender continuously intersects with race/ethnicity and socioeconomic status to influence the life experiences of students and teachers (Crenshaw, 1991). African American female students are often "negatively stereotyped regarding their physical, social, and affective traits" (Henry, 2010, p. 190).

Steele and Aronson (1995) and Steele (2004) describe with detail how stereotypes within a society can negatively influence the intellectual function and identity development of members of groups. They identify the phenomenon as *stereotype threat* (Steele & Aronson, 1995). Steele (2004) defines stereotype threat as:

> The event of a negative stereotype about a group to which one belongs becoming self-relevant, usually as a plausible interpretation for something one is doing, for an experience one is having, or for a situation one is in, that has relevance to one's self-definition (p. 686).

Stereotype threat begins with the assumption that "to sustain school success one must be identified with school achievement in the sense of its being a part of one's self-definition, a personal identity to which one is self-evaluatively accountable" (Steele, 2004, p. 682). In education, stereotype threat emerges in situations where a negative stereotype lingers and becomes relevant during the evaluation process of student performance. Stereotype threat not only effects female students in mathematics, but it has different and multiple meanings regarding male and female students of color. Steele (2004) states that “negative stereotypes about women and African Americans bear on important academic abilities” (p 683). Stereotype threat is heavily influenced by both racial and gender bias, therefore creating increased hurdles for many female students of color in mathematics achievement.

African American females are taken less seriously and receive less positive interactions with their teachers and school administrators than European American female students (Henry, 2010). Male and female students of color are more likely to be pushed into the school-to-prison pipeline through structural zero-tolerance policies (Heitzeg, 2009). The experiences of male and female students are not unique to only gender, yet they are unique to the individual’s level of participation of multiple group memberships and the social influence upon the specific groups that one is associated with. Male and female students of color are less likely to have access to advanced mathematics coursework, which negatively influences mathematics achievement and STEM opportunities (AAUW, 2010; Oakes, 1990; Oakes, Josephy, & Muir, 2004). Male and female students of color are also more likely to be pushed-out or drop-out of school than European American students (Heitzeg, 2009; Orfield, 2004; Sadker, Sadker, & Zittleman, 2009). Multiple identity intersections influence student experiences across groups, but this study did not focus on an examination gender and race/ethnicity.

Performance Gaps across Gender

Else-Quest, Hyde, and Linn (2010) conducted a meta-analysis of the 2003 Trends in International Mathematics and Science Study (TIMSS) and the Programme for International Student Assessment to determine gender differences in mathematics achievement, attitudes and affect across 69 nations. The results of their study identified that "mean effect sizes in mathematics were very small (d less than 0.15) (p. 103). Nationally, there were gender similarities in achievement, but "boys reported more positive math attitudes and affect (ds = 0.10 to 0.33); national effect sizes ranged from d = -0.61 to 0.89" (p. 103). Else-Quest, Hyde, and Linn suggest that gender equity is primarily responsible from gender gaps in mathematics.

McGraw, Lubienski, and Strutchens (2006) examined gender gaps in mathematics by "analyzing relationships among achievement and mathematical content, student proficiency and percentile levels, race, and socioeconomic status (SES)" (p. 129). The results of their study were that small gender gaps favored males and were largest in areas of measurement. McGraw, Lubienski, and Strutchens also found that gender gaps favoring males were most concentrated at the upper end of score distributions and "most consistent for White, high-SES students and non-existent for Black students" (p. 129). The study also found that female students' attitudes and self-concepts toward mathematics were more negative than male students.

LoGerfo, Nichols, and Chaplin (2006) studied the gender gaps in mathematics and reading gains in elementary school by race/ethnicity. They determined that there are still overall gender gaps favoring males in math. When mathematics achievement gaps between African American and European American female students begin during the first grade there is a substantial difference noticed by the third grade. Their study also suggests that, by high school, African American female students are performing slightly higher than African American males, but still below European males.

Lim (2008) expanded on the influence of race and gender as well as the lack of academic support for mathematical success. Lim also found that the students' levels of motivation were "fragile" when it came to mathematics. The fragile levels of motivation are probably influenced by the lack of academic support and the challenges that may arise by the intersectionality of being African American, female, and in a mathematics classroom. More research exploring sociocultural intersections in mathematics is needed to improve mathematical educational experiences of students.

Critical Race Theory

This study utilizes a *critical race theoretical* (CRT) lens to critically examine Texas mathematics achievement data by gender. The CRT framework evolved from critical legal studies taking form in the late 1980s (Tate, 1997a). According to Delgado and Stefancic (2001) there are five tenets of CRT that most will agree upon. The first tenet is that *racism is ordinary, not aberrational*. Even though race is socially constructed, racism is deeply entrenched in current and historical social structures in society. Racism has become an ordinary function of society and is supported and maintained through a colorblind perspective. The second tenet is *interest convergence* (Bell, 1980) emerged from the scholarship of Derrick Bell. Bell (1980) proposed that school desegregation from the *Brown v. Board of Education* resulted from the expected benefits of European Americans and some elite people of color. Interest convergence suggests that European Americans and some people of color only participate and support societal growth toward an antiracist society to the degree that it benefits them in some way (Delgado & Stefancic, 2001). The third tenet is that *race is socially constructed*. Simply stated, race holds no biological reality to support the structural categories of race. Racial categories are invented out of convenience to benefit a certain racial group of people (Delgado & Stefancic, 2001). The fourth tenet is *differential racialization*. Differential racialization is a term used to describe how a racial group with power racializes various groups of people at different historical points in time (Delgado & Stefancic, 2001). The fifth tenet of CRT is the *unique voice of color*. Unique voice of color is supported by including multiple perspectives. Histories of oppressed groups must include the voices of the suppressed and oppressed groups and not just of the dominant group (Delgado & Stefancic, 2001). Unique voice of color has opened pathways for scholarship related to storytelling/counter-storytelling (Lynn & Parker, 2006).

There are two more themes of CRT that has emerged from critical race studies and feminism that must be emphasized to describe the theoretical lens of this research study. They are antiessentialism (Wing, 2000) and intersectionalities (Crenshaw, 1991) which are commonly associated with critical race feminism (Evans-Winters & Esposito, 2010; Wing, 1997). Delgado & Stefancic (2001) describe intersectionality as the "examination of race, sex, class, national origin, and sexual orientation, and how their combination plays out in various settings" (p. 51). Intersectionality implies that careful attention must be given to the "multiplicity of social life" (p. 56). Crenshaw (1993) described the importance of intersectionalities as it related specifically to African American females identifying that in most situations; African American female issues are either racialized or genderized and not examined across race, gender, class, and other social categorization. The lived experiences of "women of color are influenced by both their identities as women and as persons of color" (Evans-Winters & Esposito, 2010, p. 19). Intersectionality supports that women of color do not always experience racism the same way as males of color nor do women of color experience gender bias in the same manner as men of color. Similar to intersectionality is anti-essentialism. Wong (1999) describes with detail the ongoing debate between essentialism and antiessentialism. Essentialists assume that in "all women share the same characteristics in some inherent way" (p. 74). Race, gender, and class essentialism has influenced many social movements and has been an important target of critical race theorists' critique of liberalism (Delgado & Stefancic, 2001). Antiessentialism acknowledges the interesectionalities of social categories such as race, class, and gender. Antiessentialist critical race theorists recognize that the experiences of females of are not necessarily the same as the experiences European American females. Wing (2000) describes that antiessentialists recognize that "…identity is *not* additive. In other words, Black women are not white women plus color, or Black men, plus gender" (p. 7).

The scholarship of Ladson-Billings and Tate (1995) pioneered CRT in educational research and teaching (Lynn & Parker, 2006). Ladson-Billings and Tate (2005) provide three propositions for a CRT framework to be utilized in educational research: “1) race continues to be a significant factor in determining inequity in the United States, 2) U.S. society is based on property rights, and 3) the intersection of race and property creates an analytic tool through which we can understand social (and, consequently, school) inequity” (p. 48).

Initiating a study in education through a critical race lens, acknowledges that the educational experience is not only racialized (Delgado & Stefancic, 2001; Ladson-Billings, 1998), but represents the intersections of racism, sexism, and classism (Crenshaw, 1993). Sadker and Sadker (1994) and Sadker and Zittleman (2010) magnify that education is genderized, specifically dominated by the influence of White, male, middle-class, and heterosexual. Through a CRT lens, the study acknowledges that curriculum, instruction, and assessment are racialized, genderized, and classist and are often used as a method to legitimize deficiencies of students; most often students of color, students living in poverty, immigrant students, and students whose first language is not English (Ladson-Billings, 2004). Researchers must utilize CRT to critically examine quantitative data to identify inequitable results that will initiate further research to inform and improve the educational experience of all students (Tate, 2005).

Methodology

This critical examination of TAKS mathematics data was guided by the following question: What are the differences in TAKS scores of students in grades three through eight during the years 2004, 2007, and 2010 by mathematical objective categorized by gender? This research study used descriptive statistics to describe the differences in TAKS mathematic assessment data across gender. This study takes a comparative studies approach through non-experimental design.

The targeted population were all students that took the grades three through eight mathematics TAKS during the years 2004 (N = 1,693,994), 2007 (N = 1,772,118), and 2010 (N = 1,982,467). The population is categorized by gender (male or female). Intersex data are not currently available. The guiding instrument for this study was the Texas Assessment of Knowledge and Skills (TAKS) test which was developed and is scored by Pearson Educational Measurement. The first TAKS test was administered in 2003. TAKS is the assessment instrument used in Texas public schools.

Archival data were accessed on the Texas Education Agency's website. TAKS quantitative data were analyzed using *Statistical Package for Social Studies* (SPSS) 16.0 Graduate Pack by employing independent samples *t* tests to determine relationship and significance at ($p < .05$). Within group data were also examined by running a series of *t* tests across the years 2004, 2007, and 2010 by objective to determine any significant differences within groups. This study explored both practical and statistical significance to identify, describe, and discuss differences between groups.

Findings

Independent samples *t* tests ($p < .05$) were performed to compare objective means between gender classifications in this study. The findings of this study identified that there were no statistically significant differences between groups or within groups at $p < .05$ (see Table 3.1). Data were further examined to identify themes associated between groups and within groups.

Table 3.1 Independent Samples *t* Test Group Statistics by Gender

Grade	Objective	Male		Female	
		Mean	SD	Mean	SD
3	1	8.23	.208	8.13	.306
	2	4.93	.153	4.93	.153
	3	5.10	.100	5.07	.058
	4	4.90	.173	4.80	.200
	5	3.47	.058	3.43	.058
	6	5.80	.200	5.63	.115
4	1	9.40	.265	9.30	.265
	2	5.90	.173	5.83	.208
	3	4.90	.173	4.90	.173
	4	4.73	.289	4.63	.379
	5	3.13	.153	3.13	.231
	6	6.07	.306	5.93	.306
5	1	9.07	.451	9.03	.404
	2	5.40	.265	5.33	.306
	3	6.03	.115	6.00	.173
	4	5.60	.265	5.37	.321
	5	3.20	.173	3.20	.100
	6	6.17	.252	6.13	.252
6	1	7.33	.462	7.30	.520
	2	6.40	.557	6.47	.681
	3	5.63	.379	5.60	.436
	4	3.50	.346	3.33	.379
	5	4.60	.173	4.70	.173
	6	6.70	.300	6.70	.265
7	1	7.13	.462	7.03	.462
	2	6.50	.656	6.37	.611
	3	5.13	.306	5.10	.400
	4	3.07	.208	3.13	.252
	5	4.63	.643	4.77	.681
	6	6.50	.265	6.57	.231
8	1	6.77	.569	6.77	.702
	2	7.00	.265	7.00	.361
	3	5.17	.153	4.97	.306
	4	2.87	.321	2.87	.321
	5	5.90	.436	5.93	.473
	6	6.83	.351	6.87	.451

This study further explored between group data by examining data to identify changes across objectives by years and across grade levels. In 2004, male students' mean score in objective one (numbers, operations, and quantitative reasoning) was slightly higher than female students' in every grade except for fifth (see Table 3.2). Male students' mean scores was also equivalent or higher than female students' mean scores on objectives two (patterns, relationships, and algebraic reasoning), three (geometry and spatial reasoning), and four (measurement) in all grades (see Table 3.2). Female students' mean score on objective five (probability and statistics) were slightly higher than male students' in grades five through seven and equivalent in the remaining grades (see Table 3.2).

TAKS data in 2007 were very similar to the 2004 data. Male students' mean scores by objective were slightly higher than females' across most grades and most objectives with the exception of objective five (probability and statistics) in grades six and seven (see Table 3.2). TAKS mathematics data in 2010 witnessed a major shift. In grades three through five, mean scores were mostly equal across all objectives with male students' scoring slightly higher on objective four and five in grades three and five (see Table 3.2). Grades six through eight data represent that female students' are scoring slightly higher on objective one (numbers, operations, and quantitative reasoning) in grade eight, objective two (patterns, relationships, and algebraic reasoning) in grades six and eight, objective three (geometry and spatial reasoning) in grade seven, objective five (probability and statistics) in grades six through eight, and objective six (mathematical processes and tools) in grades six and eight (see Table 3.2).

Table 3.2 TAKS Mean Scores by Gender for 2004, 2007, and 2010

Grade	Objective	2004		2007		2010	
Grade 3		**Male**	**Female**	**Male**	**Female**	**Male**	**Female**
	1	8.0	7.8	8.3	8.2	8.4	8.4
	2	5.1	5.1	4.9	4.9	4.8	4.8
	3	5.0	5.0	5.2	5.1	5.1	5.1
	4	4.8	4.6	4.8	4.8	5.1	5.0
	5	3.5	3.5	3.4	3.4	3.5	3.4
	6	5.8	5.7	5.6	5.5	5.7	5.7
Grade 4							
	1	9.1	9.0	9.5	9.4	9.6	9.5
	2	5.7	5.6	6.0	5.9	6.0	6.0
	3	4.7	4.7	5.0	5.0	5.0	5.0
	4	4.4	4.2	4.9	4.8	4.9	4.9
	5	3.0	3.0	3.1	3.0	3.3	3.4
	6	5.8	5.6	6.4	6.2	6.0	6.0
Grade 5							
	1	8.6	8.6	9.5	9.4	9.1	9.1
	2	5.1	5.0	5.5	5.4	5.6	5.6
	3	5.9	5.8	6.1	6.1	6.1	6.1
	4	5.3	5.0	5.7	5.5	5.8	5.6
	5	3.0	3.1	3.3	3.3	3.3	3.2
	6	5.9	5.9	6.4	6.4	6.2	6.1
Grade 6							
	1	6.8	6.7	7.6	7.6	7.6	7.6
	2	5.8	5.7	6.5	6.7	6.9	7.0
	3	5.2	5.1	5.8	5.8	5.9	5.9
	4	3.1	2.9	3.7	3.5	3.7	3.6
	5	4.4	4.5	4.7	4.8	4.7	4.8
	6	6.4	6.4	7.0	6.9	6.7	6.8
Grade 7							
	1	6.6	6.5	7.4	7.3	7.4	7.3
	2	5.8	5.7	6.6	6.5	7.1	6.9
	3	4.8	4.7	5.2	5.1	5.4	5.5
	4	2.9	2.9	3.3	3.4	3.0	3.1
	5	3.9	4.0	4.9	5.0	5.1	5.3
	6	6.2	6.3	6.6	6.7	6.7	6.7
Grade 8							
	1	6.3	6.1	6.6	6.7	7.4	7.5
	2	6.7	6.6	7.2	7.1	7.1	7.3
	3	5.0	4.7	5.2	4.9	5.3	5.3
	4	2.5	2.5	3.0	3.0	3.1	3.1
	5	5.4	5.4	6.1	6.1	6.2	6.3
	6	6.5	6.4	6.8	6.9	7.2	7.3

This study also examined within group data to identify any trends that may be evident since statistical significance could not be observed. Male students' are scoring higher across objective one (numbers, operations, and quantitative reasoning) and objective four (measurement) in grades three through five in 2004, 2007, and 2010 than in grades six through eight (see Table 3.3). Male students' objective two mean score has slightly decreased across 2004 (M = 5.1), 2007 (M = 4.9), and 2010 (M = 4.8). Male students' mean score across objective six (mathematical processes and tools) has also slightly decreased from 2007 to 2010 in grades four (M = 6.4; M = 6.0), five (M = 6.4; M = 6.2), and six (M = 7.0; M = 6.7) (see Table 3.3).

Table 3.3 TAKS Male Mean Scores by Objective for 2004, 2007, and 2010

Year	Grade	Objective 1	Objective 2	Objective 3	Objective 4	Objective 5	Objective 6
2004	**3**	8.0	5.1	5.0	4.8	3.5	5.8
	4	9.1	5.7	4.7	4.4	3.0	5.8
	5	8.6	5.1	5.9	5.3	3.0	5.9
	6	6.8	5.8	5.2	3.1	4.4	6.4
	7	6.6	5.8	4.8	2.9	3.9	6.2
	8	6.3	6.7	5.0	2.5	5.4	6.5
2007	**3**	8.3	4.9	5.2	4.8	3.4	5.6
	4	9.5	6.0	5.0	4.9	3.1	6.4
	5	9.5	5.5	6.1	5.7	3.3	6.4
	6	7.6	6.5	5.8	3.7	4.7	7.0
	7	7.4	6.6	5.2	3.3	4.9	6.6
	8	6.6	7.2	5.2	3.0	6.1	6.8
2010	**3**	8.4	4.8	5.1	5.1	3.5	5.7
	4	9.6	6.0	5.0	4.9	3.3	6.0
	5	9.1	5.6	6.1	5.8	3.3	6.2
	6	7.6	6.9	5.9	3.7	4.7	6.7
	7	7.4	7.1	5.4	3.0	5.1	6.7
	8	7.4	7.1	5.3	3.1	6.2	7.2

Female students' mean scores by objective seem to be slightly increasing since 2004 across most grades. There are two exceptions where female students' mean scores have slightly decreased. In grade three, female students' mean score for objective two (patterns, relationships, and algebraic reasoning) has decreased from 2004 (M = 5.1) to 2007 (M = 4.9) and again in 2010 (M = 4.8). Also, there has been a slight decrease in mean score in grade five, objective one (numbers, operations, and quantitative reasoning) from 2007 (M = 9.4) to 2010 (M = 9.1). Similar to male students' mean scores by objective, female students seem to score better on objective one (numbers, operations, and quantitative reasoning) and objective two (patterns, relationships, and algebraic reasoning) in grades three through five than grades six through eight (see Table 3.4). Female students' seem to consistently score well on objective five (probability and statistics) across all grade levels (see Table 3.4).

Table 3.4 TAKS Female Mean Scores by Objective for 2004, 2007, and 2010

Year	Grade	Objective 1	Objective 2	Objective 3	Objective 4	Objective 5	Objective 6
2004	**3**	7.8	5.1	5.0	4.6	3.5	5.7
	4	9.0	5.6	4.7	4.2	3.0	5.6
	5	8.6	5.0	5.8	5.0	3.1	5.9
	6	6.7	5.7	5.1	2.9	4.5	6.4
	7	6.5	5.7	4.7	2.9	4.0	6.3
	8	6.1	6.6	4.7	2.5	5.4	6.4
2007	**3**	8.2	4.9	5.1	4.8	3.4	5.5
	4	9.4	5.9	5.0	4.8	3.0	6.2
	5	9.4	5.4	6.1	5.5	3.3	6.4
	6	7.6	6.7	5.8	3.5	4.8	6.9
	7	7.3	6.5	5.1	3.4	5.0	6.7
	8	6.7	7.1	4.9	3.0	6.1	6.9
2010	**3**	8.4	4.8	5.1	5.0	3.4	5.7
	4	9.5	6.0	5.0	4.9	3.4	6.0
	5	9.1	5.6	6.1	5.6	3.2	6.1
	6	7.6	7.0	5.9	3.6	4.8	6.8
	7	7.3	6.9	5.5	3.1	5.3	6.7
	8	7.5	7.3	5.3	3.1	6.3	7.3

Conclusion

This study was initiated to identify any differences that may occur in TAKS mathematics data in 2004, 2007, and 2010 by gender. The critical examination explored both similarities and differences between groups as well as within groups. The results of this study were surprising since statistical significance was not observed between gender groups in grades three through eight or within each specific gender group. However, there were several notable findings that are of practical significance.

In 2004, male students' were scoring slightly higher across most objectives than female students'. By 2010, performance reports are more equivalent with male students' still scoring slightly higher across most objectives in grades three through five and female students' scoring slightly higher in grades six through eight. Female students' have consistently scored higher than males on objective five (probability and statistics) across all three years. TAKS data in 2010 provide another interesting finding: male students' mean scores by objective were equal to or slightly higher than female students' across most objectives in grades three through five, but in grades six through eight female students' mean scores by objectives are typically equal to or slightly higher than male students'. Additional research is needed to identify causation of this theme between grades five and six. Both male and female students score slightly better on objectives one (numbers, operations, and quantitative reasoning) and four (measurement) in grades three through five than in grades six through eight.

The results of this study identified that there were no statistically significant differences between the mean scores by objective across gender. The results also suggest that there are not any statistically significant differences within groups across years and objectives. Practical significance was observed and reported to identify that some differences do persist. Additional research is needed to explore intersectionalities (Crenshaw, 1991) to see if gender differences persist across race/ethnicity, socioeconomic status, and/or geographical location.

This study was performed through a critical race lens. Critical race theory provides a path to recognize that the social construction of race is deeply entrenched in the social and educational structures of the United States. Whether or not performance gaps across gender exist could not determine because TAKS data were not examined across multiple intersections of demographic data such as race/ethnicity, gender, and/or socioeconomic status. TAKS data are *essentialized* when data are categorized by single variables. This study acknowledges that the experiences of male, female, and intersex students are not the same across multiple intersections of race/ethnicity, gender, socioeconomic status, and other social categories. Also, female students of color do not experience racism, sexism, classism, and other forms of bias the same way as male students of color (Wong, 1999). TAKS data disaggregated by multiple intersections should be analyzed so that a more detailed examination of data can be performed to inform educational research, theory, and practice.

The push for single-sex education has paved the way for a modern gendered interest convergence as discussed by Bell (1980). Bell problematized the Brown v. Board of Education decision that signified school desegregation as benefiting the dominant group while appearing to benefit people of color. With the 2006 provision of the No Child Left Behind Act (2001), schools were allowed to re-segregate along the lines of the social identity of gender. Single-sex education is camouflaged by the perception that it would provide more STEM opportunities and stronger educational experiences for female students while in reality provides a path for the more privileged male population to created a social space of gender division that allows male students to occupy pathways to STEM careers. Policies to support single-sex education are supported by *edutrends* (Sadker, Sadker, & Zittleman, 2009), such as brain differences and testing, to suppress female students progress in STEM areas.

CHAPTER IV

A CRITICAL EXAMINATION OF TEXAS MATHEMATICS ACHIEVEMENT IN GRADES THREE THROUGH EIGHT BY MATHEMATICAL OBJECTIVE ACROSS SOCIOECONOMIC STATUS

Introduction

The *1966 Coleman Report* (Coleman et al., 1966) positioned discussions of educational achievement at the forefront of conversations in the United States. The report magnified that a myriad of factors influence educational achievement and educational attainment. One major acknowledgement in the *Coleman Report* was that socioeconomic status was a major predictor of educational achievement and attainment (Knapp & Woolverton, 2004). Generally, students with higher socioeconomic status have an enhanced chance of reaching higher levels of educational attainment and academic achievement (Coleman et al., 1966; Goldstein, 1967; Knapp & Woolverton, 2004; Mayeske et al., 1972; Persell, 1993). Students who are not academically successful either choose to leave school or are forced out before graduation (Orfield, 2004).

One societal impact of the difference in achievement is the correlation of academic success to students leaving school before graduation. Orfield (2004) analyzed the drop out crisis and identified the relationship between the drop-out rate and social challenges. Students who drop out or are pushed out are more likely to earn significantly lower wages over time than students and have an increased likelihood of being incarcerated during their lifetime than students who receive a high school diploma (Howard, 2010). There is an economic trickling effect in regard to student dropout rate.

A student’s performance in K-8 mathematics often holds the key to the preparatory mathematics track that a student will have access to in high school and postsecondary education (Oakes et al., 2006). Within the scope of achievement, mathematics and reading receive a tremendous amount of attention. Howard (2010) acknowledges that mathematics and reading are foundational content areas within the educational experience of a student. He emphasizes that careful attention to performance gaps in mathematics and reading will provide “considerable implications for overall success…improving students’ performance in other academic areas” (p. 19). Gay (2009) notes that when a subject area holds an elite status, such as mathematics, a certain level of positive and negative bias trickles down and influences students educational experiences and opportunities in that subject area. In turn, students of color, students living in poverty, and students living with connection to other descriptive factors that are in contrast with the determining dominant group are left without receiving the same educational opportunity to access, experience, and expectations (Gay, 2009; Moses & Cobb, 2001; Tate, 1997b).

Ladson-Billings (1995b) stated that “all students can be successful in mathematics when their understanding of it is linked to meaningful cultural referents, and when the instruction assumes that all students are capable of mastering the subject matter” (p. 141). Performance gap differences provide researchers with clear insights that differences exists, but “how the values and beliefs assigned to different subjects (and aspects within them) affect student and teacher attitudes toward them" (Gay, 2009, p. 192) is less known. Gay emphasizes that:

> …revisioning the socially constructed identity of mathematics, accepting the culturally responsive as a requirement of quality education for ethnically different students, and crafting instructional actions that exemplify them are crucial components of teachers' preparation if they are to provide more equitable learning opportunities for diverse students. (p. 193)

Addressing academic achievement, Gay urges educators to critically analyze achievement differences as they relate to students of color and students living in poverty. Stemming from the belief that mathematics achievement occurs in a cultural context, environmental factors must influence scoring. Factors to consider may include the inexperience of test-taking cultural capital, self-concept, self-efficacy, self-esteem, or teacher expectations on academic achievement (Gay, 2009). Research pertaining to mathematics achievement by specific topic across any sociocultural variable is difficult to locate (Lim, 2008; Lubienski & Bowen, 2000). The research attainable lacks specificity and is often very generic (Lim, 2008). Tate (2005) acknowledges that mathematics performance data are often unavailable to researchers and educational leaders and therefore calls for more specific analysis of mathematics performance data across various demographics to inform and influence education.

The primary objective of this research study was to identify any significant differences in TAKS mathematics achievement in grades three through eight across socioeconomic identifiers. Mathematics TAKS data were examined across grades three through eight in 2004, 2007, and 2010 by specific mathematical objective across socioeconomic status. The intent of the study was to provide a foundational data set for K-8 decision makers, mathematics teacher educators, and researchers to make informed decisions. The data set also provides a basis to expand on theory and praxis in mathematics education.

This chapter provides a brief summary of the history of mathematics education in the United States and the history of Texas assessment programs. The history of Texas assessment programs is followed by an overview of TAKS mathematics objectives before reviewing the issue of socioeconomic identifiers and educational influence. Before moving into the research methodology, a description of culturally responsive pedagogy is provided. After describing the guiding research methods, the findings are reported, followed by a conclusion of closing remarks.

History of Mathematics Education in the United States

Mathematics education prior to the 1950s could easily be described as an era of development and organization. Several committees and organizations were formed (i.e. committee of ten, College Entrance Examination Board, National Council of Teachers of Mathematics) in response to the increasing social status of mathematics and mathematics education (Klein, 2003). The early part of the 20th century witnessed the beginning of a struggle to determine what types of mathematics should be taught and who should receive mathematics education. Progressives such as John Dewey and William Kilpatrick heavily influenced mathematics education in the early 1900s and suggested that mathematics education should focus on life applicable concepts (Klein, 2003).

During the war times of the 1940s, military leaders became concerned about the mathematical ability of military recruits (Klein, 2003). Many recruits struggled with basic mathematics which inspired the *new math* movement.

The new math movement quickly found its way into K-12 classrooms. Developed by university mathematicians, the New Math curricula emphasized abstract mathematical concepts and student conceptual understanding of mathematical problems instead of basic computations and rote memorization. The new math movement began to fizzle out by the 1970s for many reasons. In many cases, teachers did not conceptually understand mathematics the way that university mathematicians understood mathematics; therefore teachers were ill-prepared to teach the new math curricula (Moon, 1986).

The social push to eliminate the new math movement during the 1970s is often referred to the *back to the basics* movement. The back to the basics movement moved to concrete understanding of mathematics before abstract as emphasized during the new math movement. “The curriculum returned to what it had been before [the new math movement]: arithmetic in the 1st through 8th grades, algebra in the 9th grade, geometry in the 10th grade, a 2nd year of algebra and sometimes trigonometry in the 11th grade, and precalculus in the 12th grade” (Schoenfeld, 2004, p. 258). Computational fluency was heavily influenced during the back to the basics movement.

Mathematics education in the 1980s underwent another major change. Influenced by the publications *Agenda for the 80s* (NCTM, 1980) and *A Nation at Risk* (1983), mathematics education was to emphasize problem solving instead of computational fluency. The late 1980s witnessed the publications of *Everybody Counts* (NRC, 1989) and *Curriculum and Evaluation Standards for School Mathematics* (NCTM, 1989) which jumpstarted the standards movement of the 1990s.

The 1989 standards published by NCTM utilized the guiding principles of equity, curriculum, teaching, learning, assessment, and technology. The standards also were broken down by content standards and process standards. The content standards were as follows: numbers and operations, algebra, geometry, measurement, and data analysis and probability. The following were the process standards: problem solving, reasoning and proof, communication, connections, and representation. Following the curriculum standards, NCTM published the *Professional Standards for Teaching Mathematics* (NCTM, 1991) and the *Assessment Standards for School Mathematics* (NCTM, 1995). The standards movement of the 1990s led the nation into the math wars (Shoenfeld, 2004). Many mathematical traditionalists became concerned that the new standards decreased attention to computation, rote practice and memorization, long division, teaching by telling, factoring, proofs, and graphing by hand (Schoenfeld, 2004).

Mathematics education in the new millennium continues to witness the math wars. The NCTM published the *Principles and Standards for School Mathematics* in 2000 which combine and update the curriculum, teaching, and assessment standards of the 1990s. In 2006, NCTM published *Curriculum Focal Points* which emphasizes the importance of early arithmetic skill development and provides information on critical areas in pre-K through eighth grade mathematics education.

A Brief History of Texas Assessments

Texas students have been required to participate in statewide assessment in the content areas of reading, writing, and mathematics since 1980 (TEA, 2002a). The first required assessment was labeled the Texas Assessment of Basic Skills (TABS) test. TABS was a criterion-referenced assessment from 1980 through 1984 (Cruse & Twing, 2000). Students were assessed in grades three, five, and nine. A mandated statewide curriculum was not available in the early 1980s and the learning objectives were created by various committees of Texas educators. By 1983, students who did not pass the grade nine assessments were required to retake the exam each year until they passed it. However, not passing TABS did not eliminate students from receiving their diploma or graduating (Cruse & Twing, 2000). TABS assessment results were available to the public.

In 1985, Texas students began taking another criterion-reference assessment labeled the Texas Educational Assessment of Minimal Skills (TEAMS). The Texas legislature pushed for a change in terminology and shifted focus from “basic skills” to “minimum basic skills” (Cruse & Twing, 2000, p. 328). TEAMS also assessed reading, writing, and mathematics, but included grades one, three, five, seven, nine, and eleven. By 1987, all students were required to pass the eleventh grade “exit level” assessments to receive their diploma. TEAMS was eliminated in 1989.

Beginning in 1990, Texas replaced TEAMS with another criterion-referenced assessment labeled the Texas Assessment of Academic Skills (TAAS). TEA (2002b) claims that the TAAS shifted away from *minimum skills* toward *academic skills*. TAAS emphasized *higher-order thinking* and *problem-solving* across reading, writing, and mathematics. TAAS was administered in grades three, five, seven, nine, and eleven. TAAS emphasized a broader focus on the essential elements (EE) and was more difficult than the TEAMS. TAAS also provide more information regarding scores and accountability. Students, campuses, and districts were all accountable for student performance and were susceptible to receiving consequences for not meeting state expectations. TAAS phased out in 2002 and opened the door for the Texas Assessment of Knowledge and Skills (TAKS).

The Texas legislature desired a more rigorous assessment program and desiring to curtail social promotion and created a law that would mandate that students meet certain expectations to exit certain grade levels. Students were required to pass TAKS reading and receive passing grades in grade three to be promoted to grade four. Students in grades five and eight were required to receive passing grades and pass TAKS reading and mathematics assessments to be promoted to the next grade level. The exit-level assessment was moved back to the eleventh grade and students were required to pass TAKS reading, mathematics, science, social studies, and writing in order to be eligible to receive a diploma. Students were also required to earn sufficient high school credits. TAKS has undergone several changes since its inception. Reading is now assessed in grades three through nine; English-language arts (ELA) is administered in tenth and eleventh grades; writing is assessed in fourth and seventh grades; mathematics is administered in third through eleventh grades; science is administered in fifth, eighth, tenth, and eleventh grades; and social studies is administered in the eighth, tenth, and eleventh grades. As of 2010, students in grade three are no longer required to pass TAKS reading to be promoted to the fourth grade.

Texas is now transitioning toward the State of Texas Assessments of Academic Readiness (STAAR) (see Table 4.1). STAAR will use End of Course (EOC) assessments in grades nine through twelve. Freshman classes beginning in the 2011-2012 academic year will be required to take twelve EOC assessments as a partial requirement to graduate (TEA, 2010). Students will be expected to pass EOC assessments in Algebra I, Algebra II, Biology, Chemistry, English I, English II, English III, Geometry, Physics, US History, World Geography, and World History. The STAAR accountability system currently is being developed and will begin in 2013.

Table 4.1 Timeline of Texas Standardized Testing Programs

Assessment Program	Years Administered	Features
TABS	1980-1984	Initial program Emphasized "basic skills" Primary use was to collect data
TEAMS	1985-1989	Emphasized "minimal skills" Students were required to pass exit level exam to receive diploma Expanded data collection methods
TAAS	1990-2002	Broader focus on essential elements (EE) Emphasized "academic skills" Students, campuses, and districts were accountable for performance.
TAKS	2003-2011	Sought to reduce social promotion 3rd, 5th, 8th, and Exit Level gatekeepers Expanded subject areas and grades assessed
STAAR	Begins in 2012	12 EOC Assessments Expected increase in rigor

TAKS Mathematics Objectives

TAKS assess mathematics across six objectives through multiple-choice and griddable items (see Figure 4-1). Objective one explores numbers operations, and quantitative reasoning. Objective two explores patterns, relationships, and algebraic reasoning. Objective three explores geometry and spatial reasoning while objective four explores measurement. Objective five explores probability and statistics and objective six explores mathematical processes and tools. Mathematics TAKS assessment begins with 40 test items in grade three and increases by two items per grade through the eighth grade assessment which has 50 test items.

Objective one is heavily emphasized in both the elementary and middle grades to build a mathematical foundation on number fluency (TEA, 2002a). The emphasis on objective two increases as students approach Algebra. The emphasis on objective three remains constant through grades three through eight (TEA, 2002a). Objective four receives more emphasis in elementary school than middle school. The focus on measurement decreases as students start focusing more on algebraic foundations (TEA, 2002a). Objective five is emphasized more in the middle grades than in grades three through five. Objective six receives a heavy emphasis throughout elementary and middle level grades. Objective six attempts to link knowledge and skills from the other five objectives and push students to think critically and to effectively problem solve (TEA, 2002a). A single test item will be represented by a combination of content from multiple objectives (TEA, 2002a).

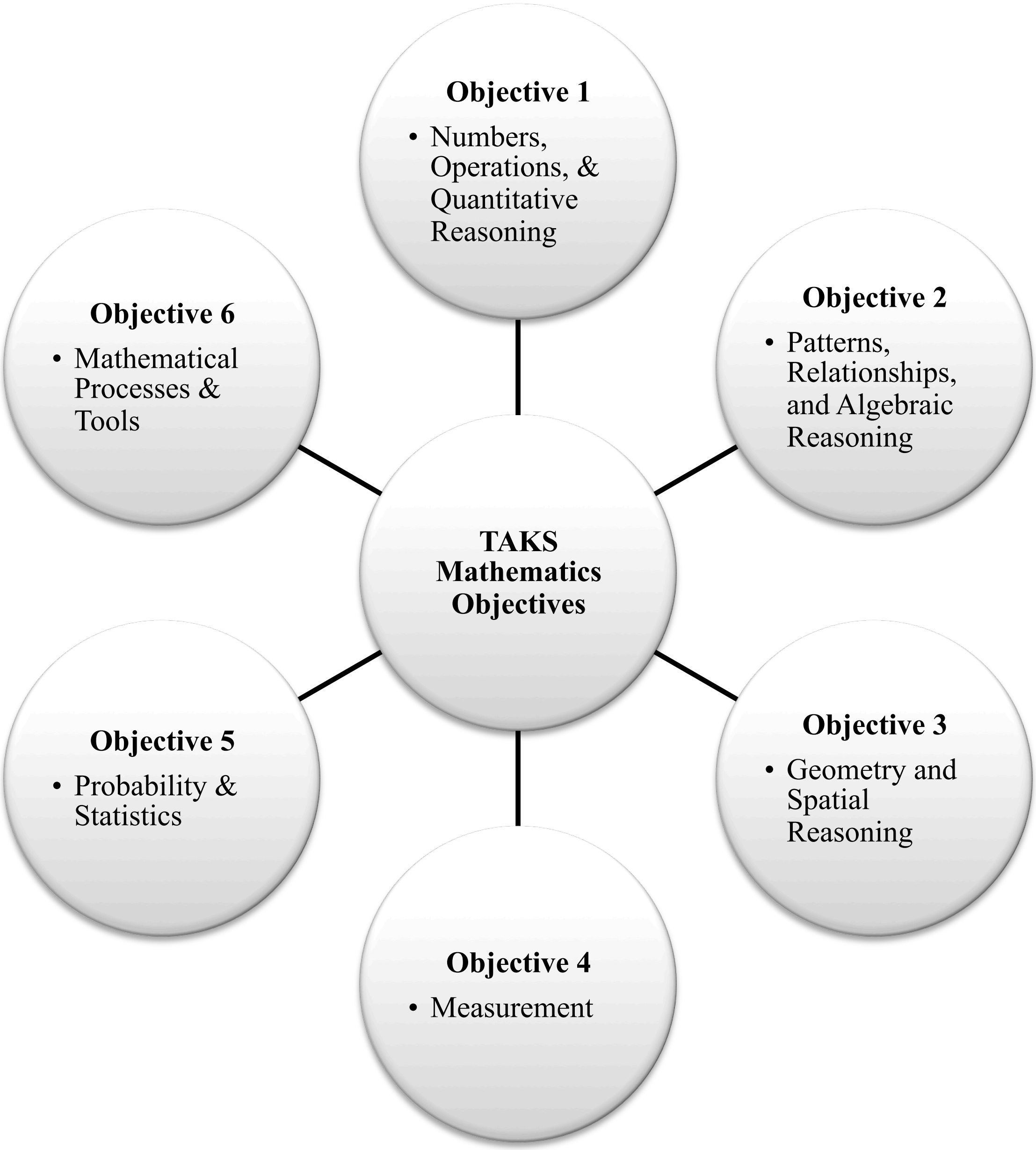

Figure 4-1. Texas Mathematics TAKS Objectives

Socioeconomic Status

Many researchers suggest that socioeconomic status is a major predictor in student achievement (Coleman et al., 1966; Jordan et al., 2007; Knapp & Woolverton, 2004; Persell, 1993). When examining data in Texas, Tajalli and Ophein (2005) found that socioeconomic status was a significant factor in predicting academic performance of fourth and eighth graders. Students from low-socioeconomic backgrounds receive less support than many of their peers from other backgrounds (Jordan et al., 2006).

Jordan and Levine (2009) explored the socioeconomic variation, number competence, and mathematics learning for young children. The foundation of their study is on the premises of “primary preverbal number knowledge and symbolic number knowledge” (p. 61). Jordan and Levine describe primary preverbal number knowledge as an object file system for precise representation of small numbers and an analogue magnitude system for approximate representation of larger sets. They describe secondary symbolic number knowledge as verbal subitizing, counting, numerical magnitude comparisons, linear representations of numbers, and arithmetic operations. Students that struggle early in mathematics usually have difficulties learning verbal and symbolic number knowledge as they progress due to the influence of experiences and instruction. Students from low-socioeconomic backgrounds often do not receive preschool experiences to assist in building verbal and symbolic number knowledge. In another study, Jordan et al. (2007) found that students from low-socioeconomic backgrounds entered kindergarten “well behind” (p. 36) students from middle-class backgrounds in tasks that assess number competence. Jordan and Levine (2009) propose that early interventions at home and school "have potential to help all children develop the foundations they need to learn school mathematics" (p. 65).

Chow (2007) initiated a four-year longitudinal study that analyzed the difference in achievement among students that were identified as receiving free lunches, receiving reduced-price lunches, and students ineligible for free or reduced lunches. The study found that there were no statistically significant differences across socioeconomic status. The study did acknowledge that there were small differences of practical significance in achievement. Students that did not receive free or reduced lunch scored with the highest mean, followed by students receiving reduced price lunch, and then students receiving free lunch. However, most students identified as receiving free lunch still passed the mathematics TAKS test. The study also found that there were not any growth rate differences across time. Scores were consistent providing evidence that students learn the same amount of information. The critical factor is where students start in relation to performance on standardized test after a period of instruction.

Critical Race Theory

This study was performed through a lens heavily influenced by critical race theory (CRT). CRT emerged from critical law studies that were examining "the impact of the law on Black-White relations" (Lynn & Parker, 2006, p. 263) has on African Americans and society. Evolving from its early foundations, CRT has been used to examine various issues pertaining to "law, immigration, national origin, language, globalization, and colonization to race" (Lynn & Parker, 2006, p. 263). Ladson-Billings and Tate (1995) pioneered the CRT movement in education by developing a framework that relies on the proposition that race is a significant variable in determining inequity in the United States; the structure of the United States is based on property rights; and the intersection of race and property provides a tool to analyze and understand social inequity.

There are five guiding tenets that have emerged from CRT. Delgado and Stefancic (2001) have identified the tenets of CRT as: 1) racism is ordinary, not aberrational; 2) interest convergence (Bell, 1980); 3) race is socially constructed; 4) differential racialization; and 5) unique voice of color. It is without doubt that race and race relations influences the experiences of all students and that race is a social construction that has been used to suppress individuals throughout the history of the United States. The primary CRT theme guiding this study is *intersectionality* (Crenshaw, 1991). TAKS data are categorized according to race/ethnicity, gender, or socioeconomic status, but not by race/ethnicity, gender, and socioeconomic status. “CRT draws upon paradigms of intersectionality and recognizes that race and racism work in concert with and through gender, ethnicity, class, and/or sexuality inequalities/discrimination…” (Hartlep, 2009, p. 15). When examining data categorized by socioeconomic status, the study cannot identify how socioeconomic status influences students across sociocultural variables. A male student of color from a specific socioeconomic situation will not experience schooling the same way as a European male student from a similar socioeconomic situation. Therefore, more specific data should be explored in attempt to eradicate performance differences across sociocultural variables.

Culturally Responsive Pedagogy

There have been numerous discussions about the intersectionality of culture, learning, and the school experience. The contributions of Lev Vygotsky to sociocultural learning theory have paved a way for educational theorists to examine to what extent culture influences the education that an individual incurs. Vygotsky (1986) described learning “as being embedded within social events and occurring as a child interacts with people, objects, and events in the environment" (p. 287). A pedagogical approach that emphasizes sociocultural learning theory is culturally responsive pedagogy (Gay, 2000). Culturally responsive pedagogy (CRP) evolved from other pedagogies that emphasized the influence of culture in student’s learning. Some have describe these pedagogies as “culturally appropriate” (Au & Jordan, 1981), culturally compatible” (Jordan, 1985; Vogt, Jordan, & Tharp, 1987), “culturally congruent” (Irvine, 2003; Mohatt & Erickson, 1981), “culturally relevant pedagogy” (Ladson-Billings, 1994), and “cultural responsive” (Cazden & Leggett, 1981; Gay, 2000).

Culturally responsive teaching (Gay, 2000) and culturally relevant teaching (Ladson-Billings, 1994) are the most common terms used today to refer to this space of cultural pedagogical theory. Ladson-Billings coined the term “culturally relevant” in response to her research of identifying effective practices and qualities of highly effective teachers of African American students. According to Ladson-Billings (1995a), culturally relevant teaching is a pedagogy of opposition that is committed to collective empowerment that relies on three propositions: 1) students must experience academic success (p. 160); 2) students must develop and/or maintain cultural competence (p. 160);

and 3) students must develop a critical consciousness through which they challenge the status quo of the current social order (p. 161).

The first is that students must experience academic success. Academic success is reliant on the development of academic skills such as literacy, numeracy, technological, social and political skills. Ladson-Billings states that these are the minimal necessary skills that students must develop “in order to be active participants in a democracy” (p. 160). Ladson-Billings stresses that “culturally relevant teaching requires that teachers attend to students’ academic needs, not merely make the ‘feel good’…the trick is to get students to ‘choose’ academic excellence” (p. 160).

The second criterion of culturally relevant teaching is that students must develop and/or maintain cultural competence (Ladson-Billings, 1995a). Ladson-Billings states that “culturally relevant teachers utilize students’ culture as a vehicle for learning” (p. 161). The school environment should not be a place where students cannot be themselves. Also, students must develop the skills of translation and code switching.

The third criterion of culturally relevant teaching is that students must develop a critical consciousness through which they challenge the status quo of the current social order (Ladson-Billings, 1995a). Students must be able to move beyond just choosing academic excellence and being culturally aware and competent. It is important for students do develop a “sociopolitical consciousness that allows them to critique the cultural norms, values, mores, and institutions that produce and maintain social inequalities” (p. 162). Teachers must help students construct knowledge of local, national, and global issues. Culturally relevant teachers assist students in developing the critical thinking and critical examination skills to empower students with the ability to actively critique and challenge sociocultural norms.

Gay (2000) takes culturally relevant teaching into more extensive depths and utilizes the term culturally responsive pedagogy (CRP). Gay's framework is a product of best practices and sociocultural approaches to education. Gay (2000) defines CRP "as using the cultural knowledge, prior experiences, frames of reference, and performance styles of ethnically diverse students to make learning encounters more relevant and effective for them" (p. 29). Gay identifies culturally responsive teaching as being comprehensive, multidimensional, empowering, transformative, as well as emancipatory. Gay's framework of culturally responsive teaching has four critical parameters: 1) caring; 2) communication; 3) curriculum; 4) and instruction.

Caring includes the personal, social, and ethical dimensions of teacher-student interactions (Gay, 2000, p. xv). Caring moves beyond the simplistic forms of kindness, gentleness, and benevolence toward the "dimensions of emotion, intellect, faith, ethics, action, and accountability" (p. 48). A caring teacher has high expectations and values accountability and holds students accountable to their high expectations, always expecting the student's best. CRP relies heavily on the importance of communication. Teachers must learn how to effectively communicate (verbally and non-verbally) with their students. Gay suggests that "aligning instruction to the cultural communication styles of different ethnic groups can improve school achievement" (p. xvi).

Another critical parameter of CRP is curriculum. Gay states that "the fundamental aim of culturally responsive pedagogy is to empower ethnically diverse students through academic success, cultural affiliation, and personal efficacy" (p. 111). It is critical to align the curriculum with the inclusive culture of the students and community. Students must be able to connect knowledge to their lives and experience both inside and outside of school.

The fourth critical parameter is instruction. CRP desires to move away from cultural mismatch and toward a curriculum that is "culturally congruent" (xvii) with the students in the specific educational setting. To accomplish this goal, teachers must not only have a curriculum that is congruent with the cultural environment of the classroom, but also must be able to identify and understand the various "procedural, communicative, substantive, environmental, organizational, perceptual, relational, and motivational stimulation preferences" (p.151) of their students. A culturally responsive teacher must be able to modify and adapt instruction to meet the various learning styles and processes of students.

Culturally responsive pedagogy is a dynamic, multifaceted framework that centralizes culture in the educational environment. Culturally responsive teachers are culturally competent, culturally sensitive, and caring. Culturally responsive teachers assist students in their educational journey by helping them develop the critical consciousness to question and challenge the status quo. They also examine the curriculum and instructional practices for bias and cultural mismatch. A culturally responsive teacher is *responsive* to the needs of the students, community, and global societal and environmental population.

Methodology

This study critically examined TAKS mathematics data through the guiding research question: What are the differences in TAKS scores of students in grades three through eight during the years 2004, 2007, and 2010 by mathematical objective categorized by socioeconomic status? This study used descriptive statistics to describe the differences in TAKS mathematic assessment data across socioeconomic status from TAKS 2004, 2007, and 2010 data. The population for this research study was students from grades three through eight who took the 2004 ($N = 1,691,828$), 2007 ($N = 1,769,783$), and 2010 ($N = 1,982,189$) TAKS mathematics test. The population is categorized by the economic situation of the student's guardians. The categories include *free meals*, *reduced meals*, *other*, or *no*.

The Texas Assessment of Knowledge and Skills (TAKS) mathematics test was the instrument used for this research study. The data used for this research study were Texas TAKS archived data. Archived quantitative data were analyzed using the statistical software *Statistical Package for Social Studies* (SPSS) 16.0 Graduate Pack. A series of one-way Analysis of Variance (ANOVA) trials were performed to determine relationship and significance ($p < .05$) between groups and within groups. To determine the location of specific significant differences, Bonferroni *post hoc* procedures were performed. This study explored both practical and statistical significance in attempt to identify differences between groups.

Findings

Mean scores were critically examined across objectives by socioeconomic identifiers through performing a series of one-way ANOVAs (p < .05) to answer the following guiding research question: What are the differences in TAKS scores of students in grades three through eight during the years 2004, 2007, and 2010 by mathematical objective categorized by socioeconomic status? Statistical significance was observed across several grades among groups (see Table 4.2), but statistical significance was not found within groups. Bonferroni *post hoc* tests were performed to identify specifically where significant differences were located.

Table 4.2 One-way ANOVA Results Between Groups by Socioeconomic Status

Grade	Objective	F	p-value
3	1	F(3, 8) = 6.06	p = .019*
	2	F(3, 8) = 4.96	p = .031*
	3	F(3, 8) = 26.25	p < .001***
	4	F(3, 8) = 4.23	p = .046*
	5	F(3, 8) = 28.67	p < .001***
	6	F(3, 8) = 42.22	p < .001***
4	1	F(3, 8) = 5.05	p = .030*
	2	F(3, 8) = 3.50	p = .069
	3	F(3, 8) = 4.07	p = .050
	4	F(3, 8) = 2.03	p = .188
	5	F(3, 8) = 2.06	p = .184
	6	F(3, 8) = 7.84	p = .009**
5	1	F(3, 8) = 2.41	p = .142
	2	F(3, 8) = 3.80	p = .058
	3	F(3, 8) = 6.21	p = .017*
	4	F(3, 8) = 3.63	p = .064
	5	F(3, 8) = 4.84	p = .033*
	6	F(3, 8) = 9.05	p = .006**
6	1	F(3, 8) = 3.05	p = .092
	2	F(3, 8) = 1.73	p = .238
	3	F(3, 8) = 2.17	p = .170
	4	F(3, 8) = 1.64	p = .256
	5	F(3, 8) = 5.09	p = .029*
	6	F(3, 8) = 8.30	p = .008**

Table 4.2 Continued

Grade	Objective	F	p-value
7	1	F(3, 8) = 2.90	p = .102
	2	F(3, 8) = 2.27	p = .157
	3	F(3, 8) = 2.05	p = .186
	4	F(3, 8) = 8.49	p = .007**
	5	F(3, 8) = 0.83	p = .511
	6	F(3, 8) = 6.40	p = .016*
8	1	F(3, 8) = 6.06	p = .190
	2	F(3, 8) = 4.96	p = .018*
	3	F(3, 8) = 26.25	p = .048*
	4	F(3, 8) = 4.23	p = .196
	5	F(3, 8) = 28.67	p = .138
	6	F(3, 8) = 42.22	p = .040*

Note: This table addresses statistical significance at $p < 0.05$: $*p < 0.05$; $**p \leq 0.01$; $***p \leq 0.001$.

Statistically significant differences were most common between students' identified as not economically disadvantaged and students' receiving free meals. Significant differences for objective one (numbers, operations, and quantitative reasoning) were observed between students' identified as not economically disadvantaged (M = 8.63) and students receiving free meals (M = 7.73, p = .028) in grade three (see Table 4.3). Similar differences remained in grade four with students' identified as not economically disadvantaged (M = 9.77) scoring higher than students' receiving free meals (M = 8.93, p = .045). No statistically significant differences were observed in grades five through eight for objective one.

Table 4.3 Statistically Significant Differences across Objective 1 by SES

Objective 1	Socioeconomic Status	Mean	MD	Sig.
Grade 3	Not Economically Disadvantaged	8.63		
	Free Meals	7.73	-0.90	p = .028*
Grade 4	Not Economically Disadvantaged	9.77		
	Free Meals	8.93	-0.83	p = .045*

Note: This table addresses statistical significance at $p < 0.05$: $*p < 0.05$.

Significant differences across objective two (patterns, relationships, and algebraic reasoning) were only observed in grades three and eight (see Table 4.4). In grade three, students' identified as not economically disadvantaged (M = 5.16) mean score was significantly higher than students' receiving free meals (M = 4.73, p = .037). In grade eight, students' identified as not economically disadvantaged (M = 7.57) mean score was higher than students' receiving free meals (M = 6.37, p = .031) and higher than students' identified as other economically disadvantaged (M = 6.43, p = .042).

Table 4.4 Statistically Significant Differences across Objective 2 by SES

Objective 2	Socioeconomic Status	Mean	MD	Sig.
Grade 3	Not Economically Disadvantaged	5.16		
	Free Meals	4.73	-0.43	p = .037*
Grade 8	Not Economically Disadvantaged	7.57		
	Free Meals	6.37	-1.20	p = .031*
	Other Economically Disadvantaged	6.43	-1.13	p = .042*

Note: This table addresses statistical significance at $p < 0.05$: $*p < 0.05$.

Statistically significant differences were also prevalent in objective three (geometry and spatial reasoning) in grade three and grade five (see Table 4.5). Statistically significant differences were not present in grades four, six, seven, and eight. Students' paying a reduced fee for meals (M= 5.07) mean score was higher than students' receiving free meals (M = 4.87, p = .017) in grade three. Also in grade three, students' identified as not economically disadvantaged (M = 5.27) mean score was significantly higher than students' receiving free meals (M = 4.87, p < .001), students' paying a reduced fee for meals (M = 5.07, p = .017), and students' identified as other economically disadvantaged (M = 4.97, p < .001). In grade five, the only difference of statistical significance was between students' identified as not economically disadvantaged (M = 6.27) and students' receiving free meals (M = 5.77, p = .019).

Table 4.5 Statistically Significant Differences across Objective 3 by SES

Objective 3	Socioeconomic Status	Mean	MD	Sig.
Grade 3	Reduced Meals	5.07		
	Free Meals	4.87	-0.20	p = .017*
	Not Economically Disadvantaged	5.27		
	Free Meals	4.87	-0.40	p < .001***
	Reduced Meals	5.07	-0.20	p = .017*
	Other Economically Disadvantaged	4.97	-0.30	p < .001***
Grade 5	Not Economically Disadvantaged	6.27		
	Free Meals	5.77	-0.50	p = .019*

Note: This table addresses statistical significance at $p < 0.05$: $*p < 0.05$; $***p \leq 0.001$.

The only significant differences across objective four (measurement) were in grade seven (see Table 4.6). Students' identified as not economically disadvantaged (M= 3.47) mean scores were higher than those of students' receiving free meals (M = 2.70, p = .015) and students' identified as other economically disadvantaged (M = 2.70, p = .015).

Table 4.6 Statistically Significant Differences across Objective 4 by SES

Objective 4	Socioeconomic Status	Mean	MD	Sig.
Grade 7	Not Economically Disadvantaged	3.47		
	Free Meals	2.70	-0.77	p = .015*
	Other Economically Disadvantaged	2.70	-0.77	p = .015*

Note: This table addresses statistical significance at $p < 0.05$: $*p < 0.05$.

Statistically significant differences were observed in grades three and five for objective five (probability and statistics), but not in grades four, six, seven, and eight. The most noticeable differences occurred in grade three where students' identified as not economically disadvantaged (M = 3.60) mean scores were higher than students' receiving free meals (M = 3.33, p < .001), students' paying a reduced fee for meals (M = 3.40, p = .002), and students' identified as other economically disadvantaged (M = 3.33, p < .001). Statistically significant differences were not observed in grades four and six through eight (see Table 4.7).

Table 4.7 Statistically Significant Differences across Objective 5 by SES

Objective 5	Socioeconomic Status	Mean	MD	Sig.
Grade 3	Not Economically Disadvantaged	3.60		
	Free Meals	3.33	-0.27	p < .001***
	Reduced Meals	3.40	-0.20	p = .002**
	Other Economically Disadvantaged	3.33	-0.27	p < .001***
Grade 5	Not Economically Disadvantaged	3.40		
	Free Meals	3.03	-0.37	p = .044*

Note: This table addresses statistical significance at $p < 0.05$: $*p < 0.05$; $**p \leq 0.01$; $***p \leq 0.001$.

The objective with the most occurrences of statistical difference among objective means was objective six (mathematical processes and tools). In the third grade, students' paying a reduced fee for meals (M = 5.57) scored higher than students' receiving free meals (M = 5.17, p = .036) and higher than students' identified as other economically disadvantaged (M = 5.13, p = .023). Also in the third grade, students' identified as not economically disadvantaged (M = 6.20) mean scores were significantly higher than all other groups (see Table 4.8). In grades four through six, the mean scores of students' identified as not economically disadvantaged were significantly higher than students' receiving free meals and students' identified as other economically disadvantaged (see Table 4.8). In grade seven, significant differences were present between students' identified as not economically disadvantaged (M = 7.03) and students receiving free meals (M = 6.00, p = .027). Grade eight was the only grade that significant differences were not observed for objective six (mathematical processes and tools) (see Table 4.8).

Table 4.8 Statistically Significant Differences across Objective 6 by SES

Objective 6	Socioeconomic Status	Mean	MD	Sig.
Grade 3	Reduced Meals	5.57		
	Free Meals	5.17	-0.40	p = .036*
	Other Economically Disadvantaged	5.13	-0.44	p = .023*
	Not Economically Disadvantaged	6.20		
	Free Meals	5.17	-1.03	p < .001***
	Reduced Meals	5.57	-0.63	p = .002**
	Other Economically Disadvantaged	5.13	-1.07	p < .001***
Grade 4	Not Economically Disadvantaged	6.50		
	Free Meals	5.53	-0.97	p = .018*
	Other Economically Disadvantaged	5.53	-0.97	p = .018*
Grade 5	Not Economically Disadvantaged	6.63		
	Free Meals	5.70	-0.93	p = .010**
	Other Economically Disadvantaged	5.77	-0.87	p = .015*
Grade 6	Not Economically Disadvantaged	7.20		
	Free Meals	6.17	-1.33	p = .014*
	Other Economically Disadvantaged	6.20	-1.00	p = .017*
Grade 7	Not Economically Disadvantaged	7.03		
	Free Meals	6.00	-1.03	p = .027*
	Other Economically Disadvantaged	6.07	-0.97	p = .039*

Note: This table addresses statistical significance at $p < 0.05$: $*p < 0.05$; $**p \leq 0.01$; $***p \leq 0.001$.

There were no statistically significant differences within groups. Within group data were also explored across 2004, 2007, and 2010 by objective and socioeconomic status to identify differences (see Table 4.9) and themes of practical significance (see Table 4.10). Students across all groups seem to score higher on objective one (numbers, operations, and quantitative reasoning) in grades three through five than in grades six through eight (see Table 4.9). Students across all groups also seem to score slightly lower on objective four (measurement) in grades seven and eight than in grades three through six (see Table 4.9). In most instances, groups mean scores improved between years within each objective (see Table 4.10). However, there was a common trend within objective six (mathematical processes and tools). Students in all groups saw a slight decrease in objective six mean scores between 2007 and 2010 in at least one grade level (see Table 4.9).

Table 4.9 TAKS Mean Scores by Objective for 2004, 2007, and 2010 by SES

Year	Grade	Objective 1	Objective 2	Objective 3	Objective 4	Objective 5	Objective 6
	Students' Identified as Receiving Free Meals						
2004	**3**	7.4	4.9	4.8	4.4	3.4	5.3
	4	8.6	5.4	4.5	4.0	2.8	5.2
	5	8.0	4.6	5.6	4.7	2.9	5.4
	6	6.1	5.1	4.8	2.6	4.1	5.8
	7	5.9	5.1	4.3	2.5	3.5	5.6
	8	5.3	5.9	4.3	2.1	4.9	5.7
2007	**3**	7.8	4.7	4.9	4.6	3.3	5.0
	4	9.0	5.7	4.7	4.6	2.9	5.8
	5	9.0	5.1	5.9	5.2	3.1	6.0
	6	7.1	6.1	5.4	3.3	4.5	6.4
	7	6.8	5.9	4.8	2.9	4.6	6.1
	8	6.0	6.5	4.6	2.7	5.6	6.3
2010	**3**	8.0	4.6	4.9	4.8	3.3	5.2
	4	9.2	5.8	4.8	4.6	3.2	5.6
	5	8.7	5.3	5.8	5.4	3.1	5.7
	6	7.1	6.5	5.6	3.4	4.5	6.3
	7	6.8	6.4	5.1	2.7	4.9	6.3
	8	6.9	6.7	5.0	2.8	5.8	6.7
	Students' Receiving Reduced Fee Meals						
2004	**3**	7.8	5.1	5.0	4.7	3.4	5.6
	4	9.0	5.6	4.7	4.3	3.0	5.6
	5	8.5	5.0	5.8	5.0	3.1	5.8
	6	6.7	5.6	5.1	2.9	4.4	6.3
	7	6.4	5.5	4.7	2.8	3.8	6.0
	8	6.0	6.5	4.7	2.4	5.3	6.3
2007	**3**	8.2	4.9	5.1	4.8	3.4	5.4
	4	9.4	5.9	5.0	4.8	3.1	6.2

Table 4.9 Continued

Year	Grade	Objective 1	Objective 2	Objective 3	Objective 4	Objective 5	Objective 6
	Students' Receiving Reduced Fee Meals						
	5	9.4	5.4	6.1	5.6	3.2	6.3
	6	7.5	6.5	5.8	3.5	4.7	6.9
	7	7.3	6.4	5.1	3.3	4.9	6.6
	8	6.5	7.0	5.0	2.9	6.0	6.8
2010	**3**	8.4	4.8	5.1	5.0	3.4	5.7
	4	9.5	6.0	5.0	4.8	3.4	6.0
	5	9.1	5.6	6.1	5.7	3.3	6.1
	6	7.6	6.9	5.9	3.6	4.8	6.7
	7	7.3	6.9	5.5	3.0	5.2	6.7
2010	**8**	7.4	7.1	5.3	3.0	6.2	7.2
	Students' Identified as Other Economically Disadvantaged						
2004	**3**	7.5	5.0	4.9	4.5	3.4	5.2
	4	8.6	5.6	4.6	4.0	2.8	5.3
	5	8.1	4.7	5.8	4.7	3.0	5.6
	6	6.2	5.1	4.9	2.7	4.0	5.9
	7	5.9	5.2	4.3	2.5	3.5	5.7
	8	5.3	5.9	4.4	2.1	4.9	5.7
2007	**3**	7.9	4.7	5.0	4.7	3.3	5.0
	4	9.2	5.8	4.8	4.6	2.8	5.7
	5	9.1	5.2	6.0	5.2	3.2	6.0
	6	7.2	6.2	5.5	3.3	4.5	6.4
	7	6.9	5.9	4.9	2.9	4.6	6.2
	8	6.0	6.7	4.8	2.8	5.6	6.4
2010	**3**	8.1	4.8	5.0	4.9	3.3	5.2
	4	9.3	5.9	4.9	4.7	3.3	5.6
	5	8.9	5.3	5.9	5.4	3.1	5.7
	6	7.1	6.5	5.5	3.4	4.5	6.3
	7	6.9	6.4	5.2	2.7	4.9	6.3
	8	7.0	6.7	5.0	2.8	5.8	6.7
	Students' Identified as Not Economically Disadvantaged						
2004	**3**	8.4	5.3	5.2	5.0	3.6	6.2
	4	9.6	5.9	4.9	4.7	3.2	6.2
	5	9.1	5.5	6.1	5.6	3.2	6.4
	6	7.4	6.4	5.6	3.3	4.8	6.9
	7	7.1	6.3	5.1	3.3	4.4	6.8
	8	6.9	7.2	5.2	2.8	5.8	7.1
2007	**3**	8.7	5.1	5.3	5.0	3.6	6.1
	4	9.8	6.2	5.2	5.1	3.3	6.8
	5	9.9	5.8	6.3	6.0	3.5	6.8
	6	8.1	7.1	6.1	3.9	5.0	7.4
	7	7.8	7.2	5.5	3.7	5.4	7.1
	8	7.2	7.7	5.4	3.3	6.5	7.4
2010	**3**	8.8	5.1	5.3	5.3	3.6	6.3
	4	9.9	6.3	5.3	5.1	3.6	6.5
	5	9.6	6.1	6.4	6.1	3.5	6.7
	6	8.2	7.5	6.2	4.0	5.1	7.3
	7	7.9	7.6	5.8	3.4	5.6	7.2
	8	8.0	7.8	5.7	3.4	6.7	7.8

Table 4.10 SES Data Analysis Observations

Socioeconomic Identifier	Observations
Free Meals	a) Scored higher in grades 3-5 on objective 1 than grades 6-8. b) Scored lower in grades 7-8 on objective 4 than grades 3-6. c) Slight decrease between 2007 and 2010 on objective 6 across grades 3, 4, and 6.
Reduced Meals	a) Scored higher in grades 3-5 on objective 1 than grades 6-8. b) Scored lower in grades 7-8 on objective 4 than grades 3-6. c) Slight decrease between 2007 and 2010 on objective 6 across grades 3-6.
Other Economically Disadvantaged	a) Scored higher in grades 3-5 on objective 1 than grades 6-8. b) Scored lower in grades 7-8 on objective 4 than grades 3-6. c) Slight decrease between 2007 and 2010 on: objective 1 across grades 5 and 6; objective 4 in grade 7; objective 5 in grade 5; and objective 6 in grades 5-6.
Not Economically Disadvantaged	a) Overall mean score is higher across all objectives and years. b) Scored higher in grades 3-5 on objective1 than grades 6-8. c) Scored lower in grade 8 on objective 4 than grades 3-7. d) Slight decrease between 2007 and 2010 on objective 6 across grades 4-6.

Conclusion

The objective of this study was to identify any differences that may occur on the TAKS mathematics assessments in grades three through eight in 2004, 2007, and 2010 between students from various socioeconomic situations. This study also examined within group data to identify performance differences across years and objectives. Statistical significance was determined by performing one-way ANOVAs ($p < .05$). Statistical significance was observed between certain groups, but not within any group.

One-way ANOVA results identified that significant differences occurred between students' identified as not economically disadvantaged and all other students at various grades and across various objectives. The only other occurrences of significantly higher scores were between students' receiving reduced meals and students' identified as other economically disadvantaged. The Bonferroni *post hoc* tests identified the location of statistical significance in mean scores by objective across socioeconomic identifiers.

The most frequent instances of statistical significance were across all objectives except objective four (measurement) in grade three and across objective six (mathematical processes and tools) in grades three through seven. The highest number of quantifiable differences occurred between the mean scores of students' identified as not economically disadvantaged scoring significantly higher on objective means than students' receiving free meals or identified as other economically disadvantaged. After students' move beyond the third grade, the number of statistically significant differences drastically reduces. By the eighth grade, statistical differences are difficult to locate.

Further exploration of within group data identified several themes that were prevalent among all groups. All four groups seemed to score higher in grades three through five on objective one (numbers, operations, and quantitative reasoning) than in grades six through eight. Student mean scores on objective four (measurement) tended to reduce in the seventh and eighth grades. Each group also experienced a slight decrease between 2007 and 2010 on objective six (mathematical processes and tools) across at least one grade level. Students' identified as not economically disadvantaged scored at-least slightly higher than all other groups across all objectives in 2004, 2007, and 2010. Culturally responsive pedagogy is a viable option to eradicate the differences in mean scores observed across all objectives.

This study was conducted through a critical race lens which recognizes that each individual student has to negotiate the social influence that race, gender, socioeconomic status, and other variables have on their educational experiences. Examining performance differences across only socioeconomic status without examining the *intersectionality* (Crenshaw, 1991) of sociocultural variables is not enough. Data that are segregated by a single variable are essentialized and do not take into account for the complexity of multiple group memberships.

Ladson-Billings and Tate (1995) highlighted the connection of race and property rights. The entrenchment of race in the structure of the United States society directly influences the opportunities to access and accumulate property rights. Property rights and geography then directly influences the opportunities that students have to receive a quality educational experience. The results of this study affirm that the influence of socioeconomic variables heavily influence students' performance on the TAKS mathematics test. Students' identified as not economically disadvantaged scored significantly higher than students' receiving free meals in the third grade during each testing year. Even though the number of statistically significant differences reduces after the third grade, students' identified as not economically disadvantaged mean scores were higher than all other groups across all grade levels and objectives.

CHAPTER V

CONCLUSION

Sullivan (2007) employed critical race theory to examine the quantitative data set that she referred to as *quantcrit*. A critical point made by Sullivan is that numerical data “shape perceptions of issues deemed important” (p. 114). Sullivan suggests that critical race theory should be employed to explore quantitative data across content areas. The primary objective of this research study was to identify any differences that exist among the Texas TAKS mathematics assessment by specific objective across the years 2004, 2007, and 2010. Archival data were used to examine differences in grades three through eight across race/ethnicity, gender, and socioeconomic status. This study examined race/ethnicity, gender, and socioeconomic status as three separate studies while consistently acknowledging that race/ethnicity, gender, and socioeconomic status are interlocked across multiple intersections. The results of this study are intended to be used to influence decisions about mathematics classroom instruction as well as to provide a foundational data set for future research studies to examine why significant differences persist between groups and why certain groups of students do better or have more difficulty on specific objectives during certain grade levels.

The guiding question for this three-article dissertation was: “What are the differences in mathematics achievement by mathematical objective as depicted by the Texas achievement tests during the years 2004, 2007, and 2010?” In attempt to answer the overarching question, three independent studies were performed; each study was guided by a specific question. The first question was “What are the differences in TAKS scores of students in grades three through eight during the years 2004, 2007, and 2010 by mathematical objective categorized by race/ethnicity?” This question guided manuscript one, which was Chapter II of this dissertation. Chapter III, which was manuscript two, was guided by the question “What are the differences in TAKS scores of students in grades three through eight during the years 2004, 2007, and 2010 by mathematical objective categorized by gender?” Chapter IV, which is manuscript three, focused on the question “What are the differences in TAKS scores of students in grades three through eight during the years 2004, 2007, and 2010 by mathematical objective categorized by socioeconomic status?” The objective means were compared in each study through appropriate analysis of variance (ANOVA) procedures for race/ethnicity and socioeconomic status while independent samples *t* tests were performed for gender analysis.

Discussion of Findings

This section of the dissertation presents a synopsis of the research findings for each respective study. Study one explored TAKS data across race/ethnicity by specific mathematical objective while study two examined TAKS data across gender by specific mathematical objective. Study three examined TAKS data across socioeconomic identifiers by specific mathematical objective.

Study One

Study one examined the differences in TAKS mathematics data across race/ethnicity. Statistically significant differences of the objective means were identified across almost every grade level and every objective with the exception of objective five (probability and statistics) in grade seven. Asian American students' and European American students' scored noticeably higher than Native American, African American, and Latino/Latina/Hispanic American students. Most observations of statistically significant differences were in grades three, five, and eight across all objectives.

Statistical significance was not observed in any instance within groups, but a closer examination of TAKS data did present valuable findings. The mean score of objective two (patterns, relationships, and algebraic reasoning) decreased slightly from 2004 to 2007 for Native American and Asian American students while slightly decreasing from 2007 to 2010 for African American, Latino/Latina/Hispanic American, and European American students. The mean scores of objective one (numbers, operations, and quantitative reasoning) and objective two (patterns, relationships, and algebraic reasoning) suggest that each group of students performs slightly better in grades three through five than in grades six through eight. Students across all groups seem to score higher on objective three (geometry and spatial reasoning) in grades five and six, but score lower on objective four (measurement) in grades six through eight.

Study Two

Study two examined the differences in performance on the TAKS mathematics test across gender. Independent samples *t* tests were performed to determine that *no* statistical significance was present between groups or within groups in grades three through eight in 2004, 2007, and 2010. The study explored further to identify any differences of practical significance between groups and within groups. The findings of study two identify that male students' were scored better across most objectives in 2004, but by 2010 data suggests that the mean scores of male and female students were more equivalent with male students' performing slightly better across most objectives in grades three through five and female students' scoring slightly better in grades six through eight. Female students' seemed to attain the highest mean score across all grade levels in objective five (probability and statistics).

A critical examination of within group data also presented valuable observations. Male students' consistently scored higher across objectives one (numbers, operations, and quantitative reasoning) and four (measurement) in grades three through five than in grades six through eight. The mean score of male students' across objective six (mathematical processes and tools) slightly decreased between 2007 and 2010. Female students' mean scores across most objectives and grades have consistently increased since 2004. Female students' mean score did decrease slightly across objective two (patterns, relationships, and algebraic reasoning) on the grade three assessments in 2007 and 2010. Female students' mean scores for objectives one (numbers, operations, and quantitative reasoning) and two (patterns, relationships, and algebraic reasoning) are slightly better in grades three through five than in grades six through eight.

Study Three

Study three examined TAKS mathematics data across socioeconomic status. Statistically significant differences were observed most commonly in grade three across all objectives as well as objective six (mathematical processes and tools) across all grade levels. In most instances of significant differences, students' identified as not economically disadvantaged scored higher than students receiving free meals. Students' identified as not economically disadvantaged score significantly higher than all other groups across objectives three (geometry and spatial reasoning), five (probability and statistics), and six (mathematical processes and tools) in grades three. As students progressed through grades, the number of observable instances of significance drastically reduces. By the eighth grade, the only observed statistical significance was on objective two (patterns, relationships, and algebraic reasoning).

There were no statistically significant differences observed within groups, but there were observations of significance. There were three common themes that emerged across all groups: 1) students score higher on objective one (numbers, operations, and quantitative reasoning) in grades three through five than in grades six through eight; 2) students score lower on objective four (measurement) in grades seven and eight than they do in grades three through six; and 3) there was a slight decrease between 2007 and 2010 on objective six (mathematical processes and tools) in grade six.

Commonalities across Race/Ethnicity, Gender, and Socioeconomic Status

Since there were no observed statistically significant differences between gender groups nor were there observable statistically significant differences when within group data were analyzed, there were no statistically significant differences that were *common* to all three groups. However, there were some commonalities of statistical power across race/ethnicity and socioeconomic status. The highest number of occurrences of statistical significance for both studies was in grade three across objectives three (geometry and spatial reasoning), five (probability and statistics), and six (mathematical processes and tools). There are also several observable differences on objective six (mathematical processes and tools) in grades four through seven across both race/ethnicity and socioeconomic status.

This study did explore commonalities that persisted across within group data across race/ethnicity, gender, and socioeconomic status even though statistical significance was not observed from within group data. A common theme that emerged was that students in all groups seemed to score higher on objectives one (numbers, operations, and quantitative reasoning) and two (patterns, relationships, and algebraic reasoning) in grades three through five than in grades six through eight. Also, students in grades seven and eight seem to score lower on objective four (measurement) than in grades three through six.

Implications for Mathematics Education in Texas

Performance gaps of statistical significance were observed across race/ethnicity and socioeconomic status, but not gender. In an era of standards and assessments, it is critical that all students to experience academic success in mathematics (Ladson-Billings, 1995b). The data analysis identified that Asian American and European American students' are scoring at least slightly higher than Native American, African American, and Latino/Latina/Hispanic American students'. The social construction of race and the entrenchment of racism in the educational structures of Texas affirm that students' of color, specifically Native American, African American, and Latino/Latina/Hispanic American students' are not preforming as well academically that may account to different educational opportunities as European American and Asian American students'.

Curriculums are influenced heavily by the dominant perspective, instruction is racialized and gendered, and assessments are a direct product of a racialized society. TAKS is just the most current method of *differential racialization* (Delgado & Stefancic, 2001). Most of the observable differences of statistical significance are in grades three, five, and eight which are commonly referred to as the gatekeeping grades. The state of Texas must examine the TEKS for cultural bias and implement a responsive set of curriculum standards that is culturally relevant (Ladson-Billings, 1995a). School districts must create a culturally responsive environment (Gay, 2000) that is centered on high expectations, academic rigor, care theory, critical thinking, and structures of success. When a teacher subscribes to culturally responsive practices, they inherently begin to problematize the influence of race and will begin to become responsive to the influence of race. Students of color must experience success in mathematics to have any hope of pursuing STEM careers which many times are higher paying than other careers.

Student's across each racial/ethnic groups scored better on objective one (numbers, operations, and quantitative reasoning), objective two (patterns, relationships, and algebraic reasoning) and objective four (measurement) in grades three through five than in grades six through eight. One possible reason for this is the movement from concrete forms of mathematics to more abstract forms (Chow, 2007; Jordan & Levine, 2009).

The critical examination of gender is limited due to the scope of gender categorization. Students in Texas are expected to identify as male or female with no opportunity to identify as intersex or the specific gender associated with intersex characteristics. Gender differences of statistical significance were not observed, but slight differences were observable across various grades and objectives. Female students' are participating in more advanced mathematics courses than in previous years and are scoring higher grades in mathematics and science courses than male students (Sadker & Zittleman, 2010). However, male students are still scoring higher on college entrance exams and are more likely to be on track for STEM careers (NEA, 2008).

The results of this study affirmed that female students' scores are increasing and that the performance gap across gender has reduced since 2004. Even though the data suggests that male and female students' are scoring more equivalent, there are slight differences present. Male students' scored slightly higher across most objectives in grades three through five and female students' scored slightly higher across most objectives in grades six through eight. Male and female students' are scoring slightly higher on objectives one (numbers, operations, and quantitative reasoning) and two (patterns, relationships, and algebraic reasoning) in grades three through five than in grades six through eight.

What is happening between grades five and six that is causing this "flip" in performance difference is a question to ponder. One explanation according to Sax 2005) and Gurian, Henley, and Trueman (2001) is that males are able to perform at higher levels in mathematics due to surges in testosterone and are more abstract thinkers than female students. Yet, the data from this study does not support that finding. As mathematics becomes more abstract, female students' are scoring higher mean scores across objectives than male students. Male students are also more likely to be expelled or suspended than female students' (Heitzeg, 2009; Sullivan, 2007) which directly influences the opportunities to learn mathematics for male students.

This study also examined the differences in performance across socioeconomic identifiers. Students' not identified as economically disadvantaged scored higher than all other groups across all objectives in 2004, 2007, and 2010. The highest number of occurrences of statistical significance was in grade three across all objectives except objective four (measurement) where students' identified as not economically disadvantaged scored significantly higher than students' receiving free meals across each objective except for objective four (measurement). After the third grade, the number of significant differences drastically reduced across all grades and objectives except for objective six (mathematical processes and tools).

Objective six (mathematical processes and tools) is expected to be the most challenging objective. Objective six (mathematical processes and tools) encompasses all other objectives and takes them to a more critical and rigorous level emphasizing problem solving. One option for addressing student's difficulty with objective six (mathematical processes and tools) would be to provide teachers with professional development on culturally responsive teaching objective six (mathematical processes and tools). Also, districts could allow for more room in the calendar for emphasizing objective six (mathematical processes and tools). Future diagnoses of students struggling with objective six (mathematical processes and tools) may be difficult because within the scope of STAAR this objective no longer stands alone. Objective six (mathematical processes and tools) is expected to be interwoven throughout all other objectives.

The construction of mathematical knowledge by students occurs in a cultural context (Gay, 2009; Ladson-Billings, 1995b; Moses & Cobb, 2001; Tate, 1997b). One method of addressing the performance differences across objectives in grades three through eight is through forms of cultural pedagogy. The scholarship of Ladson-Billings (1995b) and Gay (2000) have provided a framework of culturally relevant or culturally responsive pedagogy that is entrenched with authentic care, academic success, critical theories, and student empowerment. Schools should create a culturally responsive environment that acknowledges and embraces the cultural capital that students bring each day. Leonard (2008) has added to the scholarship on critical race theory and culturally responsive pedagogy in what is termed as "culturally specific pedagogy" (p.9) in mathematics. Leonard (2008) defines culturally specific pedagogy as the "intentional behavior by a teacher to use gestures, language, history, literature, and other cultural aspects of a particular race, ethnic, or gender group to engage students belonging to that group in authentic student-centered learning" (p. 9).

Mathematics curricular and instructional decision makers in Texas schools should examine their curriculum and instructional practices for racial/ethnic, gender, and class bias. According to the findings of this research study, curricula must become culturally relevant and teachers need to be trained through effective professional development activities in a critical cultural pedagogy such as culturally responsive pedagogy (Gay, 2000) or culturally specific pedagogy (Leonard, 2008) in mathematics.

Mathematics teacher educators should provide pre-service and in-service teachers with the appropriate resources to develop a conceptual framework that consists of critical race theory and culturally responsive pedagogy. It is critical that mathematics teacher education programs problematize issues regarding the multiple intersections of race/ethnicity, gender, socioeconomic status, and mathematics. The perception of mathematics by future educators must be one that acknowledges that culture is a critical component of mathematics and the teaching and knowledge construction of mathematics. Mathematics teacher education programs themselves must become culturally aware and culturally responsive to eradicate performance gaps.

The findings of this study suggest that the Texas Educational Agency needs to make more detailed data more easily accessible for administrators, teachers, and researchers. Data that take into account of multiple intersections of sociocultural variables would provide a better data set for a more in-depth analysis. Data segregated by a single identifier is very *essentialist* and do not acknowledge the importance of *intersectionality*.

Recommendations for Further Research

There are several implications for future research from this study. The findings of this study provide a foundation for a new strand of research in Texas mathematics education. Future research should address why Asian American and European American students' objective means are higher across all objectives and grades when compared to Native American, African American, and Latino/Latina/Hispanic American students'. Research is also needed that critically examines the influence of race/ethnicity in the Texas mathematics classrooms.

The findings of this study suggest that research regarding the experiences of female students in grades three through five and male students in grades six through eight are needed. What happens between the fifth and sixth grades that cause a one group to perform slightly higher than the other? Additional research is needed that explores at minimal the intersection of race/ethnicity, gender, and mathematics. No significant differences were observed between male and female students, but would this still be the case if race/ethnicity was included as a critical variable?

Research is also needed that explores the significant differences between students' identified as not economically disadvantaged and students' receiving free meals, specifically in the third grade across all objectives. Also, what happens in grades four through six on objective six that has caused a slight decline in mean scores across students from various socioeconomic backgrounds?

The findings of this study identified that students across all racial/ethnic groups, gender groups, and socioeconomic groups as performing slightly better on objectives one (numbers, operations, and quantitative reasoning) and two (patterns, relationships, and algebraic reasoning) in grades three through five than in grades six through eight. What changes between the fifth and sixth grades? Research that examines the curriculum, instructional methods, and mathematics knowledge construction processes would be beneficial in increasing student achievement. Students also seemed to struggle more on objective four (measurement) in grades seven and eight than in grades three through six. What happens during this transition? Research is desperately needed that explores the *intersectionality* of various groups of students and their mathematical achievement.

Concluding Remarks

The results of this study provide motivation for critical thought. Even when differences of statistical power were not observed, consistent differences of practical significance were observed across race/ethnicity, gender, and socioeconomic status. Why is there such a persistent performance gap in grades three, five, and eight which have traditionally been grades where students must pass the mathematics and reading TAKS test to be eligible for promotion? It appears that differential racialization is present through the means of the Texas state assessment program. Students' academic success directly influences life choices and life chances.

The Texas Education Agency (TEA) has used its power to maintain the invisibility of intersex students. Students are provided with only two choices, male or female which are not the only gender identifiable options. The ability to perform daily activities authentically influences ones' self-concept which can directly influence the performance of a student. At first sight it appears that significant performance differences across gender are non-existent. A closer examination identifies that gender is a critical variable in relation to students' performance on the TAKS test. There is a critical moment between grades five and six where differences flip.

Results from this study are very similar to the *Coleman Report* (1966) in that race and socioeconomic status are critical identifiers in achievement differences. This study highlighted that students' identified as receiving free meals, students paying a reduced fee for meals, and students' identified as other economically disadvantaged mean scores across all objectives are lower than students' identified as not economically disadvantaged. The number of significant differences is more noticeable in grade three than the other grades signifying that students' identified as not economically disadvantaged have an academic jumpstart on students' identified as receiving free meals, students' paying a reduced fee for meals, and students' identified as other economically disadvantaged.

The findings of this study suggest that racism and classism are still working persistently in the structures of society and education. Culturally responsive pedagogy or culturally specific pedagogy in mathematics is needed to problematize the bias that is pervading the educational system in Texas. Culturally responsive or specific pedagogy also centralizes students' needs and culture in the instructional process which should increase student performance and assist in eradicating the performance differences.

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APPENDIX A

EXTENDED REVIEW OF LITERATURE

The extended review of literature takes a more comprehensive look into the history of mathematics education in the United States and a more comprehensive review of the history of Texas achievement assessment programs. The extended review of literature also includes a more comprehensive review of critical race theory which guides the conceptual framework of the research study.

History of Mathematics Education in the United States

Mathematics education in the Unites States has an interesting history of struggles between various groups. The history of mathematics education can be categorized into specific time frames. The review of literature will briefly describe math education before 1950, followed by the New Math Movement, Back-to-Basics, Problem-Solving Movement, Standards Movement, and finally The New Millenium.

Mathematics education before 1950 can most easily be described as a time of organization. In 1893 and 1894, the committee of ten published reports recommending that mathematics curriculums should emphasize discipline and college preparation (Hertzberg, 1985). The committee of ten recommended that critical-thinking skills should be emphasized over rote memorization (Cushing, 1937). Between the late 1800s and 1950, several committees and organizations explored mathematics and mathematics education took form. Some organizations include: The College Entrance Examination Board, the Mathematical Association of America, and the National Council of Teachers of Mathematics (NCTM). In 1926, the Scholastic Aptitude Test (SAT) emerged as a college entrance exam.

The early 1900s also witnessed a struggle between what types of mathematics should be taught and who it should be taught to. Some believed that every person should be offered algebra, while progressive educators such as John Dewey and William Kilpatrick suggested that mathematics should emphasize life applicable concepts (Klein, 2003). During the 1940s, the military became concerned because military recruits struggled with basic mathematics calling the progressive influence into question (Klein, 2003).

By the 1950s, the progressive influence of mathematics education had fizzled. With the influence of war, atomic weapons, and the eventual launch of *Sputnik*, the United States witnessed the birth of the New Math Movement. Private and public funds were poured into mathematics and science education and research. Universities were also concerned about the lack of student interest and performance ability in mathematics (Kilpatrick, 1992). The “New Math” curriculum was created by university mathematicians and became a major influence in K-12 mathematics. In the elementary grades, the new curricula emphasized abstract mathematical concepts which included various topics such as operations and place value across different base systems, alternative algorithms, and set theory (Jones & Coxford, 1970). A primary goal of the new math movement was to move away from basic computations and toward the conceptual understanding of mathematical problems. The new math movement fizzled due to various reasons. Many teachers did not conceptually understand mathematics the way that university mathematicians did and because of the lack of productive professional development, teachers were ultimately ill-prepared to teach the new math curricula (Moon, 1986).

By the 1970s, there was a social push to move *back to the basics*. Instead of emphasizing abstract mathematical concepts in the elementary grades, teachers were to emphasize concrete understanding before the abstract. This transition was heavily influenced by the research of Jean Piaget (Adler, 1963). Schoenfeld (2004) states that "the curriculum returned to what it had been before: arithmetic in the 1st through 8th grades, algebra in the 9th grade, geometry in the 10th grade, a 2nd year of algebra and sometimes trigonometry in the 11th grade, and precalculus in the 12th grade" (p. 258). The back to the basics also emphasized computation and students were assessed by computational fluency and were often tracked by a presumed mathematical ability.

The 1980s witnessed the birth of the problem-solving movement. With the publications of *Agenda for the 80s* (NCTM, 1980) and *A Nation at Risk* (1983) emerged a desire to emphasize mathematics to problem solve instead of computational fluency. The National Research Council (NRC) created the Mathematical Sciences Education Board in 1985 to attend to issues of mathematics education (Schoenfeld, 2004). The NRC published *Everybody Counts* in 1989 that identified divisiveness in mathematics education and society citing that inequity exists across subgroups. The NRC responded by calling for a common core of national mathematics standards. The NCTM followed with the publication *Curriculum and Evaluation Standards for School Mathematics* (1989) which foreshadowed the standards movement of the 1990s.

The guiding principles of the standards published by NCTM (1989) were as follows: equity, curriculum, teaching, learning, assessment, and technology. The content standards were as follows: numbers and operations, algebra, geometry, measurement, and data analysis and probability. The following were the process standards: problem solving, reasoning and proof, communication, connections, and representation. The NCTM also published the *Professional Standards for Teaching Mathematics* (NCTM, 1991) and the *Assessment Standards for School Mathematics* (NCTM, 1995). The standards movement of the 1990s led the nation into the math wars (Shoenfeld, 2004). Many mathematical traditionalists became concerned that the new standards decreased attention to computation, rote practice and memorization, long division, teaching by telling, factoring, proofs, and graphing by hand (Schoenfeld, 2004).

Mathematics education in the new millennium continues to witness the math wars. The NCTM published the *Principles and Standards for School Mathematics* in 2000. The new standards combined the curriculum, teaching, and assessment into one document. The guiding principles, content standards, and process standards remain the same, but the new standards include specific expectations for pre-K through second grades, third through fifth grades, sixth through eighth grades, and ninth through twelfth grades. In 2006, NCTM published *Curriculum Focal Points* which emphasizes the importance of early arithmetic skill development and provides information on critical areas in pre-K through eighth grade mathematics education. The new millennium has also witnessed the passage of the *No Child Left Behind Act of 2001* which provided a vote of confidence to the standards movement.

History of Texas Achievement Assessments

Students in Texas public schools have participated in some form of statewide assessment of reading, writing, and mathematics since 1980 (TEA, 2002a). The first assessment was termed the Texas Assessment of Basic Skills (TABS) test and was a response to legislation passed in 1979. The criterion-referenced TABS was used as an assessment in grades three, five, and nine from 1980 until 1984 (Cruse & Twing, 2000). Since there was not a statewide curriculum in place to guide TABS, committees of Texas educators were formed to develop learning objectives that would be assessed. Students that did not pass the grade nine assessments in 1983 were required to retake the exam each year until they passed it or graduated (Cruse & Twing, 2000). Students that did not pass TABS before they graduated were not eliminated from receiving their diploma. The results of TABS was made available to the public; kicking off the high-stakes testing movement in Texas.

Following the TABS was the Texas Educational Assessment of Minimal Skills (TEAMS). TEAMS was also a criterion-referenced assessment that assessed reading, mathematics, and writing in grades one, three, five, seven, nine, and eleven that was administered from 1985 through 1989. Cruse and Twing (2000) acknowledge TEAMS was an attempt to move “from ‘basic skills competencies’ to ‘minimum’ basic skills” (p. 328). The vision behind TEAMS was that it would increase rigor and assess specific minimum skills from the proposed statewide curriculum (Cruse and Twing, 2009). One major difference between TABS and TEAMS was the exit level assessment. TEAMS exit level assessment was administered to eleventh grade students and by 1987 all students were required to pass the exit level assessment in order to receive their diploma.

The next criterion-reference statewide assessment was the Texas Assessment of Academic Skills (TAAS) which was administered from 1990 through 2002. TAAS was a major shift from the two previous assessments. TAAS emphasized academic skills instead of basic or minimal skills (TEA, 2002b). Academic skills would include an emphasis on problem solving and higher-order thinking in reading, mathematics, and writing. Texas used TABS and TEAMS to collect various forms of data such as curriculum and/or students skills, but data from TAAS was used for school accountability of student performance. TAAS data covered more depth and range of scores and statistics and was the first system to impose consequences on students, campuses, and districts for student performance. TAAS was also more difficult than previous assessments and had a broader focus on the state's essential elements (EE). Originally, TAAS was administered in the fall semester of the academic year, but in 1992 it moved to the spring semester. There were many changes to TAAS in 1993. Beginning in 1993, reading and mathematics would be assessed in grades three through eight, writing would be assessed in grades four and eight, and the exit level test was moved to the tenth grade. The Texas Learning Index (TLI) was created in 1994 to compare vertical achievement across grades to predict whether or not students were on the path to meeting TAAS exit level assessment expectations for reading and mathematics. Beginning in 1995, eighth grade students were assessed in science and social studies. TEA moved away from TAAS after the 2002 TAAS administrations to a new system of assessment and accountability known as Texas Assessment of Knowledge and Skills (TAKS).

TAKS was a product in response to a law passed by the Texas legislature in 1999 to once again increase rigor while eliminating acts of social promotion at certain grade levels. Reading is assessed in grades three through nine, English-language arts are assessed in grades ten and eleven and students in grades four and seven take the writing assessment (TEA, 2002a). Mathematics is assessed in grades three through eleven, while science is assessed in grades five, eight, ten, and eleven. Students are administered the social studies assessment in grades eight, ten, and eleven. Originally students in grade three were required to receive passing grades in reading and meet TAKS reading expectations in order to move to the fourth grade. Beginning in 2010, students in grade three were no longer required to meet TAKS reading expectation in order to be promoted to the fourth grade. Since the inception of TAKS, fifth and eighth grade students have been required to receive passing grades and meet TAKS reading and mathematics expectations in order to be promoted to the next grade. Students must earn sufficient high school credits and are required to meet TAKS expectations on the exit level TAKS reading, mathematics, science, social studies, and writing to receive their high school diploma. TEA is currently in the process of developing and implementing the next assessment and accountability system identified as the State of Texas Assessments of Academic Readiness (STAAR).

Texas is in the process of moving away from TAKS toward a new criterion-referenced program labeled as the State of Texas Assessments of Academic Readiness

(STAAR) beginning in spring 2012. STAAR is a product of House Bill 3 and is the foundation for a new accountability system for Texas public education (TEA, 2011a). TEA describes STAAR as a more rigorous assessment program that emphasizes career and college readiness. The content areas assessed in grades three through eight remain consistent with the content areas assessed under TAKS. However, STAAR assessments will emphasize the TEKS of the specific grade levels assessed to strengthen alignment of what is taught to what is tested. Grades five and eight science assessments will continue to test TEKS across multiple grades, but will emphasize the TEKS of the grade tested. TAKS grades five and eight science assessments uniformly address TEKS from multiple grades without a specific emphasis. In high school, STAAR will utilize End of Course (EOC) assessments in Algebra I, geometry, Algebra II, biology, chemistry, physics, English I, English II, English III, world geography, world history, and U.S. history instead of the current grade-specific assessments under the TAKS assessment program (TEA, 2011a). EOC assessments will emphasize the TEKS of the specific content area being assessed instead of multiple-grade TEKS. The STAAR assessment program and accountability system is still being developed. There are several expected changes for STAAR from TAKS.

STAAR is expected to implement a four hour time limit for both grades three through eight and EOC assessments. According to TEA (2011a), the implementation of a time limit is to align Texas testing practices with other assessments such as AP examinations, ACT, and SAT. Make-up testing for the STAAR program will be offered across all grades and content areas assessed. TEA is expected to extend Dyslexia accommodations beyond the eighth grade for the STAAR program. Linguistic accommodations are expected for most STAAR assessments instead of being limited to specific grades and content areas. There will be three levels of performance with the STAAR assessment program. Level one is considered unsatisfactory academic performance. According to TEA (2011b), unsatisfactory academic performance suggests that students do not demonstrate understanding of the assessed knowledge and skills for the specific content area and grade level and are unlikely to succeed at the next grade level or course. Level two is satisfactory academic performance which is used to describe students' performance on a STAAR assessment as indicating that the student is likely to be successful in the next grade level. Level three is advanced academic performance which is used to describe students' performance on a STAAR assessment as indicating that the student is well prepared for the next grade or course and is very likely to be successful in the next grade.

Critical Race Theory

This critical examination of TAKS mathematics data was conducted through a critical race lens. Critical Race Theory (CRT) situates race at the center of examining social issues in the United States (Delgado & Stefancic, 2001). Stemming from law studies examining race and racism, CRT has found its way into critiquing education. "CRT has also evolved from its early focus on African Americans and the impact of the law on Black–White relations, to examining how issues related to the law, immigration, national origin, language, globalization, and colonization are related to race" (Lynn & Parker, 2006, p. 263). Hartlep (2009) states that "CRT draws upon paradigms of intersectionality and recognizes that race and racism work in concert with and through gender, ethnicity, class, and/or sexuality inequalities/discrimination…" (p. 15). Delgado and Stefancic (2001) identified five tenets of CRT: 1) *racism is ordinary, not aberrational*; 2) *interest convergence* (Bell, 1980); 3) *race is socially constructed*; 4) *differential racialization*; and 5) *unique voice of color*.

The first tenet of CRT is that *racism is ordinary, not aberrational*. This is simply the way that society operates. Racism is so embedded in society that it is often difficult to identify, address, and eradicate. Racism is an ordinary function of society. Supporting *racism is ordinary* is the idea or stance of colorblindness (Delgado & Stefancic, 2001). Colorblindness allows people with racial or White privilege to operate daily with a clear racial consciousness. The underlying belief is that everyone has the same equal opportunity regardless of race. This belief provides a pathway of maintaining racial or White privilege of elitist influence in society.

The second tenet of CRT is *interest convergence*. Interest convergence, also identified as material determinism, derived from Derrick Bell's (1980) proposal that *Brown v. Board of Education* "may have resulted more from the self-interest of elite [W]hites than a desire to help [B]lacks" (Delgado & Stefancic, 2001, p. 7). Due to the fact that racism benefits both elites and working-class people, large groups of society are not inspired to truly eliminate racism. Within the tenet of interest convergence is that Whites and some people of color will only support progress toward an anti-racist society to the extent that it benefits them in some manner. Also, supporting the stance of equal opportunity is the false sense of meritocracy. Meritocracy allows the status quo—the ordinary—to maintain their sense of empowerment. Power is only relinquished when a person and/or an organization in power has nothing to lose (Hartlep, 2009).

The third tenet of CRT is that *race is socially constructed*. Race holds no biological or genetic reality to support racial categories. Racial categories are constructed, invented, manipulated, or retired when it is convenient or beneficial to some racial group (Delgado & Stefancic, 2001). Within this space of socially constructed races, groups with power produce belief systems—that are unsupported with valid scientific research—about other racial groups' personality, intelligence, and moral behavior. There are many historical social decisions in the United States to support the social construction of race. Some examples include, but are not limited to, the *Dred Scott v. Sandford* decision, the "one-drop rule", and the Bracero Program (Hartlep, 2009).

The fourth tenet is *differential racialization*. Delgado and Stefancic (2001) describe differential racialization as "the idea that each race has its own origins and ever evolving history" (p. 8). Differential racialization is how a society's dominant group racializes different groups of people at various times. This racialization occurs as a response to a shifting societal need, such as the labor market. At times, a certain racial group may be of high demand and viewed positively for their contributions, while at other times the same racial group will be stereotyped by the dominant group as being deficient or unfavorable. It should also be noted that differential racialization is closely related to the idea of intersectionality and anti-essentialism (Delgado & Stefancic (2001). Each person has an identity that intersects with multiple groups. A person's identity is not solely based upon one group's membership, but yet should be viewed as a unique identity with multiple group memberships.

Finally, the fifth tenet of CRT is the *unique voice of color*, or *storytelling/counter-storytelling*. Delgado and Stefancic (2001) state that "the voice of color thesis holds that because of their different histories and experiences with oppression, [B]lack, [Native American], Asian, and Latino/a writers and thinkers may be able to communicate to their [W]hite counterparts matters that the [W]hites are unlikely to know" (p. 9). Storytelling/counter-storytelling can provide a pathway to debunk what is presumed to be *master* narratives to include multiple voices and perspectives. There are some concerns about the *unique voice of color*. In many cases, the story of one person of color is signified to represent all people with that specific racial identity. Also, in many educational settings, multiple viewpoints are viewed as providing a neutral space for conversation, exploration, and education. Through a critical race lens, this is refuted. Structurally, the education system is created by the influence of White, middle-class values.

Embedded within the scope of these tenets are certain themes within CRT. Delgado and Stefancic (2001) identify some of the themes of CRT as: 1) *Interest Convergence, Material Determinism, and Racial Realism*; 2) *Revisionist History*; 3) *Critique of Liberalism*; and 4) *Structural Determinism*. Interest convergence, material determinism, and racial realism are philosophical underpinnings that separate many critical race scholars. Scholars that subscribe to interest convergence are identified as "idealists" and perceive racism and discrimination as a way of thinking and the attitude that one takes. Subscribers to material determinism identify that racism is a product of conquered nations. When a nation is conquered by another group, the new group will often demonize the original group in attempts to feel better about exploitation and conquering. Racial realists view racism as a system that allocates privilege and status dependent on one's race. There are certain benefits allocated to individuals who are located on the upper end of the hierarchy. Delgado and Stefancic (2001) identify that privileges may include access to the best jobs, best schools, and invitations to certain social gatherings.

Revisionist history is a theme embedded in CRT that "reexamines [US] America's historical record" (p. 20). During this process, many comforting interpretations of the history of the United States are replaced by the historical interpretations experienced by people of color. Another theme within CRT is the critique of liberalism. Critical race theorists deconstruct and examine the liberal framework to addressing racism. Many times the liberal framework allows one to take a color-blind stance. Critical race theorists believe that we must move beyond color blindness and examine the influence of race that is embedded in our social structures. Critical race theorists also critique liberalism's stance on rights. According to Delgado & Stefancic (2001) "rights are almost always procedural (to a fair process) rather than substantive (to food, housing, and/or education" (p. 23). The view of rights as procedural takes a stance of equality, equal opportunity for all, instead of supporting programs that would guarantee equal products.

One last theme to mention is structural determinism. Structural determinism is the idea that we cannot redress some of the various wrongs in our society due to the structure and vocabulary of the United States. One idea to support structural determinism is the pace of racial progress. The belief is that civil rights laws and enforcement of these laws occur at just the right slow pace (Delgado & Stefancic, 2001). If the pace is too slow, then oppressed groups would become impatient, likely to increase the likelihood of destabilization. A pace that is too fast would potentially “jeopardize important material and psychic benefits for elite groups” (p. 31).

APPENDIX B

MULTIPLE COMPARISONS

Between Groups: Statistically Significant Differences
(Race/Ethnicity across Objectives & Grade)
Key: Ethnicity/Race (Mean Difference, p-value)
Grades 3-5

Objective 6	Objective 5	Objective 4	Objective 3	Objective 2	Objective 1	
NA: AF(-.6333, p=.001), L(-.4, p=.023) **AS:** NA(-.9, p=.000), AF(-1.5333, p=.000), L(-1.3, p=.000), EA(-.4667, p=.008) **EA:** NA(-.4333, p=.014), AF(-1.667, p=.000) L(-.8333, p=.000)	**NA:** AF(-.2333, p=.002) **AS:** NA(-.2, p=.008), AF(-.4333, p=000), L(-.333, p=.000) **EA:** AF(-.3667, p=.000), L(-.2667, p=.001)	**NA:** AF(-.5667, p=.014) **AS:** AF(-.9333, p=.000), L(-.6, p=.010) **EA:** AF(-.7333, p=.002)	**NA:** AF(-.3, p=.001) **AS:** NA (-.4, p=.000), AF(-.7, p=.000), L(-.4333, p=.000), EA (-.233, .006) **L:**AF(-.2667, p=.002) **EA:** AF (-.4667, p=.000),L (-.2, p=.017)	**AS:** NA (-.5, p=.023), AF(-.8, p=.001), L(-.6, p=.006) **EA:** AF(-.4667,p=.035)	**AS:** NA(-.7667, p=.043), AF(-1.5, p=.000), L(-1.0667, p=.005) **EA:** AF(-1.1, p=.004)	**3rd Grade**
AS: AF(-1.5667, p=.001), L(-1.2333, p=.006) **EA:** AF(-1.1000, p=.014)	**AS:** AF(-.6000, p=.031)	**AS:** AF(-1.0333, p=.012)	**AS:** AF(-.8667, p=.001), L(-.5667, p=.025) **EA:** AF (-.6333, p=.012),	**AS:** NA (-.6, p=.023), AF(-.9333, p=.001), L(-.7333, p=.006) **EA:** (-.5667,p=.033)	**AS:** NA(-.8667, p=.017), AF(-1.5, p=.000), L(-1.0333, p=.005) **EA:** AF(-1.0333, p=.005)	**4th Grade**
NA: AF(-.7333, p=.038) **AS:** NA(-.7333, p=.038), AF(-1.4667, p=.000), L(-1.1000, p=.002) **EA:** AF(-1.0667, p=.003)	**AS:** NA(-.3333, p=.033), AF(-.6000, p=000), L(-.4333, p=.005) **EA:** AF(-.4000, p=.010)	**AS:** AF(-1.3667, p=.002), L(-1.0000, p=.019) **EA:** AF(-1.0000, p=.019)	**NA:** AF(-.5333, p=.018) **AS:** AF(-.9000, p=.000), L(-.5667, p=.012) **EA:** AF (-.6667, p=.004),	**AS:** AF(-1.2000, p=.004), L(-1.0000, p=.016) **EA:** AF(-.5667,p=.033)	**AS:** AF(-1.6333, p=.008), L(-1.2667, p=.043)	**5th Grade**

Between Groups: Statistically Significant Differences
(Race/Ethnicity across Objectives & Grade)
Key: Ethnicity/Race (Mean Difference, p-value)
Grades 6-8

Objective 6	Objective 5	Objective 4	Objective 3	Objective 2	Objective 1	
AS: NA(-.9667, p=.027), AF(-1.7333, p=.000), L(-1.3667, p=.002) **EA:** AF(-1.2000, p=.006)	**AS:** NA(-.6333, p=.016), AF(-1.0000, p=000), L(-.8667, p=.002) **EA:** AF(-.6333, p=.016)	**AS:** AF(-1.1667, p=023)	**AS:** AF(-1.1667, p=.035)	**AS:** AF(-1.9333, p=.026)	**AS:** AF(-2.0000, p=.004), L(-1.6667, p=.016)	**6th Grade**
AS: NA(-1.1000p=.012), AF(-1.8667, p=.000), L(-1.4333, p=.002) **EA:** AF(-1.3000, p=.003)		**AS:** NA(-.9000, p=.009), AF(-1.4000, p=.000), L(-1.1333, p=.002) **EA:** AF(-.9000, p=.009)	**AS:** AF(-1.3667, p=.013)	**AS:** AF(-2.3333, p=.009), L(-2.0000, p=.027)	**AS:** AF(-2.0000, p=.004), L(-1.6667, p=.014)	**7th Grade**
AS: NA(-1.3333, p=.038), AF(-2.0667, p=.002), L(-1.7667, p=.006) **EA:** AF(-1.4000, p=.028) L(-.8333, p=.000)	**AS:** AF(-1.3333, p=038)	**AS:** AF(-1.3000, p=.006), L(-1.1000, p=.019)	**NA:** AF(-.7667, p=.042) **AS:** AF(-1.4333, p=.000), L(-1.0333, p=.006) **EA:** AF (-1.1000, p=.003),	**AS:** NA (-1.4333, p=.003), AF(-2.2333, p=.000), L(-1.8333, p=.000) **EA:** AF(-1.3667,p=.034), L(-.9667 p=.045)	**AS:** AF(-2.3000, p=.013), L(-1.9333, p=.041)	**8th Grade**

Between Groups: Statistically Significant Differences
(Socioeconomic Status across Objectives & Grade)
Key: SES Identifier (Mean Difference, p-value)

Objective 6	**Objective 5**	**Objective 4**	**Objective 3**	**Objective 2**	**Objective 1**	
RM: FM(-.4000, p=.036), **NE:** FM(-1.0333, p=.000), RM(-.6333, p=.002), OE(-1.0667, p=.000)	**NE:** FM(-.2667, p=.000), RM(-.2000, p=.002) OE(-.2667, p=.000)		**RM:** FM(-.2000, p=.017) **NE:** FM(-.4000, p=.000), RM(-.2000, p=.017), OE(-.3000, p=.001)	**NE:** FM(-.4333, p=.037)	**NE:** FM(-.9000, p=.028)	**3rd Grade**
NE: FM(-.9667, p=.018), OE(-.9667, p=.018)					**NE:** FM(-.8333, p=.045)	**4th Grade**
NE: FM(-.9333, p=.010), OE(-.8667, p=.015)	**NE:** FM(-.3667, p=.044),		**NE:** FM(-.5000, p=.019)			**5th Grade**
NE: FM(-1.333, p=.014), OE(-1.0000, p=.017)						**6th Grade**
NE: FM(-1.0333, p=.027), OE(-.9667, p=.039)		**NE:** FM(-.7667, p=.015), OE(-.7667, p=.015)				**7th Grade**
				NE: FM(-1.2000, p=.031), OE(-1.1333, p=.042)		**8th Grade**

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