DIFFERENCES IN MATHEMATICS SKILLS OF TEXAS HIGH SCHOOL BOYS AS A FUNCTION OF ETHNICITY/RACE AND ECONOMIC STATUS: A MULTIYEAR STATEWIDE STUDY

A Dissertation

Presented to

The Faculty of the Department of Educational Leadership

Sam Houston State University

In Partial Fulfillment

of the Requirements for the Degree of

Doctor of Education

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by

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December, 2016

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DEDICATION

To my husband, Anthony Stephens, I thank him for his patience and understanding throughout this process. I am forever grateful for his unwavering love and support for it has have kept me grounded and focused. His commitment to our family has afforded me the opportunity to pursue my aspirations. The many days and nights he solely took care of our son Paul-Anthony during my extended nights of working, reading, and writing afforded me the opportunity to reach this educational goal. For these acts of kindness and understanding, I am eternally grateful.

ABSTRACT

Alford-Stephens, Tamika, *Differences in mathematics skills of Texas high school boys as a function of ethnicity/race and economic status: A multiyear statewide study.* Doctor of Education (Educational Leadership), December 2016, Sam Houston State University, Huntsville, Texas.

Purpose

The purpose of this journal-ready dissertation was to determine the extent to which ethnicity/race and economic status were related to the mathematics achievement of Texas high school boys. For the first journal article, the degree to which differences were present in overall mathematics achievement for high school boys by ethnicity/race (i.e., Asian, White, Hispanic, and Black) were examined. In the second investigation, differences in specific mathematics skills by ethnicity/race (i.e., Asian, White, Hispanic, and Black) for high school boys were determined. Finally, in the third study, the degree to which differences were present in specific mathematics skills between Black boys who were Extremely Poor, Moderately Poor, and Not Poor were examined. Eight years of archival data from the Texas Education Agency Public Education Information Management System were analyzed for each of these three investigations. Analyzing 8 years of Texas statewide data permitted a determination regarding the presence of trends in mathematics performance.

Method

For this multi-year quantitative study, a causal-comparative research design was used. Archival TAKS Exit Level Mathematics data previously obtained from the Texas Education Agency Public Education Information Management System for the 2004-2005 through the 2011-2012 school years were analyzed. The degree to which differences in mathematics achievement and skill development existed by ethnicity/race (i.e., Asian, White, Hispanic, and Black) and economic status was examined.

Findings

During the 2004-2005 through the 2011-2012 school years, large differences were identified in the mathematical competence of Texas high school boys by ethnicity/race (i.e., Asian, White, Hispanic, and Black) and level of poverty. For each year of this study, Asian boys outperformed White, Hispanic, and Black boys in overall mathematics achievement on the TAKS Exit Level Mathematics assessment. Asian boys also had statistically significant higher scores than White, Hispanic, and Black boys on each of the 10 TAKS Exit Level Mathematics Objectives for each year of this multi-year investigation. Black boys consistently had the lowest mathematics achievement and skill development, particularly Black boys who were Extremely Poor. Results of these empirical investigations were commensurate with the existing literature regarding ethnicity/race and economic status and their relationship to mathematics proficiency.

KEY WORDS: Economic status, Ethnicity/race, Texas Assessment of Knowledge and Skills Mathematics Test, Texas Assessment of Knowledge and Skills Mathematics Objectives

ACKNOWLEDGEMENTS

God has truly given me an extraordinary support system. My first teachers were my parents, Melvin Alford and Lena Kelly. I am so thankful God blessed me with the two of them. They taught me discipline, respect, and the value of family. The standards and expectations my parents established motivated me to never settle for mediocrity. Without their unconditional love and sacrifices, I would never have been able to embark upon this educational journey. They are the reason I am the woman I am today. My brother (Derrick) and sister (Shamel) are the best siblings I could have wished for. I am thankful for their commitment to keeping our families connected and understanding when I have missed family engagements.

I am also appreciative of my family members who have encouraged and prayed for me throughout this dissertation process. The words of wisdom from my Aunt Cordy and funny text messages from Mr. Gene often gave me the strength and motivation to complete my doctoral work when I felt weary. I am eternally grateful for the guidance received from my cousin James, the first member of the Alford family to acquire a doctorate degree. He is a true role model. He embraced life's challenges and demonstrated the ultimate display of perseverance when graduating from Columbia University with his Ph.D. He has defied odds and overcome many barriers to break cycles of generational curses.

Not many people can say they truly have friends that support them. I am fortunate to have an extended family of supporters. I am sincerely thankful for Alonda Jacks-Moorehead, Kimberly Pruitt, and Alexis Watts for being flexible, dependable, and always willing to help me with Paul-Anthony. Words cannot describe my appreciation for Kesha, Geri, and LilCharles, who have consistently encouraged me during this process. These friendships have been instrumental to the completion of this dissertation journey.

I would be remiss if I did not thank my Sam Houston State University family. My Cohort 32 classmates have made this experience endurable and enjoyable. They are truly awesome. Many thanks to my professors, who expanded my ways of thinking, allowed me to express myself freely, and helped me to develop and sharpen my skills as a writer and scholarly practitioner. I am appreciative of my committee members, Dr. Lunenburg and Dr. Moore, who have provided constructive feedback and guidance on my doctoral work. Dr. Slate and his assistance during this dissertation process are forever etched in my memory. He is invaluable. Words cannot express my gratitude for the time and effort he has spent reviewing my writing. He has been a true treasure throughout this dissertation process – I could never thank him enough.

Finally, special thanks to my husband Anthony and my son Paul-Anthony, who have shown the ultimate display of patience through this doctoral journey. They are my inspiration. For the two of them, I give my all. I hope I have made them proud.

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CHAPTER I

INTRODUCTION/BRIEF REVIEW OF THE LITERATURE

Education has been regarded as a vital component needed to achieve economic stability and to be a responsible citizen (Hout, 2012; Lewis, Cramer, Elliott, & Sprague, 2013). From early childhood until adulthood, most children are expected to attend school, learn the information being taught, pass performance assessments, and graduate from college. Though these expectations may seem simple and attainable, for some students these goals are difficult to accomplish.

Education is viewed as a vehicle that prepares students to become citizens with gainful employment. Unfortunately, some students are unable to acquire a quality education, which limits their economic and social mobility. According to the Achieve Policy Brief: The Building Blocks of Success (2008), accomplishments in school can increase the likelihood of college, workplace, and economic success. Similarly, positive relationships exist between mathematics achievement and lifelong success (Jordan, 2010). Despite researchers (e.g., Chambers, 2009; Davis, 2014; Flores, 2007) who have identified a need for students to have positive mathematics experiences, many educators continue to struggle with the challenges affiliated with educating diverse groups of students.

Economic status has been documented by many researchers (e.g., Garner & Miranda, 2001; Gutman & Midgley, 2000; Noguera, 2012) as an essential factor that can limit the ability to acquire a high quality education. According to the National Center for Education Statistics (2010), poverty level can greatly influence educational outcomes for young learners. Similarly, the Educational Testing Service (2011) reported that many children born into poverty attend inferior schools and have limited academic resources. As such, these students are more apt to struggle academically when compared to their counterparts not living in poverty.

To address the implications of poverty and its perceived influence on educational outcomes, the No Child Left Behind Act was passed by Congress in 2001. This bipartisan legislation sought to improve the academic achievement of all students by closing achievement gaps that exists between poor and minority students and their more affluent peers (Klein, 2015). Under the No Child Left Behind Act, states were required to test students in reading and mathematics as well as report student results by ethnic/racial group and economic status (Klein, 2015).

In 2003, Texas implemented the Texas Assessment of Knowledge and Skills (TAKS) as the state mandated assessment. This assessment allowed Texas to demonstrate compliance with the No Child Left Behind Act while increasing the expectations for students' academic performance. The TAKS exams were designed to measure students' knowledge and mastery of skills across multiple core content areas (e.g., Reading, Mathematics, Science, and Social Studies). Ideally, student success (or lack of) on the TAKS exams should have been representative of the alignment between curriculum and assessment. However, as evidenced by test scores in Texas, many children are not meeting the achievement standards. Specifically, the mathematics achievement for students living in poverty has been and remains problematic. Many school districts were not making adequate yearly progress as required by the federal accountability standards under the No Child Left Behind Act.

In 2007, Texas legislators expanded the scope of testing by removing the exit-level TAKS testing for Grade 11 students and requiring an End of Course assessment in English Language Arts, Science, Mathematics, and Social Studies (Clark, 2011). Afterwards, in 2009, House Bill 3 required a new assessment system be created for students in Grades 3-8 that connected to both the End Of Course tests and college readiness standards developed by the Texas Higher Education Coordinating Board. Responding to this challenge, in 2011 Texas restructured its required assessments to include alignment with college readiness standards and graduation requirements (Clark, 2011). The intentions behind this new exam, the State of Texas Assessment of Academic Readiness (STAAR), were to measure student preparedness for college and to reduce achievement gaps among ethnic/racial and economic subgroups (Clark, 2011).

Review of Literature for Mathematics Proficiency by Ethnicity/Race

For several decades, researchers (e.g., Alford-Stephens & Slate, 2016; Cooper & Schleser, 2006; Flores, 2007; Gaynor, 2012) have examined the mathematics achievement of Asian, White, Hispanic, and Black students. The quality of instruction, level of poverty, environmental conditions, and parental education and support has been regarded by various researchers (e.g., Alford-Stephens & Slate, 2016; Gardner & Miranda, 2001; Vega, Moore, & Miranda, 2015) as pivotal factors that can influence the acquisition of the knowledge and skills needed to be proficient in mathematics. Considering these complex constructs, many school districts work to ensure systems are in place to combat the struggles associated with teaching all students regardless of ethnic/racial group membership. Gaps in mathematics achievement among different ethnic/racial groups (i.e., Asian, White, Hispanic, and Black) have been a concern for several researchers (e.g., Alford-Stephens & Slate, 2016; Cooper & Schleser, 2006; Flores, 2007). Cooper and Schleser (2006) examined mathematics trend data reported by the National Center for Education Statistics for a sample of 9, 13, and 17-year-old students. White students consistently outperformed Black and Hispanic students over a 30-year period for each of the age groups. Similarly, Flores (2007) analyzed data from the National Assessment of Educational Progress and documented that in Grade 8 87% of Hispanic students and 91% of Black students were not proficient in mathematics. In contrast, Haycock (2006) determined that 53% of Asian students and 63% of White students were not proficient in mathematics. Further, The Education Trust (2006) reported that the average score on the National Assessment of Educational Progress exam for Grade 12 Hispanic and Black students was nearly equivalent to the average score of Grade 8 White students. These noted disparities in student achievement have been continuously documented across the United States.

Closing the academic performance gaps between Asian, White, Hispanic, and Black students has been the focus of numerous researchers (e.g., Alford-Stephens & Slate, 2016, Chambers, 2009; Cooper & Schleser, 2006; Flores, 2007; Gaynor, 2012; Hawley & Nieto, 2010; Salam & Sanandaji, 2011). According to Chambers (2009), disparities in mathematics achievement between different ethnic/racial groups can be attributed to educational inputs (e.g., caring and well-trained teachers, quality educational resources, and policies that promote social justice). Supporting this notion, Davis-Kean and Jager (2014) asserted that teacher competency and availability of resources can also influence the mathematics experiences of students. According to Davis-Kean and Jager (2014), Hispanic and Black students need educators who are able to engage and motivate students despite their personal circumstances or economic status. In contrast, Cooper and Schleser (2007) examined the cognitive developmental levels of White and Black students. In their study, White students scored statistically significantly higher than their Black counterparts on an assessment of mathematics achievement. Additionally, White students were in the concrete operational stage of cognitive development, whereas most Black students were in the preoperational phase of development. Cooper and Schleser (2007) concluded that when controlling for cognitive development level, the mathematics achievement gap was statistically non-existent. In a related study, Tomes (2008) also examined cognitive learning and development. An understanding of the cognitive learning styles of different ethnic/racial groups was determined to be essential in implementing instructional practices that improve mathematics skills and outcomes for all students.

Disparities in mathematics achievement among Asian, White, Hispanic, and Black students have been well documented in the United States. Specifically, the performance of boys by ethnic/racial groups has been the primary focus of some researchers (e.g., Alford-Stephens & Slate, 2016; Niederle & Vesterlund, 2010). In Texas, Asian and White boys continue to outperform their Hispanic and Black peers on state assessments (Texas Education Agency, 2015). Despite Hispanic students accounting for the majority (51%) of the state's student population, this group's mathematic achievement scores lag behind the scores of Asian and White students. Hispanic student performance, however, on state assessments exceeds the academic performance of Black students (Texas Education Agency, 2015).

The consequences of limited mathematics achievement can greatly influence future outcomes. Poorly developed mathematical skills and abilities can have a lasting influence on educational attainment and career advancement (Jordan, 2010). Harvey et al. (2013), in a statewide study in Texas over a 10-year period, analyzed the ACT test performance of students by ethnic/racial membership. The researchers documented that in 2011 the average ACT score of Asian (24.8) and White (23.2) students were at least 5 points higher than the average ACT score of Hispanic (18.5) and Black (17.5) students. Harvey et al. (2013) contended that many Black and Hispanic students were not prepared for the rigor of postsecondary expectations.

Given the body of research that exists on the relationship between successful mathematics achievement and economic stability, it is imperative that educational leaders agencies and policymakers generate and implement interventions with all ethnic/racial groups (i.e., Asian, White, Hispanic, and Black) to overcome mathematics achievement barriers. Keeping in mind that competency in mathematics is necessary for entry into science, technology, engineering, and mathematics careers and disciplines, low performing students need the support necessary to improve their mathematical skills and abilities (Achieve, 2008; National Council of Teachers of Mathematics, 2008). Consequently, this intervention and assistance could aid in reducing the persistent achievement gaps that exists among Asian, White, Hispanic, and Black students.

Review of Literature for Specific Mathematics Skills by Ethnic/Racial Membership

The knowledge and skills students are expected to possess before entering college has changed in recent years (Texas College and Career Readiness Standards, 2016). Students are expected to master a multitude of objectives and standards to demonstrate mathematical literacy. To assess the mathematical skill development of students throughout the United States, the National Assessment of Educational Progress is given to measure students' competence across five areas: (a) numbers, properties, and operations; (b) measurement; (c) geometry; (d) data analysis, statistics, and probability; and (e) algebra.

According to the National Center for Education Statistics (2015), 78% of Grade 12 Asian students and 73% of Grade 12 White students performed at the basic level on the National Assessment of Educational Progress mathematics assessment. Comparatively, only 47% of Grade 12 Hispanic Students and 36% of Grade 12 Black students scored at the basic level on the National Assessment of Educational Progress mathematics exam. Further, results from the 2015 National Assessment of Educational Progress mathematics assessment reflected that nearly all ethnic/racial groups (i.e., Asian, White, Hispanic, and Black) demonstrated low levels of mathematics proficiency. The percentage of Asian and White students who performed at the proficient level was 46% and 32% respectively. The percentage of Hispanic and Black students that scored at the proficient level was 12% and 7%, respectively. These results provide evidence of underdeveloped mathematical skills and abilities of Grade 12 students who are exiting high school and entering college or the workforce.

In Texas, the essential knowledge and skills students are expected to have a comprehensive understanding of are assessed through 10 objectives. On the Texas Assessment of Knowledge and Skills Mathematics test, students' Algebra I skill development is measured in Objectives 1 through 5, students' knowledge of geometry and measurement is assessed in Objectives 6 through 8, students' understanding of probability and statistics is measured in Objective 9, and students' ability to understand mathematical processes and tools is assessed in Objective 10. In an effort to prepare high school students better for college and career readiness, Texas modified its instructional standards. The House Bill 5 legislation passed in 2013 resulted in changes in the Texas high school curriculum and graduation requirements. Though the number of standardized assessments required for graduation was reduced, supporters of the legislation contend that the academic intensity and rigor have not diminished (Lee & Slate, 2013).

Review of Literature for Mathematics Skills by Economic Status for Black Boys

Living in poverty has a vast range of effects that adversely influence the lives of children. Burney and Beilke (2008) identified poverty as the most important risk factor that can influence achievement outcomes for students. "No racial or ethnic group is immune from poverty nor do they experience poverty in universal ways" (Burney & Beilke, 2008, p. 299). Given the degree to which poverty can affect student outcomes, many researchers (e.g., Alford-Stephens & Slate, 2016; Children's Defense Fund, 2015; Davis, 2014; Educational Testing Service, 2011) have conducted targeted investigations on poverty and its influence on the academic outcomes of children.

According to the Educational Testing Service (2011), circumstances created by poverty exacerbate the lives of many Black boys. As such, the need for intervention for Black boys has been recognized by several researchers (Davis, 2014; Educational Testing Service, 2011; Gardner & Miranda, 2001). In an effort to expand awareness of the struggles of Black boys, the Policy Evaluation and Research Center organized a symposium in which Black boys and their achievement gaps were addressed. Symposium presenters highlighted the role education, family, community, and poverty can have on the lives of Black boys. Further, strategies addressing the holistic needs of Black boys, particularly for Black boys in poverty, were shared at the conference.

To combat the challenges faced by Black boys living in poverty, the My Brother's Keeper initiative was created to confront the barriers associated with being impoverished. Specifically, this taskforce was created to improve early learning, school readiness, family engagement, college access, and economic opportunities for Black boys (United States Department of Education, 2016). Further, through this initiative, Black boys are provided mentorship and training to develop skills that will assist them in moving from poverty to the middle class and beyond.

According to the National Center for Education Statistics (2010), the poverty level of Black boys can greatly influence their mathematics achievement. Supporting this notion, Balfanz and Byrnes (2006) identified that many Black boys who were economically disadvantaged were not prepared for high school mathematics, thus limiting their ability to be academically successful. Further, the National Center for Education Statistics (2015) reported that children living in poverty during early childhood are associated with lower academic performance that extends through the high school years.

In an investigation conducted by Hernandez (2014), economic status and mathematics success were negatively related. As the percentage of students in poverty increased, the passing rate on the Florida Comprehensive Assessment Test in Mathematics decreased. Finding of this study further support the results of the Coleman Report (1968) which also identified economic status as the most powerful predictor of academic achievement (Kane, 2016).

Regardless of economic status, parents can be instrumental in the growth, development, and academic achievement of their children. According to Lee and Bowen (2006), parental involvement and educational attainment are positively related to children's educational performance and can mediate the effects of poverty. In their study of parental involvement, Lee and Bowen (2006) examined the degree to which different levels and types of parental involvement would result in different achievement outcomes among White, Hispanic, and Black students. For Black students, high levels of homework assistance from parents positively influenced academic achievement. On the contrast, lower levels of homework support from parents had a negative effect on student success.

In a related study, Joe and Davis (2009) analyzed the relationship of parental involvement with Black boys' school readiness and academic achievement. They examined information acquired from the Early Childhood Longitudinal Study on 1,616 Black boys and their guardians. Findings of the research were that when parents fostered and supported the development of their children's academic and social skills (e.g., participating in science related activities, explaining family's heritage), students were more likely to perform well on mathematics readiness assessments. Joe and Davis (2009) concluded that parental educational level, participation in academic activities, and beliefs about the value of education influenced their son's readiness for school.

Considering the importance of mathematical proficiency on future outcomes, many Black parents are seeking equitable educational opportunities for their children. In a study conducted by McGee and Spencer (2015), parental/family member support in mathematical skill development for Black students was analyzed. Further, the extent to which exposure to mathematics and mathematics related careers was also examined. McGee and Spencer (2015) discovered that (a) parents' perseverance, (b) parents instilling self-efficacy in their children, and (c) parents as mathematics educated role models to their children yielded positive mathematical achievement outcomes for their children. Additionally, McGee and Spencer (2015) noted that the multidimensional support some Black students receive from parents/family members is often not acknowledged or overlooked.

Despite economic obstacles and struggles, most parents want their children to be successful. Many parents recognize that having a quality education is essential to financial mobility and stability. As such, more parents are making purposeful decisions to ensure their children are prepared to compete with their peers academically and socially by making certain they are proficient in mathematics (Friend, Hunter, & Fletcher, 2011).

Many researchers (e.g., Eddy et al., 2015; National Council of Teachers of Mathematics, 2008) purport that Algebra is the gateway to secondary and post-secondary success. Consequently, the development of algebraic skills is needed during the elementary and middle school years (Knuth, Stephens, Blanton, & Gardiner, 2016). Eddy et al. (2015) asserted that algebraic thinking is essential in K-12 curriculum considering students are expected to demonstrate proficiency in algebra on state assessments. Similarly, Jeongeun, Jiyun, Des Jardins, and McCall (2015) stated that a thoroughly developed understanding of algebra is needed to have access to advanced educational and career opportunities.

Supporting this notion, the National Council of Teachers of Mathematics (2008) reported that completion of Algebra II is positively related with college readiness and future employment opportunities and career earnings. Additionally, the National Council of Teachers of Mathematics (2008) identified that Hispanic and Black students who had mathematics preparation at the Algebra II level graduated from college at higher rates than students who had not completed an Algebra II course. Speilhagan (2006) documented that students who enrolled in algebra courses as early as Grade 8 had improved mathematics achievement in comparison to their peers who had not enrolled in algebra courses.

Opportunities to improve and enhance mathematical achievement can be challenging for some students. According to Flores (2007) and Davis (2014), Hispanic and Black students have fewer opportunities to take high-level mathematics courses because of their limited mathematics achievement. Flores (2007) further noted that enrollment in Grade 8 mathematics courses greatly influenced the opportunity to take advanced mathematics courses before graduating from high school. In a comprehensive investigation on the link between middle school mathematics course placement and achievement, Domina (2014) analyzed Grade 8 student course placements. Grade 8 mathematics course placements were stratified by teacher assessment of student preparedness to learn and students' prior year test scores. Domina (2014) documented that the number of Black students enrolled in algebra was nearly half the amount of Asian students enrolled in algebra. The percentage of Hispanic students in algebra was greater than the percentage of White students enrolled in algebra. More White students, however, were enrolled in geometry or more advanced courses than were Hispanic students.

Noting the amount of attention given to mathematics, specifically algebra, and the mathematical skill deficiencies that exist for Asian, White, Hispanic, and Black students, it is imperative that all students have an opportunity to develop an understanding of various mathematical concepts. As referenced by Eddy et al. (2014) and the National Council of Teachers of Mathematics (2008), firm support systems and concentrated efforts are needed to ensure equity in mathematics education. Regardless of ethnicity/race, all students need to be able to have the opportunity to acquire adequate mathematical skills to compete with their peers, in addition to being college and career ready.

Statement of the Problem

Education is regarded as the gateway to financial stability and the pathway out of poverty. Without an education, the journey toward breaking the cycle of intergenerational poverty diminishes (Schott Foundation Report, 2010). Several researchers (e.g., Alford-Stephens & Slate, 2016; National Center for Education Statistics, 2010; Noguera, 2012) have documented that poverty can place children at an even greater risk of being academically unsuccessful. For Black boys, poverty can be the barrier that impedes academic and life-long success (Gardner & Miranda, 2001).

The educational plight of Black boys continues to be plagued by grade retentions, low achievement scores, low graduation rates, and limited college-readiness skills (Educational Testing Service, 2011; Gutman & Midgley, 2000). Consequently, Black boys are at an increased risk of dropping out of school, being unemployed, and living in poverty (Educational Testing Service, 2011). In fact, Black males have the highest dropout rate and incarceration rate when compared to White and Hispanic males. According to The Sentencing Project (2013), one in every three Black boys born today are more likely to go to prison in their lifetime in comparison to one in every six Hispanic males and one in every 17 White males.

Despite personal struggles and financial limitations, all students are expected to meet the established state achievement standards regardless of their race/ethnicity and economic status. However, many Black boys living in poverty are not prepared for the expectations of the academic setting (Bainbridge & Lasley, 2004). As such, these students lack the numeracy and literacy skills needed to be academically successful. The Educational Testing Service (2011) documented that only 12% of Grade 8 Black boys were proficient in mathematics as compared to 44% of Grade 8 White boys. This alarming statistic displays the severity of the skill deficits Black boys entering high school possess. Further, the lack of mathematical skill development for this group of at-risk youth increases their academic deficiencies and limits the likelihood for secondary and post-secondary success.

Noting the importance of mathematics on postsecondary success and the challenges Black boys in poverty are facing, the educational experiences and outcomes of these students has been the focus of many researchers (e.g., Alford-Stephens & Slate, 2016; Davis, 2014; Gardner & Miranda, 2001; Gutman & Midgley, 2000). The widening achievement gap and continuous poor academic performance of Black boys demonstrate the disparities that exist in the educational system. If specific reforms are not implemented to provide a better opportunity for Black boys to graduate from high school and acquire postsecondary training and education, poverty levels will continue to increase and the pathway to prison will be inevitable.

Purpose of the Study

The purpose of this journal-ready dissertation was to determine the extent to which ethnicity/race and economic status were related to the mathematics achievement of boys enrolled in Texas high schools. For the first journal article, the degree to which differences were present in overall mathematics achievement for high school boys by ethnicity/race (i.e., Asian, White, Hispanic, and Black) were examined. In the second investigation, differences in specific mathematics skills by ethnicity/race (i.e., Asian, White, Hispanic, and Black) for high school boys were determined. Finally, in the third study, the degree to which differences were present in specific mathematics skills between Black boys in extreme poverty, moderate poverty, and not in poverty were examined. Eight years of archival data from the Texas Education Agency Public Education Information Management System was analyzed for each of these three investigations. Analyzing 8 years of Texas statewide data permitted a determination regarding the presence of trends in mathematics performance.

Significance of the Study

Various factors have been offered as explanations for the gaps in mathematics achievement between ethnic/racial groups. However, many researchers (e.g., Alford-Stephens & Slate, 2016; Gardner & Miranda, 2001) believe economic status can have the most profound effect on student academic outcomes. For this study, differences in level of poverty (i.e., extreme poverty, moderate poverty, and not in poverty) by ethnicity/race and mathematics performance for all Texas high school boys who took the TAKS

Mathematics Exit-Level exam from 2004 through 2012 were analyzed. Findings from this study could increase educator awareness of the role economic status can have on the mathematics performance of students. Further, information reported in this study could be used to assist educators and policymakers with intervening and overcoming the challenges associated with educating children and parents in poverty. Perhaps the most significant part of this journal-ready dissertation was the specific delineations of achievement gaps in mathematics skills on the TAKS Mathematics exam. Although numerous researchers have documented the presence of gaps in mathematics skills by race/ethnicity, no research studies were located in which gaps on the TAKS Mathematics exam were documented.

Definition of Terms

Terms that are essential to the reader in understanding the context of this investigation are defined below.

Commended Performance

Commended Performance on the Texas Assessment of Knowledge and Skills indicates a student performed considerably above the state's passing standard. The student's passing rate demonstrated a thorough understanding of the knowledge and skills assessed at the exit level was acquired (Texas Education Agency, 2014**).**

Economic Status

A student can be identified as economically disadvantaged or not economically disadvantaged. According to the Texas Education Agency Academic Excellence Indicator System (AEIS) Glossary (2012), "the percent of economically disadvantaged students is calculated as the sum of the students coded as eligible for free or reduced-price lunch or eligible for other public assistance, divided by the total number of students." The National School Lunch program provides free or reduced priced meals to public school students based on their identified economic status. The United States Department of Agriculture (2016) identifies a student as eligible for free lunch if the household income is at or below 130 percent of the federal poverty guideline. Students whose household income is between 130 and 185 percent of the federal poverty guideline are eligible for reduced-priced meals (United States Department of Agriculture, 2016). For the purpose of this study, students who were eligible for the free lunch program were identified as extremely poor. Students who were eligible for the reduced price lunch program were identified as moderately poor.

Ethnicity/Race

Ethnicity/race is the group and origin with which an individual self-identifies. An individual can self-identify as American Indian, Asian, Black, Hispanic, Hawaiian/Pacific Islander, or White (Texas Education Agency, 2014). For the purpose of this study, the mathematics achievement of boys who identify as Asian, Black, Hispanic, and White boys were examined.

Higher Education Readiness Component

The Higher Education Readiness Component is a performance standard that identifies whether students who took the Texas Assessment of Knowledge and Skills are prepared for college level course work. The Higher Education Readiness Component performance standard serves as the criterion for receiving dual high school and college level course work credit (Pearson Educational Measurement, 2006).

Met Standard

The Met Standard identifies that a student performed at or above the state passing standard on the Texas Assessment of Knowledge and Skills examination (Texas Education Agency, 2014). Performance on this Met Standard is either the student did or did not meet the minimal score.

Texas Assessment of Knowledge and Skills Mathematics Test

The Texas Assessment of Knowledge and Skills mathematics test assesses a student's knowledge and understanding of 10 mathematics objectives. Prior to the recent change to the State of Texas Assessment of Academic Readiness test, students had to pass the Texas Assessment of Knowledge and Skills Mathematics examination to receive a diploma from a Texas public school (Texas Education Agency, 2007).

Texas Assessment of Knowledge and Skills Mathematics Objective 1- Foundations for Functional Relationships

Foundations for Functional Relationships measure a student's ability to understand and draw conclusions about pairs of numbers where the value of one number depends on the value of the other number (Texas Education Agency, 2007). A thorough understanding of Objective 1 demonstrates a student can (a) describe independent and dependent quantities in functional relationships; (b) gather record and use data sets to determine functional relationships between quantities; (c) describe functional relationships for given problem situations and write equations or inequalities to answer questions arising from the situations; (d) represent relationships among quantities using concrete models, tables, graphs, diagrams, verbal descriptions, equations, and inequalities; and (e) interpret and make decisions, predictions, and critical judgments from functional relationships (Texas Education Agency, 2007). This objective is measured with 5 test questions.

Texas Assessment of Knowledge and Skills Mathematics Objective 2- Properties and Attributes of Functions

Properties and Attributes of Functions measure a student's ability to understand and solve linear, algebraic, and quadratic equations (Texas Education Agency, 2007). A comprehensive understanding of Objective 2 signifies that a student can (a) identify and sketch the general forms of linear ($y = x$) and quadratic ($y = x^2$) parent functions; (b) identify mathematical domains and ranges and determine reasonable domain and range values for given situations, both continuous and discrete; (c) interpret situations in terms of given graphs or create situations that fit given graphs; and (d) collect and organize data, interpret scatterplots (including recognizing positive, negative, or no correlation for data approximating linear situations), and model, predict, and make decisions and critical judgments in problem situations (Texas Education Agency, 2007). Objective 2 is measured with 5 test questions.

Texas Assessment of Knowledge and Skills Mathematics Objective 3- Linear Functions

Linear Functions measure a student's ability to understand how linear functions are equations that can be represented by a line on a graph (Texas Education Agency, 2007). Measured in Objective 3 is a student's ability to (a) develop the concept of slope as rate of change and determine slopes from graphs, tables, and algebraic representations; (b) interpret the meaning of slope and intercepts in situations using data, symbolic representations, or graphs; (c) investigate, describe, and predict the effects of changes in *m* and *b* on the graph of $y = mx + b$; (d) graph and write equations of lines given characteristics such as two points, a point and a slope, or a slope and *y*-intercept; (e) determine the intercepts of the graphs of linear functions and zeros of linear functions from graphs, tables, and algebraic representations; and (f) interpret and predict the effects of changing slope and *y*-intercept in applied situations (Texas Education Agency, 2007). This objective is measured with 5 test questions.

Texas Assessment of Knowledge and Skills Mathematics Objective 4- Linear Equations and Inequalities

Linear Equations and Inequalities measure a student's ability to organize problems into equations and inequalities to find solutions to problems (Texas Education Agency, 2007). A student's understanding of Objective 4 demonstrates the ability to (a) analyze situations involving linear functions and formulate linear equations or inequalities to solve problems; (b) investigate methods for solving linear equations and inequalities using models, graphs, and the properties of equality, select a method, and solve the equations and inequalities;(c) interpret and determine the reasonableness of solutions to linear equations and inequalities; and (d) analyze situations and formulate systems of linear equations in two unknowns to solve problems (Texas Education Agency, 2007). Objective 5 is measured with 5 test items.

Texas Assessment of Knowledge and Skills Mathematics Objective 5- Quadratic and Other Nonlinear Functions

Quadratic and Other Nonlinear Functions measure a student's ability to understand quadratic functions and solve real-life problems involving quadratic equations (Texas Education Agency, 2007). In Objective 5 a student is expected to (a) investigate, describe, and predict the effects of changes in *a* on the graph of $y = ax^2 + c$;(b) investigate, describe, and predict the effects of changes in *c* on the graph of $y = ax^2 + c$; (c) analyze graphs of quadratic functions and draw conclusions; (d) solve quadratic equations using models, tables, graphs, and algebraic methods; and (e) make connections among the solutions (roots) of quadratic equations, the zeros of their related functions, and the horizontal intercepts (*x*-intercepts) of the graph of the function (Texas Education Agency, 2007). This objective is measured with5 test questions.

Texas Assessment of Knowledge and Skills Mathematics Objective 6- Geometric Relationships and Spatial Reasoning

Geometric Relationships and Spatial Reasoning measure a student's ability to understand how geometric shapes and properties can be used to solve everyday problems (Texas Education Agency, 2007). In Objective 6 a student is expected to (a) select an appropriate representation (pictorial, graphical, verbal, or symbolic) in order to solve problems; (b) use numeric and geometric patterns to develop algebraic expressions representing geometric properties; (c) use numeric and geometric patterns to make generalizations about geometric properties; (d) use properties of transformations and their compositions to make connections between mathematics and the real world; and (e) identify and apply patterns from right triangles to solve meaningful problems (Texas Education Agency, 2007). Objective 6 is measured with 7 test questions.

Texas Assessment of Knowledge and Skills Mathematics Objective 7- Two and Three Dimensional Shapes and Relationships

Two and Three Dimensional Shapes and Relationships measure a student's ability to understand how two and three dimensional shapes are represented and understand how to use slope to demonstrate geometric relationships (Texas Education Agency, 2007). A thorough understanding of Objective 7 demonstrates a student can (a) use orthographic and isometric views of three-dimensional geometric figures to represent and construct three-dimensional geometric figures and solve problems; (b) use one and two-dimensional coordinate systems to represent points, lines, rays, line segments, and figures;(c) use slopes and equations of lines to investigate geometric relationships, including parallel lines, perpendicular lines, and segments of triangles and other polygons; and (d) derive and use formulas involving length, slope, and midpoint (Texas Education Agency, 2007). This objective is measured with 7 test questions.

Texas Assessment of Knowledge and Skills Mathematics Objective 8- Concepts and Uses of Measurement

Concepts and Uses of Measurement measure a student's ability to understand and apply multiple uses of measurement such as surface area, volume, and perimeter (Texas Education Agency, 2007). A comprehensive understanding of Objective 8 demonstrates a student can (a) find areas of regular polygons, circles, and composite figures; (b) find areas of sectors and arc lengths of circles using proportional reasoning; (c) derive, extend, and use the Pythagorean Theorem; (d) find surface areas and volumes of prisms, pyramids, spheres, cones, cylinders, and composites of these figures in problem situations; and (e) use ratios to solve problems involving similar figures (Texas Education Agency, 2007). Objective 8 is measured with 7 test questions.

Texas Assessment of Knowledge and Skills Mathematics Objective 9- Percents, Proportional Relationships, Probability, and Statistics

Percents, Proportional Relationships, Probability, and Statistics measure a student's ability to understand these concepts in conjunction with central tendency and graphs (Texas Education Agency, 2007). Measured in Objective 9 is a student's ability to (a) estimate and find solutions to application problems involving percents and other proportional relationships, such as similarity and rates; (b) find the probabilities of dependent and independent events; (c) use theoretical probabilities and experimental results to make predictions and decisions; (d) select the appropriate measure of central tendency or range to describe a set of data and justify the choice for a particular situation; and (e) recognize misuses of graphical or numerical information and evaluate predictions and conclusions based on data analysis (Texas Education Agency, 2007). Objective 9 has 5 test questions.

Texas Assessment of Knowledge and Skills Mathematics Objective 10- Mathematical Processes and Tools

Mathematical Processes and Tools measure a student's ability to demonstrate his/her understanding of problem-solving strategies using tools such as rulers, graphs, tables, formulas, and calculators (Texas Education Agency, 2007). In Objective 10 a student is expected to (a) identify and apply mathematics to everyday experiences, to activities in and outside of school, with other disciplines, and with other mathematical topics; (b) use a problem-solving model that incorporates understanding the problem, making a plan, carrying out the plan, and evaluating the solution for reasonableness; (c) select or develop an appropriate problem-solving strategy from a variety of different types, including drawing a picture, looking for a pattern, systematic guessing and checking, acting it out, making a table, working a simpler problem, or working backwards to solve a problem; (d) communicate mathematical ideas using language, efficient tools, appropriate units, and graphical, numerical, physical, or algebraic mathematical models; and (e) validate conclusions using mathematical properties and relationships (Texas Education Agency, 2007). Objective 10 is measured with 9 test questions.

Procedures

Prior to acquiring approval from the Sam Houston State University Institutional Review Board, approval was acquired from the researcher's doctoral dissertation committee. After both approvals were received, data that had been acquired previously from the Texas Education Agency Public Education Information Management System for all Texas high school students were analyzed. A Public Information Request form was previously submitted for these data. Data that were provided in response to the previously submitted and fulfilled Public Information Request were analyzed by Wright (2015) in his doctoral dissertation regarding reading skills. The mathematics achievement data present in that dataset had not been analyzed. In each of the three empirical investigations in this journal-ready dissertation, variables from this archival dataset that were analyzed were student ethnicity/race, economic status, gender, TAKS Exit-level Mathematics overall performance, and the 10 TAKS Mathematics performance objectives.

Literature Review Search Procedures

To create a systematic process for review of the relevant literature, key search terms and the number of articles generated were recorded to document the literature review process (See Figure 1). An extensive amount of research has been conducted on gaps in student academic achievement. A considerable amount of that research has focused on academic achievement among different ethnic/racial groups and their related economic status. For this journal-ready dissertation, literature regarding mathematics skills and achievement by ethnicity/race and economic status for Texas high school boys was examined.

Searches were conducted through the EBSCO Host and Pro Quest databases for academic journals that contained scholarly peer reviewed articles. Article abstracts were read and stored by key terms. Following this process, relevant and pertinent articles were read and selected if the article focused on mathematics achievement and mathematical skill development for boys, secondary success, economic status, poverty, parental support, or achievement gaps among Asian, White, Hispanic, and Black boys.

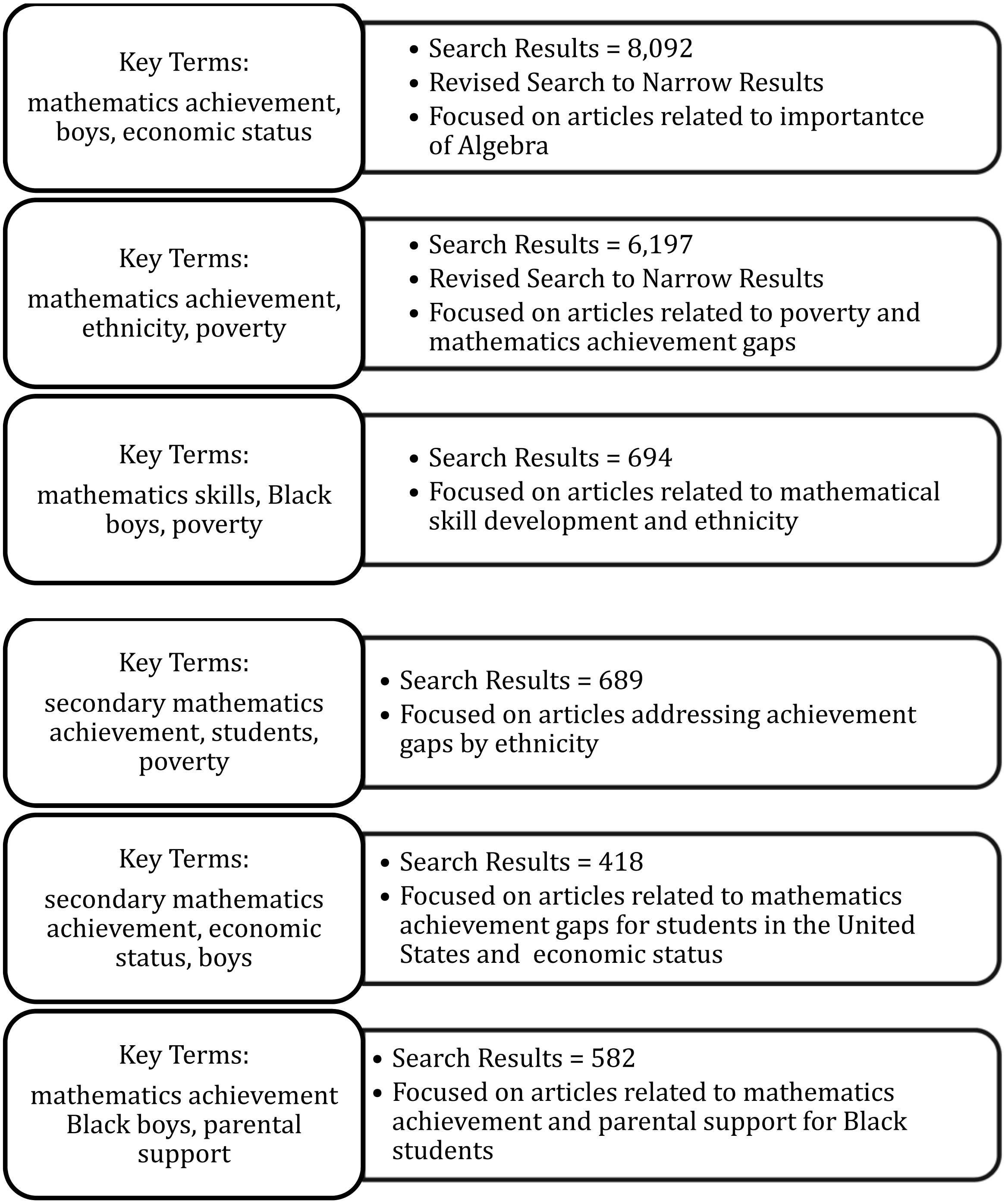

Figure 1. Overview of the literature review process.

Delimitations

For this study, mathematics achievement was defined by scores provided on the TAKS Exit-Level Mathematics exam. A second delimitation was that scores for only boys enrolled in Texas high schools were examined. Only the four ethnic/racial groups (i.e., Asian, White, Hispanic, and Black) had data that were analyzed in this journal-ready dissertation. For these four major ethnic/racial groups, the three TAKS Mathematics performance measures (e.g., Met Standard, Commended Performance, and Higher Education Readiness Standard), along with raw scores on the 10 TAKS Mathematics objectives, were examined only for the 2004-2005 through the 2011-2012 school years. As such, these performance measures may not provide results that generalize to other ways of assessing mathematics.

Readers should note that the TAKS is no longer the state-mandated assessment. In its place, students take the State of Texas Assessment of Academic Readiness and End of Course exams. Due to issues with the implementation of these two assessments, a decision was made to not use their data until such time as they had both been implemented properly. Accordingly, the degree to which TAKS results would be generalizable to results on the new state-mandated assessments is not known.

Limitations

In this research investigation, TAKS Exit-Level Mathematics assessment data were analyzed. As such, the only data used to measure mathematics proficiency were quantitative and from the Texas state-mandated assessment. Any difficulties with the score reliabilities and score validities from this state-mandated assessment could influence the results of this journal-ready dissertation. Using a norm-referenced standardized assessment of mathematics skills, rather than other methods such as a criterion-referenced assessment, provides a limitation on how mathematics skills are defined. Given the causal-comparative research design present in this journal-ready dissertation, the ability to make cause and effect interpretations is not possible. Furthermore, the analysis of archival data in the three articles in this journal-ready dissertation does not allow any variables to be controlled. As such, the degree to which results from this journal-ready dissertation would be generalizable is limited.

Assumptions

For this journal-ready dissertation, the assumption was made that the mathematics achievement data, gender, economic status, and ethnicity/race data in the Public Education Information Management System were accurately reported. Further, the manner in which Texas high schools collect and report student data were assumed to be consistent and accurate statewide. Additionally, an assumption of this study was that the validity and consistency in which the Texas Assessment of Knowledge and Skills Exit-Level Mathematics scores were collected from high schools throughout Texas were in alignment with the state of Texas guidelines. Any deviations from these assumptions could result in inaccuracies in the results.

Organization of the Study

In this journal-ready dissertation, three independent research studies were conducted. For the first journal-ready dissertation article, the degree to which differences were present in overall mathematics achievement for Texas high school boys by ethnicity/race (i.e., Asian, White, Hispanic, and Black) was examined. In the second journal-ready dissertation article, differences in specific mathematics skills by ethnicity/race (i.e., Asian, White, Hispanic, and Black) for Texas high school boys were evaluated. Finally, for the third journal-ready dissertation article, the degree to which differences were present in specific mathematics skills between Black boys in extreme poverty, moderate poverty, and not in poverty were analyzed.

This journal-ready dissertation is comprised of five chapters. Chapter I includes the background of the study, statement of the problem, purpose of the study, significance of the study, definition of terms, delimitations, limitations, assumptions and outline of the journal-ready dissertation. Chapter II included the framework for the first journal-ready dissertation investigation on differences in overall mathematics achievement for high school boys by racial/ethnic group. In Chapter III, the framework for the second journal-ready research investigation on differences in specific mathematics skills was discussed. Chapter IV included the third journal-ready research investigation on differences in specific mathematics skills with regard to economic status. Lastly, in Chapter V, an overview of the results interpreted in the three research articles was provided. Further, implications for policy and practice improvements along with recommendations for future research obtained from the three research articles were provided.

CHAPTER II

DIFFERENCES IN MATHEMATICS ACHIEVEMENT OF TEXAS HIGH SCHOOL BOYS AS A FUNCTION OF ETHNICITY/RACE: A MULTIYEAR STATEWIDE STUDY

This dissertation follows the style and format of *Research in the Schools (RITS)*.

Abstract

Investigated in this study was the extent to which differences were present in overall mathematics achievement for Texas high school boys by their ethnicity/race (i.e., Asian, White, Hispanic, and Black). Statewide data were obtained from the Texas Education Agency Public Education Information Management System on all high school boys for the 2004-2005 through the 2011-2012 school years. Inferential statistical procedures yielded statistically significant differences for all 8 school years. For each of the mathematics proficiency levels (i.e., Met Standard, Commended Performance, Higher Education Readiness Component), a stair-step effect was present. Asian boys outperformed White, Hispanic, and Black boys in all school years, with one exception in which Asian and White boys had similar proficiency levels. In all 8 school years, Black boys had the poorest mathematics achievement on each proficiency level, with Hispanic boys having the next poorest mathematics proficiency. Implications are discussed and suggestions for policy and practice are made.

Key words: Ethnicity/race, Met Standard, Commended Performance, Higher Education Readiness Component

DIFFERENCES IN MATHEMATICS ACHIEVEMENT OF TEXAS HIGH SCHOOL BOYS AS A FUNCTION OF ETHNICITY/RACE: A MULTIYEAR STATEWIDE STUDY

Education is viewed as a vehicle that prepares students to become citizens with gainful employment. Unfortunately, some students are unable to acquire a quality education, which limits their economic and social mobility. According to the Achieve Policy Brief: The Building Blocks of Success (2008), accomplishments in school can increase the likelihood of college, workplace, and economic success. Similarly, positive relationships exist between mathematics achievement and lifelong success (Jordan, 2010). Despite researchers (e.g., Chambers, 2009; Davis, 2014; Flores, 2007) who have identified a need for students to have positive mathematics experiences, many educators continue to struggle with the challenges affiliated with educating diverse groups of students.

Mathematics Achievement

For several decades, researchers (e.g., Alford-Stephens & Slate, 2016; Cooper & Schleser, 2006; Flores, 2007; Gaynor, 2012) have examined the mathematics achievement of Asian, White, Hispanic, and Black students. The quality of instruction, level of poverty, environmental conditions, and parental education and support has been regarded by various researchers (e.g., Alford-Stephens & Slate, 2016; Gardner & Miranda, 2001; Vega, Moore, & Miranda, 2015) as pivotal factors that can influence the acquisition of the knowledge and skills needed to be proficient in mathematics. Considering these complex constructs, many school districts work to ensure systems are in place to combat the struggles associated with teaching all students regardless of ethnic/racial group membership. Gaps in mathematics achievement among different ethnic/racial groups (i.e., Asian, White, Hispanic, and Black) have been a concern for several researchers (e.g., Alford-Stephens & Slate, 2016; Cooper & Schleser, 2006; Flores, 2007). Cooper and Schleser (2006) examined mathematics trend data reported by the National Center for Education Statistics for a sample of 9, 13, and 17-year-old students. White students consistently outperformed Black and Hispanic students over a 30-year period for each of the age groups. Similarly, Flores (2007) analyzed data from the National Assessment of Educational Progress and documented that in Grade 8 87% of Hispanic students and 91% of Black students were not proficient in mathematics. In contrast, Haycock (2006) determined that 53% of Asian students and 63% of White students were not proficient in mathematics. Further, The Education Trust (2006) reported that the average score on the National Assessment of Educational Progress exam for Grade 12 Hispanic and Black students was nearly equivalent to the average score of Grade 8 White students. These noted disparities in student achievement have been continuously documented across the United States.

Rationale for Mathematics Achievement Gaps

Closing the academic performance gaps between Asian, White, Hispanic, and Black students has been the focus of numerous researchers (e.g., Alford-Stephens & Slate, 2016, Chambers, 2009; Cooper & Schleser, 2006; Flores, 2007; Gaynor, 2012; Hawley & Nieto, 2010; Salam & Sanandaji, 2011). According to Chambers (2009), disparities in mathematics achievement between different ethnic/racial groups can be attributed to educational inputs (e.g., caring and well-trained teachers, quality educational resources, and policies that promote social justice). Supporting this notion, Davis-Kean and Jager (2014) asserted that teacher competency and availability of resources could also influence the mathematics experiences of students. According to Davis-Kean and Jager (2014), Hispanic and Black students need educators who are able to engage and motivate students despite their personal circumstances or economic status. In contrast, Cooper and Schleser (2007) examined the cognitive developmental levels of White and Black students. In their study, White students scored statistically significantly higher than their Black counterparts on an assessment of mathematics achievement. Additionally, White students were in the concrete operational stage of cognitive development, whereas most Black students were in the preoperational phase of development. Cooper and Schleser (2007) concluded that when controlling for cognitive development level, the mathematics achievement gap was statistically non-existent. In a related study, Tomes (2008) also examined cognitive learning and development. An understanding of the cognitive learning styles of different ethnic/racial groups was determined to be essential in implementing instructional practices that improve mathematics skills and outcomes for all students.

Implications of Poor Mathematics Achievement

Disparities in mathematics achievement among Asian, White, Hispanic, and Black students have been well documented in the United States. Specifically, the performance of boys by ethnic/racial groups has been the primary focus of some researchers (e.g., Alford-Stephens & Slate, 2016; Niederle & Vesterlund, 2010). In Texas, Asian and White boys continue to outperform their Hispanic and Black peers on state assessments (Texas Education Agency, 2015). Despite Hispanic students accounting for the majority (51%) of the state's student population, this group's mathematic achievement scores lag behind the scores of Asian and White students. Hispanic student performance, however, on state assessments exceeds the academic performance of Black students (Texas Education Agency, 2015).

The consequences of limited mathematics achievement can greatly influence future outcomes. Poorly developed mathematical skills and abilities can have a lasting influence on educational attainment and career advancement (Jordan, 2010). Harvey et al. (2013), in a statewide study in Texas over a 10-year period, analyzed the ACT test performance of students by ethnic/racial membership. The researchers documented that in 2011 the average ACT score of Asian (24.8) and White (23.2) students were at least 5 points higher than the average ACT score of Hispanic (18.5) and Black (17.5) students. Harvey et al. (2013) contended that many Black and Hispanic students were not prepared for the rigor of postsecondary expectations.

Given the body of research that exists on the relationship between successful mathematics achievement and economic stability, it is imperative that educational leaders, agencies, and policymakers generate and implement interventions with all ethnic/racial groups (i.e., Asian, White, Hispanic, and Black) to overcome mathematics achievement barriers. Keeping in mind that competency in mathematics is necessary for entry into science, technology, engineering, and mathematics careers and disciplines, low performing students need the support necessary to improve their mathematical skills and abilities (Achieve, 2008; National Council of Teachers of Mathematics, 2008). Consequently, this intervention and assistance could aid in reducing the persistent achievement gaps that exists among Asian, White, Hispanic, and Black students.

Statement of the Problem

The achievement gap that exists among students continues to be a concern for educators, policymakers, and parents (ETS Addressing Achievement Gaps Symposium, 2011). Many researchers (e.g., Carpenter & Ramirez, 2007; Cooper & Schleser, 2006; Hall, Davis, Bolen, & Chia, 1999) have attempted to explain the differences in academic performance between Asian, White, Hispanic, and Black students. These researchers have asserted that factors such as student economic status, English language acquisition, and teacher quality may influence student academic success.

To reduce achievement disparities, students need to receive quality instructional and educational experiences so that learning gaps can diminish (Gaynor, 2012). For many students, the cumulative effects of years of unequal opportunities, unsupportive systems, and expanding achievement gaps are revealed during the high school years (ETS Addressing Achievement Gaps Symposium, 2011). According to the Nation's Report Card (2013), the Black-White achievement gap for Grade 12 students continues to be unacceptably large (30 point scale score difference). Similarly, the achievement gap (21 point scale score difference) between Hispanic and White students is unacceptably large (Nation's Report Card, 2013). In contrast, Asian students continue to outperform their White, Hispanic, and Black counterparts, particularly in mathematics (Capraro et al., 2009). Therefore, regardless of racial/ethnic membership, improving the learning academic achievement for low performing students should be a central focus of educational systems so that the existing achievement gaps are reduced.

Purpose of the Study

The purpose of this study was to determine the degree to which differences were present in overall mathematics achievement by ethnicity/race (i.e., Asian, White, Hispanic, and Black) for Texas high school boys. Specifically addressed was basic proficiency in mathematics (i.e., the Met Standard), advanced proficiency in mathematics (i.e., the Commended Performance), and college-readiness in mathematics (i.e., the Higher Education Readiness Component) to ascertain whether ethnic/racial achievement gaps were present. Eight years of the Texas Assessment of Knowledge and Skills (TAKS) Exit-Level Mathematics assessment data were analyzed to determine the degree to which differences existed in overall mathematics achievement by the ethnic/racial membership of boys. Furthermore, after analyzing 8 years of school statewide data the extent to which trends were present in overall mathematics achievement was determined.

Significance of the Study

A large body of research exists on differences in student achievement among different ethnic/racial groups (Barnes & Slate, 2014; Gardner & Miranda, 2001; Gutman & Midgley, 2000). Several researchers (e.g., Alford-Stephens & Slate, 2016; Davis, 2014; ETS Addressing Achievement Gaps Symposium, 2011) have conducted research on the mathematics achievement gap between Asian, White, Hispanic, and Black students. As noted by the National Center for Education Statistics (2012), success in high school mathematics is positively related with postsecondary success. Information reported in this study may provide insight into the differences between high school mathematics achievement levels among students of different ethnic/racial groups. Further, the findings could also be useful in bringing increased awareness to mathematics achievement deficits so that educators and policymakers can implement interventions that can improve the opportunities for student achievement and success at the high school level.

Research Questions

The following research questions were addressed in this investigation: (a) What is the difference in the TAKS Mathematics Met Standard by ethnicity/race (i.e., Asian, White, Hispanic, and Black) for Texas high school boys?; (b) What is the difference in the TAKS Mathematics Commended Performance by ethnicity/race (i.e., Asian, White, Hispanic, and Black) for Texas high school boys?; (c) What is the difference in the TAKS Mathematics Higher Education Readiness Component (HERC) standard by ethnicity/race (i.e., Asian, White, Hispanic, and Black) for Texas high school boys?; and (d) What is the extent to which trends were present in the overall mathematics performance by ethnicity/race (i.e., Asian, White, Hispanic, and Black) of Texas high school boys for the 2004-2005 through the 2011-2012 school years? The first three research questions were repeated for each of the 8 school years, whereas the fourth research question constituted an examination of all 8 school years for each of the three mathematics measures. As such, a total of 27 research questions constituted this research study.

Method

Research Design

In this empirical, multiyear investigation, a causal-comparative research design was present (Johnson & Christensen, 2014). The independent variable of ethnicity/race was fixed and the dependent variables of student mathematics performance had previously occurred. In this study, archival data previously acquired from the Texas Education Agency Public Education Information Management System were examined to determine the degree to which differences were present in overall mathematics performance for four different ethnic/racial groups of Texas high school boys. The independent variable of ethnicity/race consisted of four groups: Asian, White, Hispanic, and Black boys enrolled in Texas high schools during the 2004-2005 through the 2011-2012 school years. The dependent variables in this study involved students either meeting or not meeting three TAKS Mathematics measures: Met Standard, Commended Performance, and the Higher Education Readiness Component. The analysis of existing data in this investigation constituted a causal-comparative research design (Johnson & Christensen, 2014).

Participants

In 2012, the State of Texas implemented a new standardized assessment system (Clark, 2011). To measure student competence in core content areas, the State of Texas Assessment of Academic Readiness (STAAR), is given to students in Grades 3-8 (Texas Education Agency, 2015). For students in Grades 9-12, End-of-Course (EOC) exams are given (Texas Education Agency, 2015). Considering the concerns related to STAAR and EOC transition and implementation, data from these assessment measures were not included in this investigation.

Participants in this study were all Asian, White, Hispanic, and Black high school boys who took the Texas Assessment of Knowledge and Skills Exit Level Mathematics exam in the 2004-2005 through the 2011-2012 school years. A Public Information Request form was previously submitted to the Texas Education Agency Public Education

Information Management System for the data that were analyzed in this investigation. The data that were previously obtained from the Public Information Request were analyzed in a dissertation in which reading test scores were the focus (Wright, 2015). The mathematics test performance of these Texas high school boys was analyzed in this dissertation.

Instrumentation

For this investigation, scores from the Texas Assessment of Knowledge and Skills Exit Level Mathematics exam were analyzed. Specifically, the Met Standard, Commended Performance, and the Higher Education Readiness Component scores were used to determine the extent to which differences were present in mathematics achievement by ethnicity/race for Texas high school boys. Achieving the Met Standard level indicates that a student met or slightly exceeded the state's minimum passing standard (Texas Education Agency, 2014).

To achieve Commended Performance on the Texas Assessment of Knowledge and Skills Exit Level Mathematics exam, a student must demonstrate a thorough understanding of the 10 assessed mathematics objectives. Performing at the Commended level indicates a student scored considerably above the state's passing standard (Texas Education Agency, 2014). Performance on the Texas Assessment of Knowledge and Skills Exit Level Mathematics exam has been used as one of the predictors of post-secondary success. The Higher Education Readiness Component is a performance standard that is used to determine if students taking the Texas Assessment of Knowledge and Skills Exit Level Mathematics exam are prepared for college-level course work (Texas Education Agency, 2014). Readers are directed to the Texas Education Agency website for additional information regarding the mathematics performance standards, the score reliabilities, and the score validities of the TAKS Mathematics assessment.

Results

Results of statistical analyses for high school boys who took the TAKS Exit-Level Mathematics exam will be described by overall performance measure. As previously described, the TAKS Exit-Level Mathematics performance measures are: (a) Met Standard; (b) Commended Performance; and (c) Higher Education Readiness Component. Results will be presented in chronological order beginning with the 2004-2005 school year and concluding with the 2011-2012 school year for each of the three performance measures.

Prior to conducting Pearson chi-square statistical procedures for Texas high school boys who took the TAKS Exit-Level Mathematics exam in the 2004-2005 through the 2011-2012 school years, underlying assumptions for using this procedure were checked. For each of the three performance measures, data consisted of the student either meeting that standard or not meeting that standard. As such, these data were independent of each other. In addition, with the large sample size, the available sample size per cell was more than five. Hence, the underlying assumptions of the Pearson chi-square were met (Field, 2013).

Results for the TAKS Met Standard Research Question

For the 2004-2005 school year, the Pearson chi-square revealed a statistically significant difference in the Met Standard, $\chi^2(3) = 6446.93$, $p < .001$, by student ethnicity/race. The Cramer's V or effect size was .25, a small effect size (Cohen, 1988). Present in the results was a stair-step effect (Carpenter, Ramirez, & Severn, 2006). Asian boys had the highest percentage on the Met Standard, followed by White boys, and then by Hispanic boys and last by Black boys. The frequencies and percentages for this school year are delineated in Table 2.1.

Insert Table 2.1 about here

Regarding the 2005-2006 school year, the Pearson chi-square revealed a statistically significant difference in the Met Standard, $\chi^2(3) = 7003.51$, $p < .001$, by student ethnicity/race. The effect size for this finding, Cramer's V, was small, .26 (Cohen, 1988). Again, a stair-step effect was present (Carpenter et al., 2006). Asian boys had the highest percentage on the Met Standard, followed by White boys, Hispanic boys, and then by Black boys. The frequencies and percentages for this school year are presented in Table 2.1.

With respect to the 2006-2007 school year, the Pearson chi-square again revealed a statistically significant difference in the Met Standard, $\chi^2(3) = 6715.23$, $p < .001$, by student ethnicity/race. The effect size for this finding, Cramer's V, was small, .25 (Cohen, 1988). Similar to the previous two years, a stair-step effect was clearly evident (Carpenter et al., 2006). Asian boys had the highest percentage on the Met Standard, followed by White boys, Hispanic boys, and then by Black boys. Delineated in Table 2.1 are the frequencies and percentages of Met Standard by student ethnicity/race for this school year.

Concerning the 2007-2008 school year, the Pearson chi-square revealed a statistically significant difference in the Met Standard, $\chi^2(3) = 5284.95$, $p < .001$, by student ethnicity/race. The Cramer's V or effect size was .23, a small effect size (Cohen, 1988). Again, clearly evident in these results was a stair-step effect (Carpenter et al., 2006). Asian boys had the highest percentage on the Met Standard, followed by White boys, Hispanic boys, and then by Black boys. Revealed in Table 2.2 are the frequencies and percentages for Met Standard by student ethnicity/race for this school year.

Insert Table 2.2 about here

Regarding the 2008-2009 school year, a statistically significant difference was yielded in the Met Standard, $\chi^2(3) = 5370.04$, $p < .001$, by student ethnicity/race. The effect size, or Cramer's V, was .23, a small effect size (Cohen, 1988). Again, the "stair-step of achievement" (Carpenter et al., 2006, p. 117) was revealed in the frequencies and percentages. Asian boys had the highest percentage on the Met Standard, followed by White boys, Hispanic boys, and then by Black boys. The frequencies and percentages for Met Standard by student ethnicity/race for this school year are presented in Table 2.2.

With respect to the 2009-2010 school year, a statistically significant difference was revealed in the Met Standard, $\chi^2(3) = 3156.98$, $p < .001$, by student ethnicity/race. The effect size for this finding, Cramer's V, was small, .17 (Cohen, 1988). Similar to the previous five years, a stair-step effect (Carpenter et al., 2006) was present. Again, Asian boys had the highest percentage on the Met Standard, followed by White boys, Hispanic boys, and then by Black boys. Revealed in Table 2.2 are the frequencies and percentages for Met Standard by student ethnicity/race for this school year.

For the 2010-2011 school year, a statistically significant difference was yielded in the Met Standard, $\chi^2(3) = 2216.73$, $p < .001$, by student ethnicity/race. The effect size, or Cramer's V, was .14, a small effect size (Cohen, 1988). Again, a stair-step effect (Carpenter et al., 2006) was revealed. Asian boys had the highest percentage on the Met Standard, followed by White boys, Hispanic boys, and then by Black boys. Noted in Table 2.3 are the frequencies and percentages of Met Standard by student ethnicity/race for this school year.

Insert Table 2.3 about here

In the 2011-2012 school year, a statistically significant difference was revealed in the Met Standard, $\chi^2(3) = 1878.05$, $p < .001$, by student ethnicity/race. The effect size for this finding, Cramer's V, was small, .13 (Cohen, 1988). In contrast to the previous seven years, the percentage on the Met Standard for White boys was slightly higher, 0.2%, than Asian boys. Other than this difference, Hispanic boys had the next lowest percentage of boys on the Met Standard, with Black boys having the lowest percentage. Delineated in Table 2.3 are the frequencies and percentages of Met Standard by student ethnicity/race for this school year.

Results for the TAKS Commended Performance

Regarding the 2004-2005 school year, the Pearson chi-square revealed a statistically significant difference in Commended Performance, $\chi^2(3) = 7790.96$, $p < .001$, by student ethnicity/race. The Cramer's V or effect size was .28, a small effect size (Cohen, 1988). Present in the results was a stair-step effect (Carpenter et al., 2006).

Asian boys had the highest percentage on the Commended Performance, followed by White boys, Hispanic boys, and then by Black boys. The frequencies and percentages for Commended Performance by ethnicity/race for this school year are revealed in Table 2.4.

Insert Table 2.4 about here

For the 2005-2006 school year, a statistically significant difference was yielded in Commended Performance, $\chi^2(3) = 7236.84$, $p < .001$, by student ethnicity/race. The effect size for this finding, Cramer's V, was small, .26 (Cohen, 1988). Again, present in the results was a stair-step effect (Carpenter et al., 2006). Asian boys had the highest percentage on the Commended Performance, followed by White boys, Hispanic boys, and then by Black boys. Presented in Table 2.4 are the frequencies and percentages for Commended Performance by ethnicity/race for this school year.

Concerning the 2006-2007 school year, a statistically significant difference was revealed in Commended Performance, $\chi^2(3) = 7984.42$, $p < .001$, by student ethnicity/race. The effect size, or Cramer's V, was .27, a small effect size (Cohen, 1988). Similar to the previous two years, a stair-step effect was evident (Carpenter et al., 2006). Again, Asian boys had the highest percentage on the Commended Performance, followed by White boys, Hispanic boys, and then by Black boys. The frequencies and percentages of Commended Performance by student ethnicity/race are delineated in Table 2.4.

In the 2007-2008 school year, a statistically significant difference was yielded in Commended Performance, $\chi^2(3) = 8093.34$, $p < .001$, by student ethnicity/race. The effect size for this finding, Cramer's V, was small, .29 (Cohen, 1988). Again, clearly evident in these results was a stair-step effect (Carpenter et al., 2006). Asian boys had the highest percentage on the Commended Performance, followed by White boys, Hispanic boys, and then by Black boys. Revealed in Table 2.5 are the frequencies and percentages for Commended Performance by student ethnicity/race for this school year.

Insert Table 2.5 about here

With respect to the 2008-2009 school year, a statistically significant difference was revealed in Commended Performance, $\chi^2(3) = 9006.77$, $p < .001$, by student ethnicity/race. The effect size, or Cramer's V, was .29, a small effect size (Cohen, 1988). Again, the "stair-step of achievement" (Carpenter et al., 2006, p. 117) was present in the frequencies and percentages. Asian boys had the highest percentage on the Commended Performance, followed by White boys, Hispanic boys, and then by Black boys. The frequencies and percentages for Commended Performance by student ethnicity/race for this school year are delineated in Table 2.5.

For the 2009-2010 school year, a statistically significant difference was revealed in Commended Performance, $\chi^2(3) = 8492.41$, $p < .001$, by student ethnicity/race. The effect size for this finding, Cramer's V, was small, .28 (Cohen, 1988). Clearly evident was a stair-step effect (Carpenter et al., 2006). Asian boys had the highest percentage on the Commended Performance, followed by White boys, Hispanic boys, and then by Black boys. Presented in Table 2.5 are the frequencies and percentages for Commended Performance by student ethnicity/race for this school year.

Regarding the 2010-2011 school year, a statistically significant difference was yielded in Commended Performance, $\chi^2(3) = 7765.60$, $p < .001$, by student ethnicity/race. The effect size, or Cramer's V, was .27, a small effect size (Cohen, 1988). Again, a stair-step effect (Carpenter et al., 2006) was present. Asian boys had the highest percentage on the Commended Performance, followed by White boys, Hispanic boys, and then by Black boys. The frequencies and percentages of Commended Performance by student ethnicity/race for this school year are revealed in Table 2.6.

Insert Table 2.6 about here

Concerning the 2011-2012 school year, a statistically significant difference was revealed in Commended Performance, $\chi^2(3) = 8404.58$, $p < .001$, by student ethnicity/race. The effect size for this finding, Cramer's V, was small, .27 (Cohen, 1988). Similar to the previous seven years, a stair-step effect was clearly evident (Carpenter et al., 2006). Asian boys had the highest percentage on the Commended Performance. White boys had the next highest Commended Performance percentage, followed by Hispanic boys, and then Black boys. Delineated in Table 2.6 are the frequencies and percentages of Commended Performance by student ethnicity/race for this school year.

Results for the Higher Education Readiness Component

For the 2004-2005 school year, the Pearson chi-square revealed a statistically significant difference in the Higher Education Readiness Component, $\chi^2(3) = 10939.28$, $p < .001$, by student ethnicity/race. The Cramer's V or effect size was .33, a moderate effect size (Cohen, 1988). Present in the results was a stair-step effect (Carpenter et al., 2006). Asian boys had the highest percentage on the Higher Education Readiness Component standard, followed by White boys, Hispanic boys, and then by Black boys. The frequencies and percentages for this school year are delineated in Table 2.7.

Insert Table 2.7 about here

Regarding the 2005-2006 school year, the Pearson chi-square revealed a statistically significant difference in the Higher Education Readiness Component, $\chi^2(3) = 10027.25$, $p < .001$, by student ethnicity/race. The effect size for this finding, Cramer's V, was moderate, .31 (Cohen, 1988). Again, a stair-step effect was present (Carpenter et al., 2006). Asian boys had the highest percentage on the Higher Education Readiness Component, followed by White boys, Hispanic boys, and then by Black boys. Frequencies and percentages for this school year are presented in Table 2.7.

With respect to the 2006-2007 school year, a statistically significant difference was yielded in the Higher Education Readiness Component, $\chi^2(3) = 10311.73$, $p < .001$, by student ethnicity/race. The effect size for this finding, Cramer's V, was moderate, .31 (Cohen, 1988). Similar to the previous two years, a stair-step effect was evident (Carpenter et al., 2006). Asian boys had the highest percentage on the Higher Education Readiness Component, followed by White boys, Hispanic boys, and then by Black boys. Delineated in Table 2.7 are the frequencies and percentages of the Higher Education Readiness Component by student ethnicity/race for this school year.

Concerning the 2007-2008 school year, a statistically significant difference was revealed in the Higher Education Readiness Component, $\chi^2(3) = 8533.92$, $p < .001$, by student ethnicity/race. The Cramer's V or effect size was .30, a moderate effect size (Cohen, 1988). Again, clearly evident in these results was a stair-step effect (Carpenter et al., 2006). Asian boys had the highest percentage on the Higher Education Readiness Component standard, followed by White boys, Hispanic boys, and then by Black boys. Revealed in Table 2.8 are the frequencies and percentages for the Higher Education Readiness Component by student ethnicity/race for this school year.

Insert Table 2.8 about here

Regarding the 2008-2009 school year, a statistically significant difference was revealed in the Higher Education Readiness Component, $\chi^2(3) = 8237.34$, $p < .001$, by student ethnicity/race. The effect size, or Cramer's V, was .28, a small effect size (Cohen, 1988). Again, a stair-step effect was present (Carpenter et al., 2006). Asian boys had the highest percentage on the Higher Education Readiness Component standard, followed by White boys, Hispanic boys, and then by Black boys. Frequencies and percentages for the Higher Education Readiness Component by student ethnicity/race for this school year are delineated in Table 2.8.

For the 2009-2010 school year, a statistically significant difference was revealed in the Higher Education Readiness Component, $\chi^2(3) = 7218.76$, $p < .001$, by student ethnicity/race. The effect size for this finding, Cramer's V, was small, .26 (Cohen, 1988). Clearly evident was a stair-step effect (Carpenter et al., 2006). Asian boys had the highest percentage on the Higher Education Readiness Component standard, followed by White boys, Hispanic boys, and then by Black boys. Presented in Table 2.8 are the frequencies and percentages for the Higher Education Readiness Component by student ethnicity/race for this school year.

With respect to the 2010-2011 school year, a statistically significant difference was yielded in the Higher Education Readiness Component, $\chi^2(3) = 5387.69$, $p < .001$, by student ethnicity/race. The effect size, or Cramer's V, was .23, a small effect size (Cohen, 1988). Again, a stair-step effect (Carpenter et al., 2006) was revealed. Asian boys had the highest percentage on the Higher Education Readiness Component, followed by White boys, Hispanic boys, and then by Black boys. Table 2.9 contains the frequencies and percentages of the Higher Education Readiness Component by student ethnicity/race for this school year.

Insert Table 2.9 about here

Concerning the 2011-2012 school year, a statistically significant difference was revealed in the Higher Education Readiness Component, $\chi^2(3) = 4975.36$, $p < .001$, by student ethnicity/race. The effect size for this finding, Cramer's V, was small, .21 (Cohen, 1988). Similar to the previous seven years, a stair-step effect was evident (Carpenter et al., 2006). Asian boys had the highest percentage on the Higher Education Readiness Component, followed by White boys, Hispanic boys, and then by Black boys. Revealed in Table 2.9 are the frequencies and percentages of the Higher Education Readiness Component by student ethnicity/race for this school year.

Discussion

In this study, the degree to which differences were present in mathematics achievement as a function of ethnicity/race (i.e., Asian, White, Hispanic, and Black) was examined for boys in Texas high schools during the 2004-2005 through the 2011-2012 school years. For the 8-year time period examined, statistically significant differences in mathematics achievement in each school year were yielded by student ethnicity/race. Following these statistical analyses, the presence of trends in mathematics achievement by ethnicity/race was determined. Results are summarized in the next section.

Met Standard

Students who met or exceeded the state's minimum score on the TAKS Exit-Level Mathematics exam during the 2004-2005 through the 2011-2012 school years achieved the Met Standard proficiency level. For the 2004-2005 through the 2010-2011 school years, Asian boys had the highest Met Standard percentage, followed by White boys. For the 2011-2012 school year, Asian and White boys had a similar performance on the TAKS Mathematics Met Standard. During the 8-year time period, statistically significantly lower percentages of Hispanic and Black boys Met Standard than did Asian and White boys. Black boys had the lowest Met Standard percentages in each year of the 8-year time span. In agreement with Carpenter et al. (2006), a stair-step effect was present in student achievement by ethnicity/race for the Met Standard proficiency level.

Commended Performance

Students who performed considerably above the state's passing standard on the TAKS Exit-Level Mathematics exam during the 2004-2005 through the 2011-2012 school years achieved Commended Performance. For the 2004-2005 through the 2011-

2012 school years, Asian boys had the highest Commended Performance percentages, followed by White boys, then Hispanic boys, and last Black boys. During the 8-year span, statistically significantly lower percentages of Hispanic and Black boys achieved Commended Performance than Asian and White boys. Black boys had the lowest Commended Performance percentages in each year of the 8-year time span. Again congruent with Carpenter et al. (2006), a stair-step effect was present in Commended Performance achievement by ethnicity/race.

Higher Education Readiness Component

Students who took the TAKS Exit-Level Mathematics assessment during the 2004-2005 through the 2011-2012 school years and who met the Higher Education Readiness Component standard were identified as being prepared for college-level course work. For these 8 school years, higher percentages of Asian boys met the Higher Education Readiness Component standard than White, Hispanic, and Black boys. White boys had the next highest percentages of meeting the Higher Education Readiness Component, followed by Hispanic boys and then Black boys. Black boys had the lowest percentages of students who met the Higher Education Readiness Component in each year of the 8-year span. Again, the presence of a stair-step effect (Carpenter et al., 2006) was revealed in these results.

Connection with Existing Literature

Several researchers (e.g., Alford-Stephens & Slate, 2016; Barnes & Slate, 2014; Davis-Kean & Jager, 2014; Gaynor, 2012; Hawley & Nieto, 2010) have identified that disparities exist in academic achievement among Asian, White, Hispanic, and Black students. Specifically, Alford-Stephens and Slate (2016), the Educational Testing

Service (2011), and Flores (2007) documented the presence of mathematics achievement gaps among different racial/ethnic groups (i.e., Asian, White, Hispanic, and Black). Comparatively, in 2015, the National Center for Education Statistics reported that the average mathematics scale score for Grade 12 Asian boys was 176 and for White boys was 162. Their average mathematics scale scores were at least 20 points higher than the average scale score for Hispanic boys, 141, and for Black boys, 132. Results of this research investigation are commensurate with historical and recent trend data that Asian and White boys have similar levels of mathematics achievement. Differences in mathematics achievement between these two groups of students and Hispanic and Black boys continue to be expansive.

Implications for Policy and Practice

At each level of proficiency (i.e., Met Standard, Commended Performance, and Higher Education Readiness Component) analyzed in this investigation, Hispanic and Blacks boys had the lowest levels of mathematics achievement. Evidenced in the analysis of this longitudinal investigation were vast disparities in mathematics achievement among different racial/ethnic groups (i.e., Asian, White, Hispanic, and Black). Asian and White boys consistently outperformed Hispanic and Black boys each year. Despite the implementation of the No Child Left Behind Act (2001), many school systems were unable to overcome the challenges associated with educating diverse students. As such, large differences exist in mathematics achievement among ethnic/racial groups of students (i.e., Asian, White, Hispanic, and Black). To overcome these barriers, educators and practitioners should focus on restructuring educational policies and practices so that all students can have an opportunity to achieve positive academic outcomes.

An additional implication educators should be cognizant of is the effect of successful mathematical experiences on future outcomes. Achieve (2008) stated that proficiency in mathematics is critical to secondary and postsecondary success. Conversely, the lack of mathematics achievement can influence school attendance rates, drop-outs rates, and college-readiness rates (Carpenter & Ramirez, 2007). Each of these areas is vital to the success of young learners.

Texas educators and policymakers have multiple years of data and research to support the need for targeted interventions for Hispanic and Black boys. Teacher quality, along with instructional design and delivery, are key areas that should be considered when educating diverse student groups. Further, noting the increasing population of Hispanic students and the poor levels of mathematics achievement in Hispanic and Black boys as compared to their Asian and White peers, changes must be made to help ensure these at-risk groups can have improved educational outcomes.

Suggestions for Future Research

Examined in this study was the relationship between ethnic/racial group membership and the mathematics performance of each group as determined by the TAKS Exit Level Mathematics examination. Results from this investigation could be used to encourage future researchers to expand this study by examining multiple content areas (e.g., reading, science, and social studies). Additionally, mathematics performance of elementary and middle school boys could be investigated to determine the extent to which differences exist in mathematics achievement for boys by ethnic/racial group (i.e., Asian, White, Hispanic, and Black). Further, expanding this study to include mathematics assessment data from multiple states could support the notion that alarming gaps in mathematics achievement continue to exist among different racial/ethnic groups.

Research regarding the mathematics proficiency of girls by ethnicity/race (i.e., Asian, White, Hispanic, and Black) could also be instrumental in examining overall mathematics achievement among these ethnic/racial groups. This examination would be relevant in drawing conclusions and identifying trends in mathematics achievement on the TAKS Exit-Level Mathematics assessment. Additionally, school systems that recognize and understand the implications of poor mathematics achievement on future life outcomes for different ethnic racial groups could better plan and intervene with each specific group. Improving the experiences and outcomes for all students should be one of the primary goals of educators (Davis-Kean & Jager, 2014).

In 2012, the State of Texas transitioned to a new assessment system. The State of Texas Assessment of Academic Readiness, (STAAR) and End of Course (EOC) exams could be considered as sources for assessment data for future investigations. Since its existence, however, the implementation of the STAAR and EOC exams has been problematic. As more reliable data become available, scores from the STAAR and EOC exams could be examined by researchers to determine the degree to which differences exists in mathematics achievement between different ethnic/racial groups. In this investigation, statistically significant differences were revealed among the mathematics proficiency levels of different ethnic/racial groupings. Readers are encouraged to investigate further the relationship between mathematics skills and ethnicity/race.

Additional variables that could be considered are whether differences exist in mathematics achievement by level of economic status for different ethnic/racial groups.

Conclusion

The purpose of this research study was to examine the degree to which differences were present in overall mathematics achievement by ethnicity/race (i.e., Asian, White, Hispanic, and Black) for Texas high school boys. An analysis of 8 years of statewide data was conducted and revealed the presence of statistically significant differences in TAKS Exit-Level Mathematics proficiency among Asian, White, Hispanic, and Black boys. For the 2004-2005 through the 2011-2012 school years, Asian and White boys outperformed Hispanic and Black boys at each measure of proficiency (i.e., Met Standard, Commended Performance, and High Education Readiness Component). As referenced by several researchers (e.g., Alford-Stephens & Slate, 2016; Chambers, 2009; Flores, 2007; Gaynor, 2012; Haycock, 2006; National Center for Education Statistics, 2012; Salam & Sanandaji, 2011; The Nation's Report Card, 2013), disparaging differences in mathematics achievement exists among Asian, White, Hispanic, and Black students.

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Table 2.1

Frequencies and Percentages for the TAKS Mathematics Met Standard by Student Ethnicity/Race for the 2004-2005 Through the 2006-2007 School Years

School Year and Ethnicity/Race	Met Standard %age of Total and *n*	Did Not Meet Standard %age of Total and *n*
2004-2005		
Asian	88.50% (*n* = 2,545)	11.50% (*n* = 330)
White	82.10% (*n* = 42,384)	17.90% (*n* = 9,227)
Hispanic	64.80% (*n* = 23,144)	35.20% (*n* = 12,587)
Black	52.30% (*n* = 6,651)	47.70% (*n* = 6,061)
2005-2006		
Asian	88.00% (*n* = 2,679)	12.00% (*n* = 367)
White	79.80% (*n* = 40,923)	20.20% (*n* = 10,333)
Hispanic	62.30% (*n* = 23,224)	37.70% (*n* = 14,035)
Black	47.90% (n = 6,520)	52.10% (*n* = 7.093)
2006-2007		
Asian	88.40% (*n* = 2,649)	11.60% (*n* = 346)
White	82.20% (*n* = 41,583)	17.80% (*n* = 9,035)
Hispanic	65.70% (*n* = 25,977)	34.30% (*n* = 13,569)
Black	51.40% (*n* = 7,131)	48.60% (*n* = 6,734)

Table 2.2

Frequencies and Percentages for the TAKS Mathematics Met Standard by Student Ethnicity/Race for the 2007-2008 Through the 2009-2010 School Years

School Year and Ethnicity/Race	Met Standard %age of Total and *n*	Did Not Meet Standard %age of Total and *n*
2007-2008		
Asian	93.80% (*n* = 2,845)	6.20% (*n* = 187)
White	89.80% (*n* = 40,742)	10.20% (*n* = 4,604)
Hispanic	74.60% (*n* = 28,096)	25.40% (*n* = 9,563)
Black	66.50% (*n* = 7,711)	33.50% (*n* = 3,891)
2008-2009		
Asian	93.40% (*n* = 3,020)	6.60% (*n* = 212)
White	90.40% (*n* = 41,705)	9.60% (*n* = 4,406)
Hispanic	76.30% (*n* = 32,882)	23.70% (*n* = 10,212)
Black	67.10% (*n* = 8,611)	32.90% (*n* = 4,223)
2009-2010		
Asian	95.10% (*n* = 3,236)	4.90% (*n* = 167)
White	94.20% (*n* = 42,358)	5.80% (*n* = 2,627)
Hispanic	85.30% (*n* = 39,629)	14.70% (*n* = 6,810)
Black	79.20% (*n* = 10,507)	20.80% (*n* = 2,757)

Table 2.3

Frequencies and Percentages for the TAKS Mathematics Met Standard by Student Ethnicity/Race for the 2010-2011 and the 2011-2012 School Years

School Year and Ethnicity/Race	Met Standard	Did Not Meet Standard
	%age of Total and *n*	%age of Total and *n*
2010-2011		
Asian	95.30% (*n* = 3,100)	4.70% (*n* = 154)
White	94.50% (*n* = 39,974)	5.50% (*n* = 2,347)
Hispanic	87.60% (*n* = 43,566)	12.40% (*n* = 6,153)
Black	91.90% (*n* = 10,160)	18.10% (*n* = 2,240)
2011-2012		
Asian	94.40% (*n* = 3,440)	5.60% (*n* = 204)
White	94.60% (*n* = 39,789)	5.40% (*n* = 2,254)
Hispanic	88.70% (*n* = 47,965)	11.30% (*n* = 6,113)
Black	83.30% (*n* = 10,663)	16.70% (*n* = 2,139)

Table 2.4

Frequencies and Percentages for the TAKS Mathematics Commended Performance by Student Ethnicity/Race for the 2004-2005 Through the 2006-2007 School Years

School Year and Ethnicity/Race	Met Commended Performance %age of Total and *n*	Did Not Meet Commended Performance %age of Total and *n*
2004-2005		
Asian	45.70% (*n* = 1,316)	54.30% (*n* = 1,561)
White	26.10% (*n* = 13,479)	73.90% (*n* = 38,181)
Hispanic	8.50% (*n* = 3,050)	91.50% (*n* = 32,760)
Black	3.80% (*n* = 481)	96.20% (*n* = 12,255)
2005-2006		
Asian	48.50% (*n* = 1,478)	51.50% (*n* = 1,568)
White	26.40% (*n* = 13,530)	73.60% (*n* = 37,799)
Hispanic	10.70% (*n* = 3,988)	89.30% (*n* = 33,372)
Black	4.30% (*n* = 592)	95.70% (*n* = 13,082)
2006-2007		
Asian	53.20% (*n* = 1,594)	46.80% (*n* = 1,403)
White	29.00% (*n* = 14,718)	71.00% (*n* = 35,963)
Hispanic	12.00% (*n* = 4,777)	88.00% (*n* = 34,964)
Black	5.40% (*n* = 750)	94.60% (*n* = 13,185)

Table 2.5

Frequencies and Percentages for the TAKS Mathematics Commended Performance by Student Ethnicity/Race for the 2007-2008 Through the 2009-2010 School Years

School Year and Ethnicity/Race	Met Commended Performance %age of Total and *n*	Did Not Meet Commended Performance %age of Total and *n*
2007-2008		
Asian	63.50% (*n* = 1,924)	36.50% (*n* = 1,108)
White	39.00% (*n* = 17,667)	61.00% (*n* = 27,713)
Hispanic	18.40% (*n* = 6.937)	81.60% (*n* = 30,851)
Black	10.30% (*n* = 1,197)	89.70% (*n* = 10,471)
2008-2009		
Asian	67.00% (*n* = 2,167)	33.00% (*n* = 1,065)
White	43.60% (*n* = 20,116)	56.40% (*n* = 25,995)
Hispanic	22.00% (*n* = 9,475)	78.00% (*n* = 33,619)
Black	12.30% (*n* = 1,579)	87.70% (*n* = 11,255)
2009-2010		
Asian	63.10% (*n* = 2,146)	36.90% (*n* = 1,257)
White	40.40% (*n* = 18,173)	59.60% (*n* = 26,812)
Hispanic	20.30% (*n* = 9,409)	79.70% (*n* = 37,030)
Black	11.40% (*n* = 1,511)	88.60% (*n* = 11,753)

Table 2.6

Frequencies and Percentages for the TAKS Mathematics Commended Performance by Student Ethnicity/Race for the 2010-2011 and the 2011-2012 School Years

School Year and Ethnicity/Race	Met Commended Performance %age of Total and *n*	Did Not Meet Commended Performance %age of Total and *n*
2010-2011		
Asian	66.40% (*n* = 2,160)	33.60% (*n* = 1,094)
White	39.10% (*n* = 16,531)	60.90% (*n* = 25,790)
Hispanic	21.00% (*n* = 10,464)	79.00% (*n* = 39,255)
Black	11.40% (*n* = 1,411)	88.60% (*n* = 10,989)
2011-2012		
Asian	71.70% (*n* = 2,611)	28.30% (*n* = 1,033)
White	47.70% (*n* = 20,051)	52.30% (*n* = 21,992)
Hispanic	27.50% (*n* = 14,864)	72.50% (*n* = 39,214)
Black	16.30% (*n* = 2,093)	83.70% (*n* = 10,709)

Table 2.7

Frequencies and Percentages for the TAKS Mathematics HERC Standard by Student Ethnicity/Race for the 2004-2005 Through the 2006-2007 School Years

School Year and Ethnicity/Race	Met HERC Standard %age of Total and *n*	Did Not Meet HERC Standard %age of Total and *n*
2004-2005		
Asian	75.70% (*n* = 2,177)	24.30% (*n* = 700)
White	60.50% (*n* = 31,274)	39.50% (*n* = 20,386)
Hispanic	33.20% (*n* = 11,876)	66.80% (*n* = 23,934)
Black	21.10% (*n* = 2,686)	78.90% (*n* = 10,050)
2005-2006		
Asian	77.20% (*n* = 2,353)	22.80% (*n* = 693)
White	60.60% (*n* = 31,115)	39.40% (*n* = 20,214)
Hispanic	36.50% (*n* = 13,649)	63.50% (*n* = 23,711)
Black	21.90% (n = 2,990)	78.10% (*n* = 10,684)
2006-2007		
Asian	80.20% (*n* = 2,405)	19.80% (*n* = 592)
White	65.00% (*n* = 32,966)	35.00% (*n* = 17,715)
Hispanic	40.90% (*n* = 16,240)	59.10% (*n* = 23,501)
Black	25.40% (*n* = 3,540)	74.60% (*n* = 10,395)

Table 2.8

Frequencies and Percentages for the TAKS Mathematics HERC Standard by Student Ethnicity/Race for the 2007-2008 Through the 2009-2010 School Years

School Year and Ethnicity/Race	Met HERC Standard %age of Total and *n*	Did Not Meet HERC Standard %age of Total and *n*
2007-2008		
Asian	86.40% (*n* = 2,620)	13.60% (*n* = 412)
White	73.40% (*n* = 33,264)	26.60% (*n* = 12,080)
Hispanic	49.20% (*n* = 18,572)	50.80% (*n* = 19,149)
Black	37.50% (*n* = 4,360)	62.50% (*n* = 7,261)
2008-2009		
Asian	89.00% (*n* = 2,869)	11.00% (*n* = 356)
White	77.80% (*n* = 35,380)	22.20%% (*n* = 10,080)
Hispanic	56.10% (*n* = 23,539)	43.90% (*n* = 18,384)
Black	42.70% (*n* = 5,245)	57.30% (*n* = 7,030)
2009-2010		
Asian	89.90% (*n* = 3,059)	10.10% (*n* = 343)
White	80.50% (*n* = 35,814)	19.50% (*n* = 8,652)
Hispanic	60.80% (*n* = 27,565)	39.20% (*n* = 17,754)
Black	48.90% (*n* = 6,228)	51.10% (*n* = 6,498)

Table 2.9

Frequencies and Percentages for the TAKS Mathematics HERC Standard by Student Ethnicity/Race for the 2010-2011 and the 2011-2012 School Years

School Year and Ethnicity/Race	Met HERC Standard %age of Total and *n*	Did Not Meet HERC Standard %age of Total and *n*
2010-2011		
Asian	91.10% (*n* = 2,964)	8.90% (*n* = 289)
White	81.40% (*n* = 34,163)	18.60% (*n* = 7,826)
Hispanic	65.10% (*n* = 31,830)	34.90% (*n* = 17,094)
Black	53.80% (*n* = 6,460)	46.20% (*n* = 5,539)
2011-2012		
Asian	91.20% (*n* = 3,321)	8.80% (*n* = 321)
White	84.70% (*n* = 35,408)	15.30% (*n* = 6,375)
Hispanic	70.40% (*n* = 37,469)	29.60% (*n* = 15,742)
Black	58.80% (*n* = 7,287)	41.20% (*n* = 5,102)

Table 2.10

Cramer's Vs for the TAKS Mathematics Met Standard, Commended Performance, and HERC Standard by Student Ethnicity/Race for the 2004-2005 Through the 2011-2012 School Years

School Year	Met Standard	Commended Performance	HERC Standard
2004-2005	0.25 (Small)	0.28 (Small)	0.33 (Moderate)
2005-2006	0.26 (Small)	0.26 (Small)	0.31 (Moderate)
2006-2007	0.25 (Small)	0.27 (Small)	0.31 (Moderate)
2007-2008	0.23 (Small)	0.29 (Small)	0.30 (Moderate)
2008-2009	0.23 (Small)	0.29 (Small)	0.28 (Small)
2009-2010	0.17 (Small)	0.28 (Small)	0.26 (Small)
2010-2011	0.14 (Small)	0.27 (Small)	0.23 (Small)
2011-2012	0.13 (Small)	0.27 (Small)	0.21 (Small)

CHAPTER III

ETHNIC/RACIAL DIFFERENCES IN SPECIFIC MATHEMATICS SKILLS OF TEXAS HIGH SCHOOL BOYS: A TEXAS MULTIYEAR STATEWIDE ANALYSIS

This dissertation follows the style and format of *Research in the Schools (RITS)*.

Abstract

Investigated in this study was the extent to which differences were present in 10 mathematics skills by ethnicity/race (i.e., Asian, White, Hispanic, and Black) for Texas high school boys. Statewide data were obtained from the Texas Education Agency Public Education Information Management System on all high school boys for the 2004-2005 through the 2011-2012 school years. Inferential statistical procedures revealed statistically significant differences in mathematical skill development for all 8 school years. For each of the 10 mathematics skills, a stair-step effect was present. Asian boys outperformed White, Hispanic, and Black boys on all 10 mathematics skills in all school years. For each of the 8 school years, Black boys had the poorest mathematics performance on each of the 10 mathematics skills followed by Hispanic boys having the next poorest mathematics performance on each of the 10 mathematics skills. Implications are discussed and recommendations for future research are made.

Keywords: Ethnicity/race, Texas Assessment of Knowledge and Skills Mathematics Test, Texas Assessment of Knowledge and Skills Mathematics Objectives

ETHNIC/RACIAL DIFFERENCES IN SPECIFIC MATHEMATICS SKILLS OF TEXAS HIGH SCHOOL BOYS: A TEXAS MULTIYEAR STATEWIDE ANALYSIS

Education reform in recent years has been focused on preparing students for college and career readiness (Eddy et al., 2015; Jeongeun, Jiyun, Des Jardins, & McCall, 2015; McCormick & Lucas, 2011; Moran, 2008). In the K-12 educational setting, competence in mathematics has garnered the attention of many educators and researchers (Byrnes & Miller-Cotto, 2016; Cirino, Tolar, Fuchs, & Hutson-Warren, 2016; Flores, 2007; Milgram, 2005; Moran, 2008). According to Milgram (2005), proficiency in mathematics is essential to having opportunities for educational achievement, economic advancement, and financial stability. As such, it is critical for students to develop the ability to problem solve and understand mathematical processes.

Mathematical Skills

The knowledge and skills students are expected to possess before entering college has changed in recent years (Texas College and Career Readiness Standards, 2016). Students are expected to master a multitude of objectives and standards to demonstrate mathematical literacy. To assess the mathematical skill development of students throughout the United States, the National Assessment of Educational Progress is given to measure students' competence across five areas: (a) numbers, properties, and operations; (b) measurement; (c) geometry; (d) data analysis, statistics, and probability; and (e) algebra.

According to the National Center for Education Statistics (2015), 78% of Grade 12 Asian students and 73% of Grade 12 White students performed at the basic level on the National Assessment of Educational Progress mathematics assessment.

Comparatively, only 47% of Grade 12 Hispanic Students and 36% of Grade 12 Black students scored at the basic level on the National Assessment of Educational Progress mathematics exam. Further, results reported by the National Center for Education Statistics (2015) for the National Assessment of Educational Progress mathematics assessment reflected that nearly all ethnic/racial groups (i.e., Asian, White, Hispanic, and Black) demonstrated low levels of mathematics proficiency. The percentage of Asian and White students who performed at the proficient level was 46% and 32% respectively. The percentage of Hispanic and Black students that scored at the proficient level was 12% and 7%, respectively. These results provide evidence of underdeveloped mathematical skills and abilities of Grade 12 students who are exiting high school and entering college or the workforce.

In Texas, the essential knowledge and skills students are expected to have a comprehensive understanding of are assessed through 10 objectives. On the Texas Assessment of Knowledge and Skills Mathematics test, students' Algebra I skill development is measured in Objectives 1 through 5, students' knowledge of geometry and measurement is assessed in Objectives 6 through 8, students' understanding of probability and statistics is measured in Objective 9, and students' ability to understand mathematical processes and tools is assessed in Objective 10. In an effort to prepare high school students better for college and career readiness, Texas modified its instructional standards. The House Bill 5 legislation passed in 2013 resulted in changes in the Texas high school curriculum and graduation requirements. Though the number of standardized assessments required for graduation was reduced, supporters of the legislation contend that the academic intensity and rigor have not diminished (Lee & Slate, 2013).

Importance of Algebra

Many researchers (e.g., Eddy et al., 2015; National Council of Teachers of Mathematics, 2008) purport that Algebra is the gateway to secondary and post-secondary success. Consequently, the development of algebraic skills is needed during the elementary and middle school years (Knuth, Stephens, Blanton, & Gardiner, 2016). Eddy et al. (2015) asserted that algebraic thinking is essential in K-12 curriculum considering students are expected to demonstrate proficiency in algebra on state assessments. Similarly, Jeongeun et al. (2015) stated that a thoroughly developed understanding of algebra is needed to have access to advanced educational and career opportunities.

Supporting this notion, the National Council of Teachers of Mathematics (2008) reported that completion of Algebra II is positively related with college readiness and future employment opportunities and career earnings. Additionally, the National Council of Teachers of Mathematics (2008) identified that Hispanic and Black students who had mathematics preparation at the Algebra II level graduated from college at higher rates than students who had not completed an Algebra II course. Speilhagan (2006) documented that students who enrolled in algebra courses as early as Grade 8 had improved mathematics achievement in comparison to their peers who had not enrolled in algebra courses.

Opportunities to improve and enhance mathematical achievement can be challenging for some students. According to Flores (2007) and Davis (2014), Hispanic and Black students have fewer opportunities to take high-level mathematics courses because of their limited mathematics achievement. Flores (2007) further noted that enrollment in Grade 8 mathematics courses greatly influenced the opportunity to take advanced mathematics courses before graduating from high school. In a comprehensive investigation on the link between middle school mathematics course placement and achievement, Domina (2014) analyzed Grade 8 student course placements. Grade 8 mathematics course placements were stratified by teacher assessment of student preparedness to learn and students' prior year test scores. Domina (2014) documented that the number of Black students enrolled in algebra was nearly half the amount of Asian students enrolled in algebra. The percentage of Hispanic students in algebra was greater than the percentage of White students enrolled in algebra. More White students, however, were enrolled in geometry or more advanced courses than were Hispanic students.

Noting the amount of attention given to mathematics, specifically algebra, and the mathematical skill deficiencies that exist for Asian, White, Hispanic, and Black students, it is imperative that all students have an opportunity to develop an understanding of various mathematical concepts. As referenced by Eddy et al. (2014) and the National Council of Teachers of Mathematics (2008), firm support systems and concentrated efforts are needed to ensure equity in mathematics education. Regardless of ethnicity/race, all students need to be able to have the opportunity to acquire adequate mathematical skills to compete with their peers, in addition to being college and career ready.

Statement of the Problem

Academic achievement gaps among Asian, White, Hispanic, and Black students continue to be highly visible (Educational Testing Service, 2011; National Center for

Education Statistics, 2011; Schott Foundation 50 State Report on Public Education and Black Males, 2010). Despite the implementation of the No Child Left Behind Act (2001) with its emphasis on improving the educational progress of all students, many school systems have made limited progress in reducing achievement gaps among ethnic/racial groups (i.e., Asian, White, Hispanic, and Black). Consequently, the differences in skills and abilities among ethnic/racial groups remain.

Differences in mathematics performance among Asian, White, Hispanic and Black students continue to be a concern for educators, researchers, and policymakers (National Assessment of Educational Progress, 2012; Noguera & Wing, 2006). According to Gutman and Midley (2000), the differences in mathematical skill development among different ethnic/racial groups are evident during the middle school years. Subsequently, some students enter high school underprepared for mathematics course work because of their skill deficits. Several researchers (e.g., American Institute for Research, 2013; Mosqueda & Maldonado, 2013) have identified that secondary and postsecondary success are positively related to proficiency in mathematics. Thus, it is imperative that non-mastered mathematics skills and objectives are identified and effectively addressed to improve the likelihood of future student academic experiences and outcomes.

Purpose of the Study

The purpose of this study was to examine the extent to which differences were present in 10 mathematics skills by ethnicity/race (i.e., Asian, White, Hispanic, and Black) for Texas high school boys. The Texas Assessment of Knowledge and Skills (TAKS) Exit Level Mathematics objectives data were used to determine the degree to which differences were present in the 10 mathematics skills by ethnicity/race (i.e., Asian, White, Hispanic, and Black) for Texas high school boys. Eight years of TAKS Mathematics Objectives data were examined to determine the extent to which trends were present for the specific objectives assessed on the TAKS Mathematics exam by ethnicity/race (i.e., Asian, White, Hispanic, and Black) for Texas high school boys.

Significance of the Study

Differences in student achievement between ethnic/racial groups have been investigated extensively (e.g., Alford-Stephens & Slate, 2016; Barnes & Slate, 2014; Educational Testing Service, 2013; National Center for Education Statistics, 2012). Despite the depth of information available on the disparities in mathematics achievement between White boys and their Asian, Hispanic, and Black counterparts, limited research exists on specific mathematics skill differences among different ethnic/racial groups (i.e., Asian, White, Hispanic, and Black). The focus of this study was the performance of Texas high school boys on the TAKS Exit-Level Mathematics exam. Each of the 10 mathematics performance objectives assessed on the TAKS Exit-Level Mathematics assessment were analyzed for each ethnic/racial group (i.e., Asian, White, Hispanic, and Black). The findings from this study could be used to provide insight regarding the skills and objectives students have mastered and not mastered. Additionally, knowledge acquired from this investigation could be used to modify and improve instructional delivery methods and models so that Texas high school boys are better prepared to meet each of the mathematics performance objectives.

Research Questions

The following overarching research question was addressed in this investigation: What is the difference in the mathematics skills by ethnicity/race (i.e., Asian, White, Hispanic, and Black) for Texas high school boys for the 2004-2005 school year? Under this overarching research question, the following sub-questions were addressed:(a) What is the difference in functional relationships by ethnicity/race (i.e., Asian, White, Hispanic, and Black) for Texas high school boys for the 2004-2005 school year?; (b) What is the difference in properties and attributes by ethnicity/race (i.e., Asian, White, Hispanic, and Black) for Texas high school boys for the 2004-2005 school year?; (c) What is the difference in linear functions by ethnicity/race (i.e., Asian, White, Hispanic, and Black) for Texas high school boys for the 2004-2005 school year?; (d) What is the difference in linear equations and inequalities by ethnicity/race (i.e., Asian, White, Hispanic, and Black) for Texas high school boys for the 2004-2005 school year?; (e) What is the difference in quadratic and other nonlinear functions for Texas high school boys by ethnicity/race (i.e., Asian, White, Hispanic, and Black) for the 2004-2005 school year?; (f) What is the difference in geometric relationships and spatial reasoning for Texas high school boys for the 2004-2005 school year?; (g) What is the difference in 2D and 3D representations by ethnicity/race (i.e., Asian, White, Hispanic, and Black) for Texas high school boys for the 2004-2005 school year?;(h) What is the difference in measurement by ethnicity/race (i.e., Asian, White, Hispanic, and Black) for Texas high school boys for the 2004-2005 school year?; (i) What is the difference in percent, proportions, probability, and statistics by ethnicity/race (i.e., Asian, White, Hispanic, and Black) for Texas high school boys for the 2004-2005 school year?;(j) What is the difference in mathematical tools and processes by ethnicity/race (i.e., Asian, White, Hispanic, and Black) for Texas high school boys for the 2004-2005 school year?; and (k) What is the extent to which a trend was present in the mathematics skills by ethnicity/race (i.e., Asian White, Hispanic, and Black) of Texas high school boys for the 2004-2005 through the 2011-2012 school years? The first 10 research questions, which correspond to the 10 TAKS Mathematics Objectives, were repeated for each of the 8 school years. The last research question regarding trends was repeated for each mathematics objective. Thus, a total of 90 research questions constituted this statewide investigation.

Method

Research Design

For this multi-year investigation, a causal-comparative research design was present (Johnson & Christensen, 2014). The independent variable of ethnicity/race is fixed and the dependent variables of student mathematics performance had previously occurred. In this study, archival data previously acquired from the Texas Education Agency Public Education Information Management System were analyzed to determine the degree to which differences were present in mathematics performance for four different ethnic/racial groups of Texas high school boys. The independent variable of ethnicity/race consisted of four groups: Asian, White, Hispanic, and Black boys enrolled in Texas high schools during the 2004-2005 through the 2011-2012 school years. The dependent variables in this study were the Texas Assessment of Knowledge and Skills Exit Level Mathematics scores in the 10 mathematics objectives in the 2004-2005 through the 2011-2012 school years for Asian, White, Hispanic, and Black boys.

Participants

In 2012 the State of Texas implemented a new standardized assessment system to assess student academic achievement (Clark, 2011). To measure knowledge and skills in core content areas, the State of Texas Assessment of Academic Readiness (STAAR) is given to students in Grades 3-8 (Texas Education Agency, 2015). For students in Grades 9-12, End-of-Course (EOC) exams are given (Texas Education Agency, 2015). Because of concerns regarding the STAAR and EOC transition and implementation, data from these assessment measures were not included in this study.

Participants in this study were all Asian, White, Hispanic, and Black high school boys who took the Texas Assessment of Knowledge and Skills Exit Level Mathematics exam in the 2004-2005 through the 2011-2012 school years. A Public Information Request was previously submitted to the Texas Education Agency Public Education Information Management System for the data that were analyzed in this study. The data that were previously obtained from the Public Information Request were analyzed in a dissertation in which reading test scores were the focus (Wright, 2015). The mathematics test performance by objective for these Texas high school boys was analyzed in this article.

Instrumentation

For this study, scores by mathematics objective from the Texas Assessment of Knowledge and Skills Exit Level Mathematics exam were analyzed. Data regarding each ethnic/racial group's performance by objective was used to determine the degree to which differences were present in mathematics skill development by ethnicity/race for Texas high school boys. As mentioned previously, the Texas Assessment of Knowledge and

Skills Exit Level Mathematics assessment has 10 performance objectives: (a) Objective 1-Foundations for Functional Relationships, (b) Objective 2–Properties and Attributes of Functions, (c) Objective 3–Linear Functions, (d) Objective 4–Linear Equations and Inequalities, (e) Objective 5-Quadratic and Other Nonlinear Functions, (f) Objective 6–Geometric Shapes and Spatial Reasoning, (g) Objective 7-Two and Three Dimensional Shapes and Relationships, (h) Objective 8–Concepts and Uses of Measurement, (i) Objective 9-Percents, Proportional Relationships, Probability, and Statistics, and (j) Objective 10–Mathematical Processes and Tools (Texas Education Agency, 2015).

Results

Results of statistical analyses for high school boys who took the TAKS Exit-Level Mathematics exam will be described by Mathematics Objective. As previously noted, the TAKS Exit-Level Mathematics Objectives are: (a) Objective 1—Foundations for Functional Relationships; (b) Objective 2–Properties and Attributes of Functions; (c) Objective 3–Linear Functions; (d) Objective 4–Linear Equations and Inequalities; (e) Objective 5–Quadratic and Other Nonlinear Functions; (f) Objective 6–Geometric Shapes and Spatial Reasoning; (g) Objective 7–Two and Three Dimensional Shapes and Relationships; (h) Objective 8–Concepts and Uses of Measurement; (i) Objective 9–Percents, Proportional Relationships, Probability, and Statistics; and (j) Objective 10–Mathematical Processes and Tools. Results will be presented in chronological order beginning with the 2004-2005 school year and concluding with the 2011-2012 school year.

Overall MANOVA Results

Prior to conducting a Multivariate Analysis of Variance (MANOVA) for the TAKS Exit Level Mathematics exam scores during the 2004-2005 through the 2011-2012 school years, the underlying assumptions for the normality of the dependent variables were checked. Further, the Box's Test of Equality of Covariance and Levene's Test of Equality of Error Variances were also examined. Although the assumptions of the MANOVA procedure were not met, Field (2013) contends that the strength of the MANOVA procedure can withstand violation of its underlying assumptions.

For the 2004-2005 through the 2011-2012 school years, the MANOVA revealed statistically significant differences in TAKS Exit Level Mathematics skills for boys by ethnicity/race (i.e., Asian, White, Hispanic, and Black). In this 8-year span, the MANOVA yielded a Wilks' $\Lambda = .88$, $p < .001$, partial $\eta^2 = .04$, in the 2004-2005 school year; Wilks' $\Lambda = .88$, $p < .001$, partial $\eta^2 = .04$, for the 2005-2006 school year; Wilks' $\Lambda = .89$, $p < .001$, partial $\eta^2 = .04$, in the 2006-2007 school year; Wilks' $\Lambda = .86$, $p < .001$, partial $\eta^2 = .05$ for the 2007-2008 school year; Wilks' $\Lambda = .88$, $p < .001$, partial $\eta^2 = .04$, in the 2008-2009 school year; Wilks' $\Lambda = .88$, $p < .001$, partial $\eta^2 = .04$, in the 2009-2010 school year; Wilks' $\Lambda = .91$, $p < .001$, partial $\eta^2 = .03$, in the 2010-2011 school year; and Wilks' $\Lambda = .92$, $p < .001$, partial $\eta^2 = .05$, for the 2011-2012 school year. Using Cohen's (1988) criteria, the effect size for each year during the 8-year time period was small.

TAKS Mathematics Objective 1: Foundations for Functional Relationships

Analysis of Variance Results

For the 2004-2005 through the 2011-2012 school years, univariate follow-up analysis of variance (ANOVA) procedures yielded statistically significant differences in student performance on the TAKS Mathematics Objective 1 by ethnicity/race (i.e., Asian, White, Hispanic and Black). During this 8-year time period, the ANOVA results were: $F(3, 103079) = 2274.38$, $p < .001$, partial $\eta^2 = .06$, medium effect size for the 2004-2005 school year; $F(3, 105405) = 1998.48$, $p < .001$, partial $\eta^2 = .05$, small effect size for the 2005-2006 school year; $F(3, 107350) = 1477.35$, $p < .001$, partial $\eta^2 = .04$, small effect size for the 2006-2007 school year; $F(3, 97714) = 1996.10$, $p < .001$, partial $\eta^2 = .06$, medium effect size for the 2007-2008 school year; $F(3, 105109) = 2393.68$, $p < .001$, partial $\eta^2 = .06$, medium effect size for the 2008-2009 school year; $F(3, 108046) = 1010.23$, $p < .001$, partial $\eta^2 = .03$, small effect size for the 2009-2010 school year; $F(3, 107644) = 1114.98$, $p < .001$, partial $\eta^2 = .03$, small effect size for the 2010-2011 school year; and $F(3, 112563) = 963.31$, $p < .001$, partial $\eta^2 = .03$, small effect size for the 2011-2012 school year.

To determine which pairs of ethnic/racial groups differed, Scheffé post hoc procedures were conducted. They revealed the presence of statistically significant differences in the skills assessed in TAKS Mathematics Objective 1 for each ethnic/racial grouping. For the TAKS Mathematics Objective 1, large mean differences existed in the scores of Asian and White boys as compared to Hispanic and Black boys. Scores were lowest for Hispanic and Black boys during each year of the 8-year time span. A stair-step effect was identified in the scores for Asian, White, Hispanic, and Black boys for TAKS Mathematics Objective 1 (Carpenter et al., 2006). Asian boys had the highest score on TAKS Mathematics Objective 1 during each year of the 8-year time period, followed by White boys, Hispanic boys, and then Black boys. Readers are directed to Table 3.1 for the descriptive statistics for the TAKS Mathematics Objective 1.

Insert Table 3.1 about here

TAKS Mathematics Objective 2: Properties and Attributes of Functions
Analysis of Variance Results

For the 2004-2005 through the 2011-2012 school years, ANOVA procedures revealed statistically significant differences in student performance on the TAKS Mathematics Objective 2 by ethnicity/race (i.e., Asian, White, Hispanic and Black). For this 8-year time period, the ANOVA results were: $F(3, 103079) = 2564.20$, $p < .001$, partial $\eta^2 = .07$, medium effect size for the 2004-2005 school year; $F(3, 105405) = 1877.80$, $p < .001$, partial $\eta^2 = .05$, small effect size for the 2005-2006 school year; $F(3, 107350) = 2007.98$, $p < .001$, partial $\eta^2 = .05$, small effect size for the 2006-2007 school year; $F(3, 97714) = 1691.12$, $p < .001$, partial $\eta^2 = .05$, small effect size for the 2007-2008 school year; $F(3, 105109) = 2385.25$, $p < .001$, partial $\eta^2 = .06$, medium effect size for the 2008-2009 school year; $F(3, 108046) = 996.41$, $p < .001$, partial $\eta^2 = .03$, small effect size for the 2009-2010 school year; $F(3, 107644) = 913.85$, $p < .001$, partial $\eta^2 = .03$, small effect size for the 2010-2011 school year; and $F(3, 112563) = 1254.45$, $p < .001$, partial $\eta^2 = .03$, small effect size for the 2011-2012 school year.

Scheffé post hoc procedures again revealed statistically significant differences were present in the skill development for the TAKS Mathematics Objective 2 for each ethnic/racial comparison. Large mean differences were present in the scores of Asian and White boys as compared to Hispanic and Black boys. Scores were lowest for Hispanic and Black boys on the TAKS Mathematics Objective 2. Again, as referenced by Carpenter et al. (2006), a stair-step effect was present in the scores for TAKS

Mathematics Objective 2 by ethnicity/race (i.e., Asian, White, Hispanic, and Black). Asian boys had the highest score on TAKS Mathematics Objective 2, followed by White boys, Hispanic boys, and then Black boys. The descriptive statistics for Objective 2 are delineated in Table 3.2

Insert Table 3.2 about here

TAKS Mathematics Objective 3: Linear Functions

Analysis of Variance Results

For the 2004-2005 through the 2011-2012 school years, ANOVA procedures yielded statistically significant differences in student performance on the TAKS Mathematics Objective 3 by ethnicity/race (i.e., Asian, White, Hispanic and Black). For this 8-year time period, the ANOVA results were: $F(3, 103079) = 2854.60$, $p < .001$, partial $\eta^2 = .08$, medium effect size for the 2004-2005 school year; $F(3, 105405) = 2217.64$, $p < .001$, partial $\eta^2 = .06$, medium effect size for the 2005-2006 school year; $F(3, 107350) = 1978.21$, $p < .001$, partial $\eta^2 = .05$, small effect size for the 2006-2007 school year; $F(3, 97714) = 1510.06$, $p < .001$, partial $\eta^2 = .04$, small effect size for the 2007-2008 school year; $F(3, 105109) = 1533.80$, $p < .001$, partial $\eta^2 = .04$, small effect size for the 2008-2009 school year; $F(3, 108046) = 1821.57$, $p < .001$, partial $\eta^2 = .05$, small effect size for the 2009-2010 school year; $F(3, 107644) = 1603.07$, $p < .001$, partial $\eta^2 = .04$, small effect size for the 2010-2011 school year; and $F(3, 112563) = 1491.64$, $p < .001$, partial $\eta^2 = .04$, small effect size for the 2011-2012 school year.

Scheffé post hoc procedures revealed statistically significant differences were present in the skill development for the TAKS Mathematics Objective 3 for each ethnic/racial grouping. Large mean differences existed in the scores of Asian and White boys as compared to Hispanic and Black boys. Scores were lowest for Hispanic and Black boys on Objective 3. A stair-step effect was evident in the scores for Asian, White, Hispanic, and Black boys for the TAKS Mathematics Objective 3 (Carpenter et al., 2006). Again, Asian boys had the highest score on the TAKS Mathematics Objective 3 followed by White boys, Hispanic boys, and then Black boys. Presented in Table 3.3 are the descriptive statistics for Objective 3.

Insert Table 3.3 about here

TAKS Mathematics Objective 4: Linear Equations and Inequalities

Analysis of Variance Results

For the 2004-2005 through the 2011-2012 school years, ANOVA procedures yielded statistically significant differences in student performance on the TAKS Mathematics Objective 4 by ethnicity/race (i.e., Asian, White, Hispanic and Black). For this 8-year time span, the ANOVA results were: $F(3, 103079) = 2676.49$, $p < .001$, partial $\eta^2 = .07$, medium effect size for the 2004-2005 school year; $F(3, 105405) = 2136.02$, $p < .001$, partial $\eta^2 = .06$, medium effect size for the 2005-2006 school year; $F(3, 107350) = 2053.65$, $p < .001$, partial $\eta^2 = .05$, small effect size for the 2006-2007 school year; $F(3, 97714) = 1972.33$, $p < .001$, partial $\eta^2 = .06$, medium effect size for the 2007-2008 school year; $F(3, 105109) = 1604.82$, $p < .001$, partial $\eta^2 = .04$, small effect size for the 2008-

2009 school year; *F*(3, 108046) = 1580.17, $p < .001$, partial $\eta^2 = .04$, small effect size for the 2009-2010 school year; *F*(3, 107644) = 1525.64, $p < .001$, partial $\eta^2 = .04$, small effect size for the 2010-2011 school year; and *F*(3, 112563) = 1264.18, $p < .001$, partial $\eta^2 = .03$, small effect size for the 2011-2012 school year.

Scheffé post hoc procedures revealed statistically significant differences were present in the skill development for the TAKS Mathematics Objective 4 by ethnicity/race (i.e., Asian, White, Hispanic, and Black). For TAKS Mathematics Objective 4, large mean differences existed in the scores of Asian and White boys as compared to Hispanic and Black boys. Scores for the TAKS Mathematics Objective 4 were lowest for Hispanic and Black boys. A stair-step effect was present in these results (Carpenter et al., 2006). Similar to the previous 3 mathematics objectives, Asian boys had the highest score on TAKS Mathematics Objective 4 followed by White boys, Hispanic boys, and then Black boys. Presented in Table 3.3 are the descriptive statistics for Objective 4.

Insert Table 3.4 about here

TAKS Mathematics Objective 5: Quadratic and Other Nonlinear Functions

Analysis of Variance Results

For the 2004-2005 through the 2011-2012 school years, ANOVA procedures yielded statistically significant differences in student performance on the TAKS Mathematics Objective 5 by ethnicity/race (i.e., Asian, White, Hispanic and Black). For this 8-year time span, the ANOVA results were: *F*(3, 103079) = 2213.38, $p < .001$, partial $\eta^2 = .06$, medium effect size for the 2004-2005 school year; *F*(3, 105405) = 1867.34, $p <$

.001, partial $\eta^2 = .05$, small effect size for the 2005-2006 school year; $F(3, 107350) = 2368.74$, $p < .001$, partial $\eta^2 = .06$ medium effect size, for the 2006-2007 school year; $F(3, 97714) = 1481.05$, $p < .001$, partial $\eta^2 = .04$, small effect size for the 2007-2008; $F(3, 105109) = 1962.46$, $p < .001$, partial $\eta^2 = .05$, small effect size for the 2008-2009 school year; $F(3, 108046) = 1110.12$, $p < .001$, partial $\eta^2 = .03$, small effect size for the 2009-2010 school year; $F(3, 107644) = 838.27$, $p < .001$, partial $\eta^2 = .02$, small effect size for the 2010-2011 school year; and $F(3, 112563) = 1125.06$, $p < .001$, partial $\eta^2 = .03$, small effect size for the 2011-2012 school year.

Scheffé post hoc procedures revealed statistically significant differences were present in student performance for the TAKS Mathematics Objective 5 by ethnicity/race (i.e., Asian, White, Hispanic, and Black). For the TAKS Mathematics Objective 5, large mean differences were present in the scores of Asian and White boys as compared to Hispanic and Black boys. The scores for the TAKS Mathematics Objective 5 were lowest for Hispanic and Black boys. Again, a stair-step effect was present in these results (Carpenter et al., 2006). Asian boys had the highest score on the TAKS Mathematics Objective 5 followed by White boys, Hispanic boys, and then Black boys. The descriptive statistics for Objective 5 are presented in Table 3.5.

Insert Table 3.5 about here

TAKS Mathematics Objective 6: Geometric Relationships and Spatial Reasoning

Analysis of Variance Results

For the 2004-2005 through the 2011-2012 school years, ANOVA procedures yielded statistically significant differences in student performance on the TAKS Mathematics Objective 6 by ethnicity/race (i.e., Asian, White, Hispanic and Black). During this 8-year time period, the ANOVA results were: $F(3, 103079) = 3451.74$, $p < .001$, partial $\eta^2 = .09$, medium effect size for the 2004-2005 school year; $F(3, 105405) = 2451.15$, $p < .001$, partial $\eta^2 = .07$, medium effect size for the 2005-2006 school year; $F(3, 107350) = 2575.80$, $p < .001$, partial $\eta^2 = .07$, medium effect size for the 2006-2007 school year; $F(3, 97714) = 2702.66$, $p < .001$, partial $\eta^2 = .08$, medium effect size for the 2007-2008 school year; $F(3, 105109) = 3334.71$, $p < .001$, partial $\eta^2 = .09$, medium effect size for the 2008-2009 school year; $F(3, 108046) = 2048.60$, $p < .001$, partial $\eta^2 = .05$, small effect size for the 2009-2010 school year; $F(3, 107644) = 2062.92$, $p < .001$, partial $\eta^2 = .05$, small effect size for the 2010-2011 school year; and $F(3, 112563) = 2011.48$, $p < .001$, partial $\eta^2 = .05$, small effect size for the 2011-2012 school year.

Scheffé post hoc procedures again yielded statistically significant differences in student performance for the TAKS Mathematics Objective 6 by ethnicity/race (i.e., Asian, White, Hispanic, and Black). For the TAKS Mathematics Objective 6, large mean differences existed in the scores of Asian and White boys as compared to Hispanic and Black boys. The scores for the TAKS Mathematics Objective 6 were lowest for Hispanic and Black boys. Again, a stair-step effect was also revealed in these results (Carpenter et al., 2006). Asian boys had the highest score on the TAKS Mathematics Objective 6 followed by White boys, Hispanic boys, and then Black boys. Presented in Table 3.6 are the descriptive statistics for Objective 6.

Insert Table 3.6 about here

TAKS Mathematics Objective 7: 2D and 3D Representations

Analysis of Variance Results

For the 2004-2005 through the 2011-2012 school years, ANOVA procedures revealed statistically significant differences in student performance on the TAKS Mathematics Objective 7 by ethnicity/race (i.e., Asian, White, Hispanic and Black). During this 8-year time period, the ANOVA results were: $F(3, 103079) = 2549.14$, $p < .001$, partial $\eta^2 = .07$, medium effect size for the 2004-2005 school year; $F(3, 105405) = 2323.35$, $p < .001$, partial $\eta^2 = .06$, medium effect size for the 2005-2006 school year; $F(3, 107350) = 2678.31$, $p < .001$, partial $\eta^2 = .07$, medium effect size for the 2006-2007 school year; $F(3, 97714) = 2112.41$, $p < .001$, partial $\eta^2 = .06$, medium effect size for the 2007-2008; $F(3, 105109) = 2315.20$, $p < .001$, partial $\eta^2 = .06$, medium effect size for the 2008-2009 school year; $F(3, 108046) = 2305.97$, $p < .001$, partial $\eta^2 = .06$, medium effect size for the 2009-2010 school year; $F(3, 107644) = 1336.78$, $p < .001$, partial $\eta^2 = .04$, small effect size for the 2010-2011 school year; and $F(3, 112563) = 1928.55$, $p < .001$, partial $\eta^2 = .05$, small effect size for the 2011-2012 school year.

Scheffé post hoc procedures revealed statistically significant differences were present in skill development for the TAKS Mathematics Objective 7 by ethnicity/race (i.e., Asian, White, Hispanic, and Black). For the TAKS Mathematics Objective 7, large mean differences were present in the scores of Asian and White boys as compared to Hispanic and Black boys. The scores for the TAKS Mathematics Objective 7 were lowest for Hispanic and Black boys. Again, clearly evident was a stair-step effect in these results (Carpenter et al., 2006). Asian boys had the highest score on the TAKS Mathematics Objective 7 followed by White boys, Hispanic boys, and then Black boys. Displayed in Table 3.7 are the descriptive statistics for the TAKS Mathematics Objective 7.

Insert Table 3.7 about here

TAKS Mathematics Objective 8: Measurement

Analysis of Variance Results

For the 2004-2005 through the 2011-2012 school years, ANOVA procedures revealed statistically significant differences in student performance on the TAKS Mathematics Objective 8 by ethnicity/race (i.e., Asian, White, Hispanic and Black). For this 8-year time span, the ANOVA results were: $F(3, 103079) = 3343.92$, $p < .001$, partial $\eta^2 = .09$, medium effect size for the 2004-2005 school year; $F(3, 105405) = 3074.63$, $p < .001$, partial $\eta^2 = .08$, medium effect size for the 2005-2006 school year; $F(3, 107350) = 2979.15$, $p < .001$, partial $\eta^2 = .07$, medium effect size for the 2006-2007 school year; $F(3, 97714) = 3249.86$, $p < .001$, partial $\eta^2 = .09$, medium effect size for the 2007-2008 school year; $F(3, 105109) = 3168.95$, $p < .001$, partial $\eta^2 = .08$, medium effect size for the 2008-2009 school year; $F(3, 108046) = 2772.09$, $p < .001$, partial $\eta^2 = .07$, medium effect size for the 2009-2010 school year; $F(3, 107644) = 2057.57$, $p < .001$, partial $\eta^2 = .05$, small effect size for the 2010-2011 school year; and $F(3, 112563) = 2009.56$, $p < .001$, partial $\eta^2 = .05$, small effect size for the 2011-2012 school year.

Scheffé post hoc procedures revealed statistically significant differences were present in student performance for the TAKS Mathematics Objective 8 by ethnicity/race (i.e., Asian, White, Hispanic, and Black). For the TAKS Mathematics Objective 8, large mean differences were present in the scores of Asian and White boys as compared to Hispanic and Black boys. The scores for the TAKS Mathematics Objective 8 were lowest for Hispanic and Black boys. Again, a stair-step effect was present in these results (Carpenter et al., 2006). Asian boys had the highest score on the TAKS Mathematics Objective 8 followed by White boys, Hispanic boys, and then Black boys. The descriptive statistics for Objective 8 are presented in Table 3.5.

Insert Table 3.8 about here

TAKS Mathematics Objective 9: Percents, Proportions, Probability, and Statistics Analysis of Variance Results

For the 2004-2005 through the 2011-2012 school years, ANOVA procedures yielded statistically significant differences in student performance on the TAKS Mathematics Objective 9 by ethnicity/race (i.e., Asian, White, Hispanic and Black). During this 8-year time period, the ANOVA results were: $F(3, 103079) = 2653.41$, $p < .001$, partial $\eta^2 = .07$, medium effect size for the 2004-2005 school year; $F(3, 105405) = 2759.38$, $p < .001$, partial $\eta^2 = .07$, medium effect size for the 2005-2006 school year; $F(3, 107350) = 3239.78$, $p < .001$, partial $\eta^2 = .08$, medium effect size for the 2006-2007 school year; $F(3, 97714) = 3019.22$, $p < .001$, partial $\eta^2 = .08$, medium effect size for the 2007-2008 school year; $F(3, 105109) = 2432.80$, $p < .001$, partial $\eta^2 = .07$, medium effect size for the 2008-2009 school year; $F(3, 108046) = 2468.58$, $p < .001$, partial $\eta^2 = .06$, medium effect size for the 2009-2010 school year; $F(3, 107644) = 2157.14$, $p < .001$, partial $\eta^2 = .06$, medium effect size for the 2010-2011 school year; and $F(3, 112563) = 1812.02$, $p < .001$, partial $\eta^2 = .05$, small effect size for the 2011-2012 school year.

Scheffé post hoc procedures again yielded statistically significant differences in student performance for the TAKS Mathematics Objective 9 by ethnicity/race (i.e., Asian, White, Hispanic, and Black). For the TAKS Mathematics Objective 9, large mean differences existed in the scores of Asian and White boys as compared to Hispanic and Black boys. The scores for the TAKS Mathematics Objective 9 were lowest for Hispanic and Black boys. Again, a stair-step effect was also revealed in these results (Carpenter et al., 2006). Asian boys had the highest score on the TAKS Mathematics Objective 9 followed by White boys, Hispanic boys, and then Black boys. Presented in Table 3.9 are the descriptive statistics for Objective 9.

Insert Table 3.9 about here

TAKS Mathematics Objective 10: Mathematical Processes and Tools

Analysis of Variance Results

For the 2004-2005 through the 2011-2012 school years, ANOVA procedures revealed statistically significant differences in student performance on the TAKS Mathematics Objective 10 by ethnicity/race (i.e., Asian, White, Hispanic and Black).

During this 8-year time period, the ANOVA results were: $F(3, 103079) = 3236.38$, $p <$ .001, partial $\eta^2 = .09$, medium effect size for the 2004-2005 school year; $F(3, 105405) =$ 3318.35, $p < .001$, partial $\eta^2 = .09$, medium effect size for the 2005-2006 school year; $F(3, 107350) = 3055.92$, $p < .001$, partial $\eta^2 = .08$, medium effect size for the 2006-2007 school year; $F(3, 97714) = 3217.74$, $p < .001$, partial $\eta^2 = .09$, medium effect size for the 2007-2008 school year; $F(3, 105109) = 2823.60$, $p < .001$, partial $\eta^2 = .08$, medium effect size for the 2008-2009 school year; $F(3, 108046) = 3639.90$, $p < .001$, partial $\eta^2 = .09$, medium effect size for the 2009-2010 school year; $F(3, 107644) = 2428.78$, $p < .001$, partial $\eta^2 = .06$, medium effect size for the 2010-2011 school year; and $F(3, 112563) =$ 2438.86, $p < .001$, partial $\eta^2 = .06$, medium effect size for the 2011-2012 school year.

Scheffé post hoc procedures revealed statistically significant differences were present in skill development for the TAKS Mathematics Objective 10 by ethnicity/race (i.e., Asian, White, Hispanic, and Black). For the TAKS Mathematics Objective 10, large mean differences existed in the scores of Asian and White boys as compared to Hispanic and Black boys. Again, scores for the TAKS Mathematics Objective 10 were lowest for Hispanic and Black boys. Evident in these results was a stair-step effect (Carpenter et al., 2006). Asian boys had the highest score on the TAKS Mathematics Objective 10 followed by White boys, Hispanic boys, and then Black boys. Presented in Table 3.10 are the descriptive statistics for Objective 10.

Insert Table 3.10 about here

Discussion

The extent to which differences were present in mathematics skill development of Asian, White, Hispanic, and Black Texas high school boys was examined for the 2004-2005 through the 2011-2012 school years. In each school year, statistically significant differences in mathematical skill development were revealed by ethnicity/race for the 8-year time span. Following these statistical analyses, the presence of trends in each of the 10 mathematical skills was analyzed by ethnicity/race. Results are summarized in the next section.

TAKS Mathematics Objective 1 Through Objective 10

Objective 1 through Objective 10 of the TAKS Exit-Level Mathematics examination assessed students' ability to understand an array of mathematical concepts. For the 2004-2005 through the 2011-2012 school years, student performance on these objectives was assessed through a 60-question examination. During each year of this 8-year time period, Asian boys performed best on each of the TAKS Exit-Level Mathematics Objectives, followed by White boys, then Hispanic boys, and last Black boys. Statistically significantly lower scores for Hispanic and Black boys were identified in comparison to Asian and White boys. Black boys had the poorest performance on each of the 10 objectives in each year of the 8-year time span. As referenced by Carpenter et al. (2006), a stair-step effect was present in mathematical skill development for each TAKS Exit-Level Mathematics Objective by ethnicity/race for each year of the investigation.

Connection with Existing Literature

The importance of mathematical skill development has been recognized by numerous researchers (e.g., Eddy et al., 2015; Jeongeun et al., 2015; National Council of Teachers of Mathematics, 2008). According to Milgram (2005), competence in mathematics promotes positive educational outcomes, aides in college and career preparedness, and contributes to future economic stability. Given the extensive differences in mathematics proficiency among different ethnic/racial groups (i.e., Asian, White, Hispanic, and Black), several researchers (Knuth, McCormick, & Lucas, 2011; Milgram, 2005) have noted the importance of early intervention in addressing deficit skill areas. Hall, Davis, Bolen, and Chia (1999) reported that a clear pattern of differences in mathematics performance exists among Asian, White, Hispanic, and Black students beginning as early as Grade 2. For mathematics proficiency, Asian students continuously outperform White students, Asian and White students are more proficient than Hispanic students, and all three groups outperform Black students. Results of this research investigation correspond with the findings of other researchers (Alford-Stephens & Slate, 2016; Davis, 2014; Flores, 2007; National Center for Education Statistics, 2015) who have documented the presence of lower mathematics skills development for Hispanic and Black boys as compared to their Asian and White peers.

Implications for Policy and Practice

Analyzed in this study was the relationship between ethnic/racial group membership and the mathematics skills of each group as determined by the TAKS Exit Level Mathematics examination. For each of the 10 TAKS Exit-Level Mathematics objectives analyzed in this multi-year investigation, Asian and White boys demonstrated the highest levels of proficiency. Clearly evident in the analysis of this longitudinal investigation were deficiencies in mathematical skill development for Hispanic and Black boys. As such, gaps in mathematical skills and abilities continue to exist among Asian, White, Hispanic, and Black students. Given the importance of mathematical skill development for all students, results from this investigation could be used to guide educators in implementing practices that promote improved learning opportunities for all students.

Despite several years of data that document the importance of mathematics achievement and disparaging differences in mathematical competency among different racial/ethnic groups (i.e., Asian, White, Hispanic, and Black), many educational systems continue to struggle with implementing instructional practices that reduce the performance gaps that exist among these groups. Thus, it is critical that educators and policymakers work collaboratively to ensure all students receive the intervention and academic support needed to develop and improve their mathematical skills and abilities. Noting proficiency in mathematics can influence course failures, grade retention, drop-out rates, and college readiness, educators should work diligently to address poor student performance (McCormick & Lucas, 2011). Further, educators should understand the specific skills and objectives students are not mastering. With this awareness, school districts can purposefully intervene with students to reduce their skill deficiencies. Identifying and addressing skill deficits could increase the likelihood of more students having improved mathematics experiences; thereby minimizing the gaps that exist in student skills and abilities among different ethnic/racial groups (i.e., Asian, White, Hispanic, and Black).

Recommendations for Future Research

The level of skill development across different content areas (e.g., reading, writing, science, and social studies) could be investigated to determine the degree to which differences exist in skills and abilities for high school boys by ethnic/racial group (i.e., Asian, White, Hispanic, and Black). Additionally, extending this study to include the mathematical skill development of girls could provide comprehensive data regarding differences in mathematics proficiency among different racial/ethnic groups. Additionally, research concerning the skill development of Texas high school students could be useful in discovering trends that exist among different ethnic/racial groups (i.e., Asian, White, Hispanic, and Black). With this insight, school systems could implement specific instructional practices to improve the quality of education provided to all students, particularly those who are struggling learners.

With the implementation of the new assessment system in Texas, data from the State of Texas Assessment of Academic Readiness (STAAR) and End of Course (EOC) tests could be used for future investigations. Though this assessment system has yielded inconsistent data in its infancy, more dependable data will become available for researchers to analyze. As more reliable scores from STAAR and EOC exams become accessible, researchers could investigate these data to ascertain the extent to which differences exists in mathematical skill development between different racial/ethnic groups. In this investigation, statistically significant differences were identified among the mathematics skills and abilities of different ethnic/racial groupings. Readers are encouraged to study the relationship between mathematics skills and postsecondary success. Additional variables that could be considered are whether differences exist in mathematics proficiency by gender for different ethnic/racial groups.

Conclusion

The purpose of this research study was to examine the extent to which differences were present in mathematical skill development by ethnicity/race (i.e., Asian, White, Hispanic, and Black) for Texas high school boys. An analysis of 8 years of statewide data was conducted and revealed the presence of statistically significant differences in TAKS Exit-Level Mathematics skill development among Asian, White, Hispanic, and Black boys. For the 2004-2005 through the 2011-2012 school years, Asian and White boys demonstrated better mathematics skill development than did Hispanic and Black boys on each of the 10 TAKS Exit-level Mathematics objectives. As referenced by numerous researchers (e.g., Alford-Stephens & Slate, 2016; Davis, 2014; Flores, 2007; National Center for Education Statistics, 2015; Noguera & Wing, 2006; The Nation's Report Card, 2012), large gaps in mathematics proficiency exist among Asian, White, Hispanic, and Black students.

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Table 3.1

Descriptive Statistics for TAKS Exit Level Mathematics Objective 1 by Ethnicity/Race for the 2004-2005 Through the 2011-2012 School Years

School Year and Ethnicity/Race	*n*	*M*	*SD*
2004-2005			
Asian	2,877	4.04	1.51
White	51,660	3.52	1.67
Hispanic	35,810	2.82	1.77
Black	12,736	2.40	1.85
2005-2006			
Asian	3,046	4.06	1.45
White	51,329	3.60	1.61
Hispanic	37,360	3.00	1.71
Black	13,674	2.57	1.80
2006-2007			
Asian	2,997	4.13	1.45
White	50,681	3.77	1.54
Hispanic	39,741	3.29	1.63
Black	13,935	2.91	1.79
2007-2008			
Asian	3,032	4.47	1.15
White	45,344	4.32	1.11
Hispanic	37,721	3.77	1.40
Black	11,621	3.55	1.46
2008-2009			
Asian	3,229	4.45	1.16
White	46,072	4.17	1.15
Hispanic	43,018	3.58	1.37
Black	12,794	3.40	1.42
2009-2010			
Asian	3,403	4.16	1.12
White	44,963	3.92	1.12
Hispanic	46,433	3.58	1.18
Black	13,251	3.47	1.26
2010-2011			
Asian	3,254	4.40	1.09
White	42,316	4.14	1.11
Hispanic	49,689	3.80	1.25
Black	12,389	3.59	1.35
2011-2012			
Asian	3,644	4.29	1.12
White	42,043	4.07	1.10
Hispanic	54,078	3.76	1.20
Black	12,802	3.59	1.30

Table 3.2

Descriptive Statistics for TAKS Exit Level Mathematics Objective 2 by Ethnicity/Race for the 2004-2005 Through the 2011-2012 School Years

School Year and Ethnicity/Race	*n*	*M*	*SD*
2004-2005			
Asian	2,877	3.95	1.54
White	51,660	3.43	1.67
Hispanic	35,810	2.72	1.72
Black	12,736	2.25	1.76
2005-2006			
Asian	3,046	4.09	1.45
White	51,329	3.50	1.63
Hispanic	37,360	2.93	1.70
Black	13,674	2.55	1.78
2006-2007			
Asian	2,997	4.01	1.48
White	50,681	3.47	1.57
Hispanic	39,741	2.89	1.62
Black	13,935	2.52	1.68
2007-2008			
Asian	3,032	4.30	1.20
White	45,344	3.78	1.23
Hispanic	37,721	3.33	1.32
Black	11,621	3.11	1.35
2008-2009			
Asian	3,229	4.43	1.19
White	46,072	4.05	1.27
Hispanic	43,018	3.46	1.48
Black	12,794	3.13	1.52
2009-2010			
Asian	3,403	4.24	1.11
White	44,963	3.93	1.12
Hispanic	46,433	3.65	1.22
Black	13,251	3.42	1.27
2010-2011			
Asian	3,254	4.47	1.11
White	42,316	4.11	1.15
Hispanic	49,689	3.81	1.25
Black	12,389	3.65	1.31
2011-2012			
Asian	3,644	4.44	1.11
White	42,043	4.04	1.17
Hispanic	54,078	3.70	1.25
Black	12,802	3.49	1.30

Table 3.3

Descriptive Statistics for TAKS Exit Level Mathematics Objective 3 by Ethnicity/Race for the 2004-2005 Through the 2011-2012 School Years

School Year and Ethnicity/Race	*n*	*M*	*SD*
2004-2005			
Asian	2,877	3.88	1.49
White	51,660	3.43	1.64
Hispanic	35,810	2.66	1.69
Black	12,736	2.22	1.73
2005-2006			
Asian	3,046	3.91	1.50
White	51,329	3.36	1.62
Hispanic	37,360	2.76	1.67
Black	13,674	2.29	1.71
2006-2007			
Asian	2,997	4.07	1.48
White	50,681	3.65	1.58
Hispanic	39,741	3.10	1.71
Black	13,935	2.60	1.78
2007-2008			
Asian	3,032	4.33	1.19
White	45,344	3.97	1.25
Hispanic	37,721	3.53	1.42
Black	11,621	3.24	1.48
2008-2009			
Asian	3,229	4.31	1.23
White	46,072	3.91	1.27
Hispanic	43,018	3.47	1.46
Black	12,794	3.18	1.49
2009-2010			
Asian	3,403	4.20	1.15
White	44,963	3.86	1.78
Hispanic	46,433	3.44	1.31
Black	13,251	3.42	1.27
2010-2011			
Asian	3,254	4.35	1.15
White	42,316	4.08	1.18
Hispanic	49,689	3.66	1.35
Black	12,389	3.33	1.40
2011-2012			
Asian	3,644	4.35	1.17
White	42,043	4.03	1.22
Hispanic	54,078	3.63	1.36
Black	12,802	3.31	1.43

Table 3.4

Descriptive Statistics for TAKS Exit Level Mathematics Objective 4 by Ethnicity/Race for the 2004-2005 Through the 2011-2012 School Years

School Year and Ethnicity/Race	*n*	*M*	*SD*
2004-2005			
Asian	2,877	3.97	1.52
White	51,660	3.61	1.66
Hispanic	35,810	2.86	1.72
Black	12,736	2.38	1.78
2005-2006			
Asian	3,046	4.11	1.45
White	51,329	3.64	1.63
Hispanic	37,360	3.06	1.75
Black	13,674	2.53	1.78
2006-2007			
Asian	2,997	4.10	1.46
White	50,681	3.69	1.55
Hispanic	39,741	3.11	1.68
Black	13,935	2.66	1.81
2007-2008			
Asian	3,032	4.31	1.20
White	45,344	3.95	1.22
Hispanic	37,721	3.38	1.41
Black	11,621	3.21	1.44
2008-2009			
Asian	3,229	4.43	1.48
White	46,072	4.20	1.13
Hispanic	43,018	3.77	1.33
Black	12,794	3.51	1.40
2009-2010			
Asian	3,403	4.48	1.08
White	44,963	4.13	1.82
Hispanic	46,433	3.68	1.39
Black	13,251	3.47	1.43
2010-2011			
Asian	3,254	4.44	1.13
White	42,316	4.11	1.17
Hispanic	49,689	3.71	1.34
Black	12,389	3.41	1.39
2011-2012			
Asian	3,644	4.45	1.12
White	42,043	4.20	1.14
Hispanic	54,078	3.85	1.30
Black	12,802	3.57	1.39

Table 3.5

Descriptive Statistics for TAKS Exit Level Mathematics Objective 5 by Ethnicity/Race for the 2004-2005 Through the 2011-2012 School Years

School Year and Ethnicity/Race	*n*	*M*	*SD*
2004-2005			
Asian	2,877	3.99	1.54
White	51,660	3.51	1.65
Hispanic	35,810	2.84	1.73
Black	12,736	2.40	1.82
2005-2006			
Asian	3,046	4.15	1.46
White	51,329	3.67	1.66
Hispanic	37,360	3.11	1.77
Black	13,674	2.62	1.85
2006-2007			
Asian	2,997	4.10	1.50
White	50,681	3.75	1.60
Hispanic	39,741	3.12	1.71
Black	13,935	2.60	1.78
2007-2008			
Asian	3,032	4.34	1.21
White	45,344	3.94	1.23
Hispanic	37,721	3.47	1.35
Black	11,621	3.33	1.38
2008-2009			
Asian	3,229	4.42	1.17
White	46,072	4.05	1.21
Hispanic	43,018	3.52	1.43
Black	12,794	3.30	1.48
2009-2010			
Asian	3,403	4.45	1.07
White	44,963	4.17	1.12
Hispanic	46,433	3.79	1.29
Black	13,251	3.72	1.30
2010-2011			
Asian	3,254	4.46	1.09
White	42,316	4.17	1.07
Hispanic	49,689	3.90	1.17
Black	12,389	3.74	1.22
2011-2012			
Asian	3,644	4.53	1.10
White	42,043	4.34	1.07
Hispanic	54,078	4.00	1.23
Black	12,802	3.81	1.31

Table 3.6

Descriptive Statistics for TAKS Exit Level Mathematics Objective 6 by Ethnicity/Race for the 2004-2005 Through the 2011-2012 School Years

School Year and Ethnicity/Race	*n*	*M*	*SD*
2004-2005			
Asian	2,877	5.07	2.13
White	51,660	4.33	2.21
Hispanic	35,810	3.22	2.14
Black	12,736	2.62	2.11
2005-2006			
Asian	3,046	5.14	2.05
White	51,329	4.31	2.12
Hispanic	37,360	3.53	2.12
Black	13,674	2.88	2.08
2006-2007			
Asian	2,997	5.32	2.05
White	50,681	4.70	2.08
Hispanic	39,741	3.12	1.71
Black	13,935	2.60	1.77
2007-2008			
Asian	3,032	5.78	1.72
White	45,344	5.16	1.75
Hispanic	37,721	4.37	1.88
Black	11,621	3.80	1.88
2008-2009			
Asian	3,229	5.83	1.71
White	46,072	5.37	1.70
Hispanic	43,018	4.42	1.92
Black	12,794	3.98	1.91
2009-2010			
Asian	3,403	5.70	1.56
White	44,963	5.36	1.54
Hispanic	46,433	4.71	1.73
Black	13,251	4.35	1.77
2010-2011			
Asian	3,254	6.03	1.61
White	42,316	5.46	1.59
Hispanic	49,689	4.85	1.71
Black	12,389	4.42	1.72
2011-2012			
Asian	3,644	5.96	1.63
White	42,043	5.42	1.64
Hispanic	54,078	4.81	1.81
Black	12,802	4.34	1.85

Table 3.7

Descriptive Statistics for TAKS Exit Level Mathematics Objective 7 by Ethnicity/Race for the 2004-2005 Through the 2011-2012 School Years

School Year and Ethnicity/Race	*n*	*M*	*SD*
2004-2005			
Asian	2,877	5.53	2.06
White	51,660	5.07	2.22
Hispanic	35,810	4.21	2.34
Black	12,736	3.32	2.41
2005-2006			
Asian	3,046	5.38	1.96
White	51,329	5.05	2.14
Hispanic	37,360	4.31	2.30
Black	13,674	3.42	2.34
2006-2007			
Asian	2,997	5.34	2.04
White	50,681	4.87	2.08
Hispanic	39,741	4.11	2.15
Black	13,935	3.24	2.18
2007-2008			
Asian	3,032	6.03	1.59
White	45,344	5.72	1.54
Hispanic	37,721	5.12	1.71
Black	11,621	4.55	1.85
2008-2009			
Asian	3,229	5.89	1.60
White	46,072	5.73	1.45
Hispanic	43,018	5.18	1.67
Black	12,794	4.52	1.81
2009-2010			
Asian	3,403	5.98	1.54
White	44,963	5.58	1.50
Hispanic	46,433	4.98	1.64
Black	13,251	4.48	1.71
2010-2011			
Asian	3,254	5.90	1.54
White	42,316	5.75	1.43
Hispanic	49,689	5.32	1.58
Black	12,389	4.88	1.70
2011-2012			
Asian	3,644	5.98	1.57
White	42,043	5.79	1.49
Hispanic	54,078	5.27	1.66
Black	12,802	4.69	1.79

Table 3.8

Descriptive Statistics for TAKS Exit Level Mathematics Objective 8 by Ethnicity/Race for the 2004-2005 Through the 2011-2012 School Years

School Year and Ethnicity/Race	*n*	*M*	*SD*
2004-2005			
Asian	2,877	5.07	2.13
White	51,660	4.46	2.24
Hispanic	35,810	3.43	2.23
Black	12,736	2.61	2.13
2005-2006			
Asian	2,046	5.17	2.06
White	51,329	4.51	2.18
Hispanic	37,360	3.61	2.19
Black	13,674	2.78	2.07
2006-2007			
Asian	2,997	5.38	2.03
White	50,681	4.81	2.07
Hispanic	39,741	3.93	2.16
Black	13,935	3.16	2.19
2007-2008			
Asian	3,032	5.74	1.73
White	45,344	5.32	1.71
Hispanic	37,721	4.46	1.93
Black	11,621	3.73	1.98
2008-2009			
Asian	3,229	5.87	1.69
White	46,072	5.45	1.67
Hispanic	43,018	4.60	1.91
Black	12,794	4.02	1.91
2009-2010			
Asian	3,403	5.77	1.63
White	44,963	5.26	1.67
Hispanic	46,433	4.50	1.91
Black	13,251	3.93	1.93
2010-2011			
Asian	3,254	5.90	1.68
White	42,316	5.24	1.78
Hispanic	49,689	4.56	1.89
Black	12,389	4.11	1.87
2011-2012			
Asian	3,644	5.89	1.63
White	42,043	5.46	1.66
Hispanic	54,078	4.81	1.83
Black	12,802	4.37	1.87

Table 3.9

Descriptive Statistics for TAKS Exit Level Mathematics Objective 9 by Ethnicity/Race for the 2004-2005 Through the 2011-2012 School Years

School Year and Ethnicity/Race	*n*	*M*	*SD*
2004-2005			
Asian	2,877	3.61	1.51
White	51,660	3.23	1.59
Hispanic	35,810	2.52	1.58
Black	12,736	2.10	1.65
2005-2006			
Asian	3,046	3.75	1.48
White	51,329	3.42	1.58
Hispanic	37,360	2.68	1.68
Black	13,674	2.26	1.71
2006-2007			
Asian	2,997	3.95	1.50
White	50,681	3.50	1.55
Hispanic	39,741	2.76	1.59
Black	13,935	2.30	1.62
2007-2008			
Asian	3,032	4.25	1.24
White	45,344	4.02	1.21
Hispanic	37,721	3.28	1.41
Black	11,621	3.13	1.41
2008-2009			
Asian	3,229	4.33	1.22
White	46,072	4.01	1.23
Hispanic	43,018	3.45	1.42
Black	12,794	3.09	1.47
2009-2010			
Asian	3,403	4.20	1.17
White	44,963	4.00	1.15
Hispanic	46,433	3.44	1.30
Black	13,251	3.18	1.31
2010-2011			
Asian	3,254	4.08	1.23
White	42,316	3.75	1.22
Hispanic	49,689	3.27	1.30
Black	12,389	2.90	1.34
2011-2012			
Asian	3,644	4.23	1.21
White	42,043	3.91	1.15
Hispanic	54,078	3.49	1.27
Black	12,802	3.18	1.32

Table 3.10

Descriptive Statistics for TAKS Exit Level Mathematics Objective 10 by Ethnicity/Race for the 2004-2005 Through the 2011-2012 School Years

School Year and Ethnicity/Race	*n*	*M*	*SD*
2004-2005			
Asian	2,877	6.34	2.63
White	51,660	5.57	2.66
Hispanic	35,810	4.27	2.58
Black	12,736	3.54	2.62
2005-2006			
Asian	3,046	6.73	2.62
White	51,329	5.79	2.79
Hispanic	37,360	4.50	2.75
Black	13,674	3.63	2.69
2006-2007			
Asian	2,997	6.89	2.59
White	50,681	6.05	2.62
Hispanic	39,741	4.92	2.68
Black	13,935	4.02	2.67
2007-2008			
Asian	3,032	7.33	2.14
White	45,344	6.66	2.07
Hispanic	37,721	5.43	2.40
Black	11,621	5.03	2.35
2008-2009			
Asian	3,229	7.39	2.10
White	46,072	6.81	2.00
Hispanic	43,018	5.84	2.25
Black	12,794	5.24	2.30
2009-2010			
Asian	3,403	7.34	2.06
White	44,963	6.75	2.02
Hispanic	46,433	5.61	2.25
Black	13,251	5.04	2.23
2010-2011			
Asian	3,254	7.50	2.06
White	42,316	6.65	2.03
Hispanic	49,689	5.80	2.16
Black	12,389	5.26	2.18
2011-2012			
Asian	3,644	7.51	2.16
White	42,043	6.77	2.15
Hispanic	54,078	5.86	2.34
Black	12,802	5.26	2.36

CHAPTER IV

DIFFERENCES IN MATHEMATICS SKILLS BY ECONOMIC STATUS OF TEXAS HIGH SCHOOL BLACK BOYS: A TEXAS STATEWIDE MULTIYEAR INVESTIGATION

This dissertation follows the style and format of *Research in the Schools (RITS)*.

Abstract

Investigated in this study was the degree to which differences were present in 10 mathematics skills by level of poverty (i.e., Extremely Poor, Moderately Poor, and Not Poor) for Texas high school Black boys. Texas statewide data were obtained from the Public Education Information Management System on all high school boys for the 2004-2005 through the 2011-2012 school years. Inferential statistical procedures yielded statistically significant differences in mathematical skill development by level of poverty for all 8 school years. For each of the 10 mathematics skills, a stair-step effect was present for 5 consecutive years. During this 5-year time span Black boys who were Not Poor performed best, followed by Moderately Poor Black boys and then by Extremely Poor Black boys. For the 2004-2005 through the 2006-2007 school years, Extremely Poor Black boys scored higher on each of the 10 mathematics skill objectives than Moderately Poor Black boys. Implications are discussed and recommendations for future research are made.

Keywords: Extremely Poor, Moderately Poor, Not Poor, Texas Assessment of Knowledge and Skills Mathematics Test, Texas Assessment of Knowledge and Skills Mathematics Objectives

DIFFERENCES IN MATHEMATICS SKILLS BY ECONOMIC STATUS OF TEXAS HIGH SCHOOL BLACK BOYS: A TEXAS STATEWIDE MULTIYEAR INVESTIGATION

Living in poverty has a vast range of effects that adversely influence the lives of children. Burney and Beilke (2008) identified poverty as the most important risk factor that can influence achievement outcomes for students. "No racial or ethnic group is immune from poverty nor do they experience poverty in universal ways" (Burney & Beilke, 2008, p. 299). Given the degree to which poverty can affect student outcomes, many researchers (e.g., Alford-Stephens & Slate, 2016; Children's Defense Fund, 2015; Davis, 2014; Educational Testing Service, 2011) have conducted targeted investigations on poverty and its influence on the academic outcomes of children.

Implications of Poverty

According to the Educational Testing Service (2011), circumstances created by poverty exacerbate the lives of many Black boys. As such, the need for intervention for Black boys has been recognized by several researchers (Davis, 2014; Educational Testing Service, 2011; Gardner & Miranda, 2001). In an effort to expand awareness of the struggles of Black boys, the Policy Evaluation and Research Center organized a symposium in which Black boys and their achievement gaps were addressed. Symposium presenters highlighted the role education, family, community, and poverty can have on the lives of Black boys. Further, strategies in which the holistic needs were addressed of Black boys, particularly for Black boys in poverty, were shared at the conference.

To combat the challenges faced by Black boys living in poverty, the My Brother's Keeper initiative was created to confront the barriers associated with being impoverished. Specifically, this taskforce was created to improve early learning, school readiness, family engagement, college access, and economic opportunities for Black boys (United States Department of Education, 2016). Further, through this initiative, Black boys are provided mentorship and training to develop skills that will assist them in moving from poverty to the middle class and beyond.

According to the National Center for Education Statistics (2010), the poverty level of Black boys can greatly influence their mathematics achievement. Supporting this notion, Balfanz and Byrnes (2006) identified that many Black boys who were economically disadvantaged were not prepared for high school mathematics, thus limiting their ability to be academically successful. Further, the National Center for Education Statistics (2015) reported that children living in poverty during early childhood are associated with lower academic performance that extends through the high school years.

In an investigation conducted by Hernandez (2014), economic status and mathematics success were negatively related. As the percentage of students in poverty increased, the passing rate on the Florida Comprehensive Assessment Test in Mathematics decreased. Finding of this study further support the results of The Coleman Report in which economic status was also identified as the most powerful predictor of academic achievement (Kane, 2016).

Parental Involvement

Regardless of economic status, parents can be instrumental in the growth, development, and academic achievement of their children. According to Lee and Bowen (2006), parental involvement and educational attainment are positively related to children's educational performance and can mediate the effects of poverty. In their study of parental involvement, Lee and Bowen (2006) examined the degree to which different levels and types of parental involvement would result in different achievement outcomes among White, Hispanic, and Black students. For Black students, high levels of homework assistance from parents positively influenced academic achievement. On the contrast, lower levels of homework support from parents had a negative effect on student success.

In a related study, Joe and Davis (2009) analyzed the relationship of parental involvement with Black boys' school readiness and academic achievement. They examined information acquired from the Early Childhood Longitudinal Study on 1,616 Black boys and their guardians. Finding of the research were that when parents fostered and supported the development of their children's academic and social skills (e.g., participating in science related activities, explaining family's heritage), students were more likely to perform well on mathematics readiness assessments. Joe and Davis (2009) concluded that parental educational level, participation in academic activities, and beliefs about the value of education influenced their son's readiness for school.

Considering the importance of mathematical proficiency on future outcomes, many Black parents are seeking equitable educational opportunities for their children. In a study conducted by McGee and Spencer (2015), parental/family member support in mathematical skill development for Black students was analyzed. Further, the extent to which exposure to mathematics and mathematics related careers was also examined. McGee and Spencer (2015) discovered that (a) parents' perseverance, (b) parents instilling self-efficacy in their children, and (c) parents as mathematics educated role models to their children yielded positive mathematical achievement outcomes for their children. Additionally, McGee and Spencer (2015) noted that the multidimensional support some Black students receive from parents/family members is often not acknowledged or overlooked.

Despite economic obstacles and struggles, most parents want their children to be successful. Many parents recognize that having a quality education is essential to financial mobility and stability. As such, more parents are making purposeful decisions to ensure their children are prepared to compete with their peers academically and socially by making certain they are proficient in mathematics (Friend, Hunter, & Fletcher, 2011; Jeynes, 2013).

Statement of the Problem

The implications of living in poverty can be devastating for some children and families. According to the Children's Defense Fund (2012), poverty can destroy childhoods, family bonds, and academic achievement abilities. Reporting that 16.1 million children were living in poverty in 2011, the Children's Defense Fund (2015) identified that this group of youth were at a more increased risk of entering the cradle to prison pipeline than children not living in poverty.

For Black children, the effects of living in poverty can be detrimental. In 2015, the Children's Defense Fund identified that health problems (e.g., low birth weight, asthma, obesity) many poor Black children experience can be attributable to living in poverty. Further, the Educational Testing Service in collaboration with the Children's Defense Fund (2015) reported that by 2 years of age the gap in cognitive development between White and Black children has tripled. By age 4, White children statistically significantly outperform Black children in letter, number, and shape recognition (Children's Defense fund, 2015). Compounding these statistics, according to the National Center for Education Statistics (2015), only 12% of Black boys were proficient in mathematics demonstrating that this at-risk group is less likely to be prepared for high school and post-secondary expectations.

Without adequate education or workforce skills, poverty rates will continue to rise. In 2013, the poverty rate for Black children under age 18 was 39% (United States Census Bureau, 2015). In 2014, the poverty rate for this same group increased by 10%, whereas among other groups (i.e., Asian, White, Hispanic) the poverty rate decreased. The percentage of Black children in poverty is persistently higher than the percentage of Asian, White, and Hispanic children who live in poverty. As such, it is critical that educators and policy makers recognize the realities of these youth. From birth, children born in poverty are at an heightened disadvantage of being unable to have positive educational and economic outcomes when compared to their peers not living in poverty. Targeted reform efforts are needed to change the adverse trajectory of these young learners.

Purpose of the Study

The purpose of this study was to examine the degree to which differences were present in 10 specific mathematics skills as a function of economic status for Texas Black high school boys. Data from the Texas Assessment of Knowledge and Skills (TAKS) Exit Level Mathematics examination were analyzed to determine the extent to which differences were present in specific mathematics skills among Black boys who were determined to be Extremely Poor, Moderately Poor, and Not Poor. Through this 8-year analysis of Texas statewide data, the degree to which trends were present in the 10 mathematics objectives for Black boys in these three economic groups was determined.

Significance of the Study

Poverty and its perceived influence on student academic outcomes have been studied by several researchers (e.g., Alford-Stephens & Slate, 2016; Balfanz & Byrnes, 2006; Burney & Beilke, 2008; Davis, 2014; Gardner & Miranda, 2001; National Center for Education Statistics, 2012). Consequently, a large body of research exists on the academic experiences of students who were economically disadvantaged in comparison to students who were not economically disadvantaged. For boys living in poverty, mathematics achievement is considerably lower when compared to boys not living in poverty (Alford-Stephens & Slate, 2016). Considering the documented academic struggles of Black boys and the effect economic status can have on academic success, this investigation will focus on the degree to which levels of poverty (i.e., extreme poverty, moderate poverty, not in poverty) can influence the mathematics performance of Black boys. The findings could provide useful information about within group differences in mathematics skills by degree of poverty. Ideally, data from this study will provide an increased awareness to the differences in mathematics skills between Black boys by economic status so that educators can effectively intervene with these learners to reduce their deficit skill areas.

Research Questions

The following overarching research question was addressed in this investigation: What is the difference in the mathematics achievement of Texas Black high school boys by economic status for the 2004-2005 school year? Under this overarching research question, the following sub-questions were addressed: (a) What is the difference in functional relationships by economic status for Black high school boys forthe2004-2005 school year?; (b) What is the difference in properties and attributes by economic status for Black high school boys for the 2004-2005 school year?; (c) What is the difference in linear functions by economic status for Black high school boys for the 2004-2005 school year?; (d) What is the difference in linear equations and inequalities by economic status for Black high school boys for the 2004-2005 school year?; (e) What is the difference in quadratic and other nonlinear functions by economic status for Black high school boys for the 2004-2005 school year?; (f) What is the difference in geometric relationships and spatial reasoning by economic status for Black high school boys as a function of economic status for the 2004-2005 school year?; (g) What is the difference in 2D and 3D representations by economic status for Black high school boys for the 2004-2005 school year?; (h) What is the difference in measurement by economic status for Black high school boys for the 2004-2005 school year?; (i)What is the difference in percent, proportions, probability, and statistics by economic status for Black high school boys for the 2004-2005 school year?; (j) What is the difference in mathematical tools and processes by economic status for Black high school boys for the 2004-2005 school year?; and (k) What is the extent to which a trend is present in the mathematics skills by economic status of Black high school boys for the 2004-2005 through the 2011-2012 school years? The first 10 research questions which correspond to the 10 TAKS Mathematics Objectives were repeated for each of the 8 school years. The last research question regarding trends was repeated for each mathematics objective. Thus, a total of 90 research questions constituted this empirical investigation.

Method

Research Design

A causal-comparative research design was present in this multi-year investigation (Johnson & Christensen, 2014). For this study, archival data previously obtained from the Texas Education Agency Public Education Information Management System were analyzed to ascertain the extent to which differences were present in 10 specific mathematics skills for Texas high school Black boys as a function of their economic status. The independent variable in this study was economic status for Black boys enrolled in Texas high schools during the 2004-2005 through the 2011-2012 school years. The dependent variables in this study were the 10 Texas Assessment of Knowledge and Skills Exit-Level Mathematics objectives in each of the 2004-2005 through 2011-2012 school years.

The United States Department of Agriculture (2016) identifies a student as eligible for the free lunch program if the household income is at or below 130 percent of the federal poverty guideline. Students whose household income is between 130 and 185 percent of the federal poverty guideline are eligible for reduced-priced meals. In this study, Black boys who were identified as eligible for the free lunch program were referred to as Extremely Poor and Black boys who were eligible for the reduced-price lunch program were referred to as Moderately Poor. Black boys who were not eligible for participation in either the free or the reduced lunch program were referred to as Not Poor.

Participants

In 2012 the state of Texas implemented a new standardized assessment system (Clark, 2011). To measure proficiency in core content areas, the State of Texas Assessment of Academic Readiness (STAAR) is given in Grades 3-8 (Texas Education Agency, 2015b). For students in Grades 9-12, End-of-Course (EOC) exams are administered (Texas Education Agency, 2015). Considering the concerns related to the STAAR and EOC transition and implementation, data from these assessment measures were not included in this investigation.

Participants in this study were all Black high school boys who took the Texas Assessment of Knowledge and Skills Exit Level Mathematics exam in the 2004-2005 through the 2011-2012 school years. A Public Information Request was previously submitted to the Texas Education Agency Public Education Information Management System for the data that were reviewed in this study. The data that were previously obtained from the Public Information Request were analyzed in a dissertation in which reading test scores were the focus (Wright, 2015). The mathematics test performance by objective and economic status for Texas high school Black boys were analyzed in this dissertation.

Instrumentation

For this investigation, scores by mathematics objective from the Texas Assessment of Knowledge and Skills Exit Level Mathematics exam were examined. Data regarding the performance of Black high school boys by objective were used to determine the degree to which differences were present in mathematics skill development by level of poverty. The Texas Assessment of Knowledge and Skills Exit Level Mathematics assessment has 10 performance objectives: (a) Objective 1-Foundations for Functional Relationships, (b) Objective 2–Properties and Attributes of Functions, (c) Objective 3–Linear Functions, (d) Objective 4–Linear Equations and Inequalities, (e) Objective 5-Quadratic and Other Nonlinear Functions, (f) Objective 6–Geometric Shapes and Spatial Reasoning, (g) Objective 7-Two and Three Dimensional Shapes and Relationships, (h) Objective 8–Concepts and Uses of Measurement, (i) Objective 9-Percents, Proportional Relationships, Probability, and Statistics, and (j) Objective 10–Mathematical Processes and Tools (Texas Education Agency, 2007). The scores for each mathematics performance objective are combined to formulate the passing percentage on the Texas Assessment of Knowledge and Skills Exit Level Mathematics assessment. For each mathematics performance objective, Black boys are expected to display mastery learning regardless of their economic status. Readers are directed to the Texas Education Agency website for additional information regarding the TAKS Mathematics performance objectives and validity of scores for this assessment.

Results

Results of statistical analyses for high school Black boys who took the TAKS Exit-Level Mathematics assessment will be described by economic status and TAKS Mathematics Objective. As previously referenced, the TAKS Exit-Level Mathematics Objectives are: (a) Objective 1–Foundations for Functional Relationships; (b) Objective 2 –Properties and Attributes of Functions; (c) Objective 3–Linear Functions; (d) Objective 4–Linear Equations and Inequalities; (e) Objective 5–Quadratic and Other Nonlinear

Functions; (f) Objective 6–Geometric Shapes and Spatial Reasoning; (g) Objective 7–Two and Three Dimensional Shapes and Relationships; (h) Objective 8–Concepts and Uses of Measurement; (i) Objective 9–Percents, Proportional Relationships, Probability, and Statistics; and (j) Objective 10–Mathematical Processes and Tools. Results will be presented in chronological order beginning with the 2004-2005 school year and concluding with the 2011-2012 school year.

Overall MANOVA Results

Prior to conducting a Multivariate Analysis of Variance (MANOVA) for the TAKS Exit Level Mathematics exam scores during the 2004-2005 through the 2011-2012 school years, the underlying assumptions for the normality of the dependent variables were checked. The Box's Test of Equality of Covariance and Levene's Test of Equality of Error Variances were also analyzed. Despite the assumptions of the MANOVA procedure not being met, Field (2013) asserts that the MANOVA procedure is sufficiently robust to withstand the violation of its underlying assumptions.

For the 2004-2005 through the 2011-2012 school years, the MANOVA revealed statistically significant differences in TAKS Exit Level Mathematics skills for Black boys by level of poverty (i.e., Extremely Poor, Moderately Poor, and Not Poor). During this 8-year span, the MANOVA yielded a Wilks' $\Lambda = .92$, $p < .001$, partial $\eta^2 = .04$, in the 2004-2005 school year; Wilks' $\Lambda = .94$, $p < .001$, partial $\eta^2 = .03$, for the 2005-2006 school year; Wilks' $\Lambda = .93$, $p < .001$, partial $\eta^2 = .03$, in the 2006-2007 school year; Wilks' $\Lambda = .97$, $p < .001$, partial $\eta^2 = .02$, for the 2007-2008 school year; Wilks' $\Lambda = .96$, $p < .001$, partial $\eta^2 = .02$, in the 2008-2009 school year; Wilks' $\Lambda = .96$, $p < .001$, partial $\eta^2 = .02$, in the 2009-2010 school year; Wilks' $\Lambda = .97$, $p < .001$, partial $\eta^2 = .02$, in the 2010-2011 school year; and Wilks' $\Lambda = .97$, $p < .001$, partial $\eta^2 = .02$, for the 2011-2012 school year. Using Cohen's (1988) criteria, the effect size for each year during the 8-year time period was small.

TAKS Mathematics Objective 1: Foundations for Functional Relationships

Analysis of Variance Results

For the 2004-2005 through the 2011-2012 school years, univariate follow-up analysis of variance (ANOVA) procedures revealed statistically significant differences in the performance of Black boys on the TAKS Mathematics Objective 1 by level of poverty (i.e., Extremely Poor, Moderately Poor, and Not Poor). In this 8-year time period, the ANOVA results were: $F(2, 12567) = 415.65$, $p < .001$, partial $\eta^2 = .06$, medium effect size for the 2004-2005 school year; $F(2, 13419) = 323.46$, $p < .001$, partial $\eta^2 = .05$, medium effect size for the 2005-2006 school year; $F(2, 13692) = 323.82$, $p < .001$, partial $\eta^2 = .05$, medium effect size for the 2006-2007 school year; $F(2, 11486) = 118.89$, $p < .001$, partial $\eta^2 = .02$, small effect size for the 2007-2008 school year; $F(2, 12604) = 197.67$, $p < .001$, partial $\eta^2 = .03$, small effect size for the 2008-2009 school year; $F(2, 12956) = 108.19$, $p < .001$, partial $\eta^2 = .02$, small effect size for the 2009-2010 school year; $F(2, 12066) = 117.83$, $p < .001$, partial $\eta^2 = .02$, small effect size for the 2010-2011 school year; and $F(2, 12423) = 95.64$, $p < .001$, partial $\eta^2 = .02$, small effect size for the 2011-2012 school year. During the 2004-2005 through the 2006-2007 school years, medium effect sizes were present for Objective 1; however, during the 2007-2008 through the 2011-2012 school years small effect sizes were yielded (Cohen, 1988).

To determine which poverty levels differed, Scheffé post hoc procedures were performed. Statistically significant differences in the skills assessed in the TAKS

Mathematics Objective 1 were present between each poverty comparison. Extensive differences in scores for the TAKS Mathematics Objective 1 existed for Black boys who were Extremely Poor and Moderately Poor in comparison to Black boys who were Not Poor. For the 2004-2005 through the 2006-2007 school years, Extremely Poor Black boys outperformed Moderately Poor Black boys during this 3-year span. Scores were lowest for Black boys who were Extremely Poor during the 2007-2008 through the 2011-2012 school years. In agreement with Carpenter, Ramirez, and Severn (2006), a stair-step effect was identified in the scores for Black boys by economic status for the 2007-2008 through the 2011-2012 school years. Readers are directed to Table 4.1 for the descriptive statistics for the TAKS Mathematics Objective 1.

Insert Table 4.1 about here

TAKS Mathematics Objective 2: Properties and Attributes of Functions

Analysis of Variance Results

In the 2004-2005 through the 2011-2012 school years, ANOVA procedures yielded statistically significant differences in student performance on the TAKS Mathematics Objective 2 by level of poverty (i.e., Extremely Poor, Moderately Poor, and Not Poor). For this 8-year time period, the ANOVA results were: $F(2, 12567) = 400.48$, $p < .001$, partial $\eta^2 = .06$, medium effect size for the 2004-2005 school year; $F(2, 13419) = 334.22$, $p < .001$, partial $\eta^2 = .05$, medium effect size for the 2005-2006 school year; $F(2, 13692) = 347.76$, $p < .001$, partial $\eta^2 = .05$, medium effect size for the 2006-2007 school year; $F(2, 11486) = 87.26$, $p < .001$, partial $\eta^2 = .02$, small effect size for the 2007-

2008 school year; $F(2, 12604) = 178.10$, $p < .001$, partial $\eta^2 = .03$, small effect size for the 2008-2009 school year; $F(2, 12956) = 85.07$, $p < .001$, partial $\eta^2 = .01$, small effect size for the 2009-2010 school year; $F(2, 12066) = 86.82$, $p < .001$, partial $\eta^2 = .01$, small effect size for the 2010-2011 school year; and $F(2, 12423) = 101.81$, $p < .001$, partial $\eta^2 = .02$, small effect size for the 2011-2012 school year. For the 2004-2005 through the 2006-2007 school years, medium effect sizes were present for Objective 2; however, during the 2007-2008 through the 2011-2012 school years small effect sizes were yielded (Cohen, 1988).

Again, Scheffé post hoc procedures revealed statistically significant differences were present in the mathematical skill development of Black boys for the TAKS Mathematics Objective 2 for each level of poverty. Large differences in scores for the TAKS Mathematics Objective 2 existed for Extremely Poor and Moderately Poor Black boys in comparison to Black boys who were Not Poor. In the 2004-2005 through the 2006-2007 school years, Extremely Poor Black boys scored higher on the TAKS Mathematics Objective 2 than Moderately Poor Black boys. During the 2007-2008 through the 2011-2012 school years, scores were lowest for Black boys who were Extremely Poor during each year of this 5-year time span. Carpenter et al. (2006), again revealed a stair-step effect was present in the scores for Black boys on the TAKS Mathematics Objective 2 by economic status for the 2007-2008 through the 2011-2012 school years. Black boys who were Not Poor had the highest score on the TAKS Mathematics Objective 2, during each year of the 8-year time span. The descriptive statistics for Objective 2 are delineated in Table 4.2.

Insert Table 4.2 about here

TAKS Mathematics Objective 3: Linear Functions

Analysis of Variance Results

For the 2004-2005 through the 2011-2012 school years, ANOVA procedures yielded statistically significant differences in the performance of Black boys on the TAKS Mathematics Objective 3 by level of poverty (i.e., Extremely Poor, Moderately Poor, and Not Poor). For this 8-year time period, the ANOVA results were: $F(2, 12567) = 402.32$, $p < .001$, partial $\eta^2 = .06$, medium effect size for the 2004-2005 school year; $F(2, 13419) = 317.77$, $p < .001$, partial $\eta^2 = .05$, small effect size for the 2005-2006 school year; $F(2, 13692) = 336.82$, $p < .001$, partial $\eta^2 = .05$, small effect size for the 2006-2007 school year; $F(2, 11486) = 103.70$, $p < .001$, partial $\eta^2 = .02$, small effect size for the 2007-2008 school year; $F(2, 12604) = 139.38$, $p < .001$, partial $\eta^2 = .02$, small effect size for the 2008-2009 school year; $F(2, 12956) = 118.69$, $p < .001$, partial $\eta^2 = .02$, small effect size for the 2009-2010 school year; $F(2, 12066) = 106.18$, $p < .001$, partial $\eta^2 = .02$, small effect size for the 2010-2011 school year; and $F(2, 12423) = 109.85$, $p < .001$, partial $\eta^2 = .02$, small effect size for the 2011-2012 school year. Results for Objective 3 for the 2004-2005 school year revealed a medium effect size; however, for the 2005-2006 through the 2011-2012 school years, small effect sizes were revealed (Cohen, 1988).

Scheffé post hoc procedures revealed statistically significant differences were present in the skill development for the TAKS Mathematics Objective 3 for each level of poverty. Differences in scores for the TAKS Mathematics Objective 3 existed for Black boys who were Extremely Poor and Moderately Poor in comparison to Black boys who were Not Poor. For the 2004-2005 through the 2006-2007 school years, Extremely Poor Black boys scored higher than Moderately Poor Black boys on Objective 3 during this 3-year time span. Scores were lowest for Black boys who were Extremely Poor during the 2007-2008 through the 2011-2012 school years. Cleary evident was a stair-step effect in the scores for Black boys for the TAKS Mathematics Objective 3 by economic status for the 2007-2008 through the 2011-2012 school years (Carpenter et al., 2006). Again, Black boys who were Not Poor had the best performance on the TAKS Mathematics Objective 3 during each year of the 8-year time period. Presented in Table 4.3 are the descriptive statistics for Objective 3.

Insert Table 4.3 about here

TAKS Mathematics Objective 4: Linear Equations and Inequalities

Analysis of Variance Results

For the 2004-2005 through the 2011-2012 school years, ANOVA procedures yielded statistically significant differences in the performance of Black boys on the TAKS Mathematics Objective 4 by level of poverty (i.e., Extremely Poor, Moderately Poor, and Not Poor). For this 8-year time period, the ANOVA results were: $F(2, 12567) = 436.18$, $p < .001$, partial $\eta^2 = .07$, medium effect size for the 2004-2005 school year; $F(2, 13419) = 309.32$, $p < .001$, partial $\eta^2 = .04$, small effect size for the 2005-2006 school year; $F(2, 13692) = 353.13$, $p < .001$, partial $\eta^2 = .05$, small effect size for the

2006-2007 school year; $F(2, 11486) = 124.84$, $p < .001$, partial $\eta^2 = .02$, small effect size for the 2007-2008 school year; $F(2, 12604) = 144.98$, $p < .001$, partial $\eta^2 = .02$, small effect size for the 2008-2009 school year; $F(2, 12956) = 154.39$, $p < .001$, partial $\eta^2 = .02$, small effect size for the 2009-2010 school year; $F(2, 12066) = 138.46$, $p < .001$, partial $\eta^2 = .02$, small effect size for the 2010-2011 school year; and $F(2, 12423) = 98.94$, $p < .001$, partial $\eta^2 = .02$, small effect size for the 2011-2012 school year. Again, results for Objective 4 for the 2004-2005 school year revealed a medium effect size; however, for the 2005-2006 through the 2011-2012 school years, small effect sizes were present (Cohen, 1988).

Scheffé post hoc procedures again revealed statistically significant differences were present in the skill development for the TAKS Mathematics Objective 4 for each level of poverty. For the TAKS Mathematics Objective 4, extensive differences in scores existed for Extremely and Moderately Poor Black boys in comparison to Black boys who were Not Poor. During the 2004-2005 through the 2006-2007 school years, Extremely Poor Black boys outperformed Moderately Poor Black boys during this 3-year time span. For the 2007-2008 through the 2011-2012 school years, scores were lowest for Black boys who were Extremely Poor. Evident was a stair-step effect in the scores for Black boys for the TAKS Mathematics Objective 4 by economic status for this 5-year time span (Carpenter et al., 2006). Similar to the previous 3 objectives, Black boys who were Not Poor had the highest score on the TAKS Mathematics Objective 4. Presented in Table 4.4 are the descriptive statistics for Objective 4.

Insert Table 4.4 about here

TAKS Mathematics Objective 5: Quadratic and Other Nonlinear Functions

Analysis of Variance Results

For the 2004-2005 through the 2011-2012 school years, ANOVA procedures revealed statistically significant differences in the performance of Black boys on the TAKS Mathematics Objective 5 by level of poverty (i.e., Extremely Poor, Moderately Poor, and Not Poor). During this 8-year time period, the ANOVA results were: $F(2, 12567) = 440.10$, $p < .001$, partial $\eta^2 = .07$, medium effect size for the 2004-2005 school year; $F(2, 13419) = 341.43$, $p < .001$, partial $\eta^2 = .05$, small effect size for the 2005-2006 school year; $F(2, 13692) = 345.12$, $p < .001$, partial $\eta^2 = .05$, small effect size for the 2006-2007 school year; $F(2, 11486) = 86.48$, $p < .001$, partial $\eta^2 = .02$, small effect size for the 2007-2008 school year; $F(2, 12604) = 176.66$, $p < .001$, partial $\eta^2 = .03$, small effect size for the 2008-2009 school year; $F(2, 12956) = 87.23$, $p < .001$, partial $\eta^2 = .01$, small effect size for the 2009-2010 school year; $F(2, 12066) = 76.63$, $p < .001$, partial $\eta^2 = .01$, small effect size for the 2010-2011 school year; and $F(2, 12423) = 107.17$, $p < .001$, partial $\eta^2 = .02$, small effect size for the 2011-2012 school year. Results for Objective 5 for the 2004-2005 school year reflected a medium effect size. For the 2005-2006 through the 2011-2012 school years, small effect sizes were again revealed (Cohen, 1988).

Scheffé post hoc procedures revealed statistically significant differences were present in the skill development for the TAKS Mathematics Objective 5 for each level of poverty. For the TAKS Mathematics Objective 5, large differences in scores existed for Black boys who were Extremely and Moderately Poor in comparison to Black boys who were Not Poor. For the 2004-2005 through the 2006-2007 school years, Extremely Poor Black boys outperformed Moderately Poor Black boys during this 3-year time period. The scores for Extremely Poor Black boys were lowest during the 2007-2008 through the 2011-2012 school years. Again, during this 5-year time period, a stair-step effect was present in the scores for Black boys for the TAKS Mathematics Objective 5 by economic status (Carpenter et al., 2006). Black boys who were Not Poor had the highest score on the TAKS Mathematics Objective 5. Presented in Table 4.5 are the descriptive statistics for Objective 5.

Insert Table 4.5 about here

TAKS Mathematics Objective 6: Geometric Relationships and Spatial Reasoning

Analysis of Variance Results

For the 2004-2005 through the 2011-2012 school years, ANOVA procedures yielded statistically significant differences in the performance of Black boys on the TAKS Mathematics Objective 6 by level of poverty (i.e., Extremely Poor, Moderately Poor, and Not Poor). During this 8-year time period, the ANOVA results were: $F(2, 12567) = 377.72$, $p < .001$, partial $\eta^2 = .06$, medium effect size for the 2004-2005 school year; $F(2, 13419) = 295.72$, $p < .001$, partial $\eta^2 = .05$, small effect size for the 2005-2006 school year; $F(2, 13692) = 348.87$, $p < .001$, partial $\eta^2 = .05$, small effect size for the 2006-2007 school year; $F(2, 11486) = 99.55$, $p < .001$, partial $\eta^2 = .02$, small effect size for the 2007-2008 school year; $F(2, 12604) = 193.55$, $p < .001$, partial $\eta^2 = .03$, small effect size for the 2008-2009 school year; $F(2, 12956) = 148.86$, $p < .001$, partial $\eta^2 = .02$, small effect size for the 2009-2010 school year; $F(2, 12066) = 121.14$, $p < .001$, partial $\eta^2 = .02$, small effect size for the 2010-2011 school year; and $F(2, 12423) = 131.37$, $p < .001$, partial $\eta^2 = .02$, small effect size for the 2011-2012 school year. Results for the 2004-2005 school year were reflective of a medium effect size; however, for the 2005-2006 through the 2011-2012 school years, small effect sizes were present (Cohen, 1988).

Scheffé post hoc procedures again revealed statistically significant differences in the skill development for the TAKS Mathematics Objective 6 for each level of poverty. For the TAKS Mathematics Objective 6, extensive differences in scores existed for Black boys who were Extremely Poor and Moderately Poor in comparison to Black boys who were Not Poor. In the 2004-2005 through the 2006-2007 school years, Extremely Poor Black boys performed better on the TAKS Mathematics Objective 6 than Moderately Poor Black boys. During the 2007-2008 through the 2011-2012 school years, scores were lowest for Black boys who were Extremely Poor during each year of this 5-year time span. Carpenter et al. (2006) again revealed a stair-step effect was present in the scores for Black boys on the TAKS Mathematics Objective 6 by economic status for the 2007-2008 through the 2011-2012 school years. Again, Black boys who were Not Poor had the highest score on the TAKS Mathematics Objective 6 for each year of the 8-year time period. Table 4.6 contains the descriptive statistics for Objective 6.

Insert Table 4.6 about here

TAKS Mathematics Objective 7: 2D and 3D Representations

Analysis of Variance Results

During the 2004-2005 through the 2011-2012 school years, ANOVA procedures yielded statistically significant differences in the performance of Black boys on the TAKS Mathematics Objective 7 by level of poverty (i.e., Extremely Poor, Moderately Poor, and Not Poor). During this 8-year time period, the ANOVA results were: $F(2, 12567) = 449.28$, $p < .001$, partial $\eta^2 = .06$, medium effect size for the 2004-2005 school year; $F(2, 13419) = 320.13$, $p < .001$, partial $\eta^2 = .05$, small effect size for the 2005-2006 school year; $F(2, 13692) = 364.78$, $p < .001$, partial $\eta^2 = .05$, small effect size for the 2006-2007 school year; $F(2, 11486) = 109.74$, $p < .001$, partial $\eta^2 = .02$, small effect size for the 2007-2008 school year; $F(2, 12604) = 174.81$, $p < .001$, partial $\eta^2 = .03$, small effect size for the 2008-2009 school year; $F(2, 12956) = 112.25$, $p < .001$, partial $\eta^2 = .02$, small effect size for the 2009-2010 school year; $F(2, 12066) = 77.87$, $p < .001$, partial $\eta^2 = .01$, small effect size for the 2010-2011 school year; and $F(2, 12423) = 117.06$, $p < .001$, partial $\eta^2 = .02$, small effect size for the 2011-2012 school year. During the 2004-2005 school year, a medium effect size was present for Objective 7 revealed a medium effect size. For the 2005-2006 through the 2011-2012 school years, small effect sizes were yielded (Cohen, 1988).

Scheffé post hoc procedures again statistically significant differences in the skill development for the TAKS Mathematics Objective 7 for each level of poverty. For the

TAKS Mathematics Objective 7, extensive differences in scores existed for Black boys who were Extremely Poor and Moderately Poor as compared to Black boys who were Not Poor. Again, in the 2004-2005 through the 2006-2007 school years, Extremely Poor Black boys scored higher on the TAKS Mathematics Objective 7 than Moderately Poor Black boys. For the 2007-2008 through the 2011-2012 school years, Extremely Poor Black boys were outperformed by Moderately Poor and Not Poor Black boys during each year of this 5-year time span. A stair-step effect (Carpenter et al., 2006) was present in the scores for Black boys on the TAKS Mathematics Objective 2 by economic status for the 2007-2008 through the 2011-2012 school years. A stair-step effect was again present in the scores for Black boys for the TAKS Mathematics Objective 7 by level of poverty for the 2007-2008 through the 2011-2012 school years. Again, Black boys who were Not Poor had the highest score on the TAKS Mathematics Objective 7 for each year of the 8-year time period. Presented in Table 4.7 are the descriptive statistics for Objective 7.

Insert Table 4.7 about here

TAKS Mathematics Objective 8: Measurement

Analysis of Variance Results

During the 2004-2005 through the 2011-2012 school years, ANOVA procedures yielded statistically significant differences in the performance of Black boys on the TAKS Mathematics Objective 8 by level of poverty (i.e., Extremely Poor, Moderately Poor, and Not Poor). During this 8-year time period, the ANOVA results were: $F(2, 12567) = 369.95$, $p < .001$, partial $\eta^2 = .06$, medium effect size for the 2004-2005 school year; $F(2, 13419) = 328.88$, $p < .001$, partial $\eta^2 = .05$, small effect size for the 2005-2006 school year; $F(2, 13692) = 391.38$, $p < .001$, partial $\eta^2 = .05$, small effect size for the 2006-2007 school year; $F(2, 11486) = 128.82$, $p < .001$, partial $\eta^2 = .02$, small effect size for the 2007-2008 school year; $F(2, 12604) = 171.95$, $p < .001$, partial $\eta^2 = .03$, small effect size for the 2008-2009 school year; $F(2, 12956) = 134.94$, $p < .001$, partial $\eta^2 = .02$, small effect size for the 2009-2010 school year; $F(2, 12066) = 106.90$, $p < .001$, partial $\eta^2 = .02$, small effect size for the 2010-2011 school year; and $F(2, 12423) = 107.09$, $p < .001$, partial $\eta^2 = .02$, small effect size for the 2011-2012 school year. Similar to the previous 6 objectives, a medium effect size was present for the 2004-2005 school year. For the 2005-2006 through the 2011-2012 school years, small effect sizes were present (Cohen, 1988).

Scheffé post hoc procedures revealed statistically significant differences in the skill development for the TAKS Mathematics Objective 8 for each level of poverty. For the TAKS Mathematics Objective 8, extensive differences in scores were present for Black boys who were Extremely Poor and Moderately Poor in comparison to Black boys who were Not Poor. For the 2004-2005 through the 2006-2007 school years, Extremely Poor Black boys performed better on the TAKS Mathematics Objective 8 than Moderately Poor Black boys. During the 2007-2008 through the 2011-2012 school years, scores were lowest for Black boys who were Extremely Poor during each year of this 5-year time span. Again a stair-step effect (Carpenter et al., 2006) was present in the results for the 2007-2008 through the 2011-2012 school years. Black boys who were Not Poor had the highest score on the TAKS Mathematics Objective 8 for each year of the 8-year time period. Table 4.8 contains the descriptive statistics for Objective 8.

Insert Table 4.8 about here

TAKS Mathematics Objective 9: Percents, Proportions, Probability, and Statistics

Analysis of Variance Results

For the 2004-2005 through the 2011-2012 school years, ANOVA procedures yielded statistically significant differences in the performance of Black boys on the TAKS Mathematics Objective 9 by level of poverty (i.e., Extremely Poor, Moderately Poor, and Not Poor). During this 8-year time period, the ANOVA results were: $F(2, 12567) = 407.23$, $p < .001$, partial $\eta^2 = .06$, medium effect size for the 2004-2005 school year; $F(2, 13419) = 357.51$, $p < .001$, partial $\eta^2 = .05$, small effect size for the 2005-2006 school year; $F(2, 13692) = 388.77$, $p < .001$, partial $\eta^2 = .05$, small effect size for the 2006-2007 school year; $F(2, 11486) = 126.81$, $p < .001$, partial $\eta^2 = .02$, small effect size for the 2007-2008 school year; $F(2, 12604) = 139.59$, $p < .001$, partial $\eta^2 = .02$, small effect size for the 2008-2009 school year; $F(2, 12956) = 149.64$, $p < .001$, partial $\eta^2 = .02$, small effect size for the 2009-2010 school year; $F(2, 12066) = 95.13$, $p < .001$, partial $\eta^2 = .02$, small effect size for the 2010-2011 school year; and $F(2, 12423) = 101.44$, $p < .001$, partial $\eta^2 = .02$, small effect size for the 2011-2012 school year. A medium effect size was present for Objective 9 for the 2004-2005 school year. For the 2005-2006 through the 2011-2012 school years, small effect sizes were present (Cohen, 1988).

Scheffé post hoc procedures again revealed statistically significant differences in the skill development for the TAKS Mathematics Objective 9 for each level of poverty. For the TAKS Mathematics Objective 9, extensive differences in scores existed for Black boys who were Extremely and Moderately Poor as compared to Black boys who were Not Poor. During the 2004-2005 through the 2006-2007 school years, Extremely Poor Black boys performed better on the TAKS Mathematics Objective 9 than Moderately Poor Black boys. During the 2007-2008 through the 2011-2012 school years, Extremely Poor Black boys had the lowest scores for Objective 9 for each year of this 5-year time span. Clearly evident was a stair-step effect in the results (Carpenter et al., 2006). Again, Black boys who were Not Poor performed best on the TAKS Mathematics Objective 9 for each year of the 8-year time span. Revealed in Table 4.9 are the descriptive statistics for Objective 9.

Insert Table 4.9 about here

TAKS Mathematics Objective 10: Mathematical Processes and Tools

Analysis of Variance Results

For the 2004-2005 through the 2011-2012 school years, ANOVA procedures yielded statistically significant differences in the performance of Black boys on the TAKS Mathematics Objective 10 by level of poverty (i.e., Extremely Poor, Moderately Poor, and Not Poor). During this 8-year time period, the ANOVA results were: $F(2, 12567) = 403.64$, $p < .001$, partial $\eta^2 = .06$, medium effect size for the 2004-2005 school year; $F(2, 13419) = 370.19$, $p < .001$, partial $\eta^2 = .05$, small effect size for the 2005-2006 school year; $F(2, 13692) = 376.88$, $p < .001$, partial $\eta^2 = .05$, small effect size for the 2006-2007 school year; $F(2, 11486) = 151.00$, $p < .001$, partial $\eta^2 = .03$, small effect size for the 2007-2008 school year; $F(2, 12604) = 195.68$, $p < .001$, partial $\eta^2 = .03$, small effect size for the 2008-2009 school year; $F(2, 12956) = 202.25$, $p < .001$, partial $\eta^2 = .03$, small effect size for the 2009-2010 school year; $F(2, 12066) = 134.86$, $p < .001$, partial $\eta^2 = .02$, small effect size for the 2010-2011 school year; and $F(2, 12423) = 140.63$, $p < .001$, partial $\eta^2 = .02$, small effect size for the 2011-2012 school year. A medium effect size was presents for Objective 10 for the 2004-2005 school year. For the other school years, small effect sizes were present (Cohen, 1988).

Scheffé post hoc procedures revealed statistically significant differences were present in the skill development for the TAKS Mathematics Objective 10 for each level of poverty. For the TAKS Mathematics Objective 10, extensive differences in scores existed for Black boys who were Extremely and Moderately Poor as compared to Black boys who were Not Poor. During the 2004-2005 through the 2006-2007 school years, Extremely Poor Black boys outperformed Moderately Poor Black boys on Objective 10. During the 2007-2008 through the 2011-2012 school years, scores were lowest for Black boys who were Extremely Poor during each year of this 5-year time span. Again, evident was a stair-step effect in the results (Carpenter et al., 2006). Black boys who were Not Poor again had the highest scores on TAKS Mathematics Objective 10 for each year of the investigation. Presented in Table 4.10 are the descriptive statistics for Objective 10.

Insert Table 4.10 about here

Discussion

The degree to which differences were present in the mathematics skill development of Black Texas high school boys by level of poverty was analyzed for the

2004-2005 through the 2011-2012 school years. In each school year, statistically significant differences in mathematical skill development were revealed by level of poverty for the 8-year time span. Following these statistical analyses, the presence of trends in each of the 10 mathematical skills was analyzed by level of poverty. Results are summarized in the next section.

TAKS Mathematics Objective 1 Through Objective 10

Objective 1 through Objective 10 of the TAKS Exit-Level Mathematics assessment examined students' ability to understand an array of mathematical concepts. For the 2004-2005 through the 2011-2012 school years, student performance on these objectives was assessed through a 60-question examination. During each year of this 8-year time span, Blacks boys who were Not Poor performed best on each of the TAKS Exit-Level Mathematics Objectives in comparison to Moderately Poor and Extremely Poor Black boys. In agreement with Carpenter et al. (2006), a stair-step effect was present in mathematical skill development for Black boys by level of poverty for the TAKS Exit-Level Mathematics Objectives during 5 years of this investigation.

Connection With Existing Literature

The Children's Defense Fund (2015) reported that poverty is a critical factor that can influence the academic experiences of students. For Black boys, the effects of being impoverished coupled with underdeveloped mathematical skills and limited parental support can adversely influence academic outcomes (Joe & Davis, 2009). Considering the differences in mathematical skill development between students in poverty in comparison to students who are not in poverty, multiple researchers (e.g., Children's Defense Fund, 2012; Davis, 2014; Educational Testing Service, 2011; Gardner &

Miranda, 2001) have recognized poverty as a complex factor that can impede the opportunities for academic achievement. Given the challenges some Black families have in overcoming academic and economic struggles, Lee and Bowen (2006) identified that when Black boys received parental guidance and support they were more apt to perform better in mathematics. Further, Friend, Hunter, and Fletcher (2011) noted that despite financial circumstances, many Black parents work diligently to make certain their children have the mathematical skills needed to be successful in school and beyond. Results of this investigation are commensurate with trend data and the findings of other researchers (Alford-Stephens & Slate, 2016; Balfanz & Byrnes, 2006; Burney & Beilke, 2008; Educational Testing Service, 2011) who have identified differences in mathematics proficiency between students in poverty in comparison to students who are not in poverty.

Implications for Policy and Practice

For each degree of poverty (i.e., Extremely Poor, Moderately Poor, and Not Poor) analyzed in this study, Black boys who were Not Poor had the highest level of mathematical skill development. Evident in the analysis of this longitudinal investigation were differences in mathematical competence for Extremely Poor, Moderately Poor, and Not Poor Black boys. The persistent gap in mathematical skill development between students who were economically disadvantaged and those students who were not economically disadvantaged remain. As such, results from this investigation could be used to support the notion that additional mechanisms are needed to assist school systems with educating students in poverty.

Effectively educating diverse groups of students can be challenging. Despite the barriers poverty can pose to some students, educators and policy makers should strive to implement programs that can reduce the effects of poverty on student success. With the transition to the Every Student Succeeds Act (2015), school systems and policy makers are expected to implement practices that address the social, emotional, nutritional, and physical needs of its learners. According to Ladd, Noguera, Reville, and Starr (2016), programs such as quality pre-kindergarten schooling, enriching after school programs, and nutritional supports foster improved opportunities for students to develop the skills needed to have college, career, and life success.

The constraints of living in poverty are well documented (Alford-Stephens & Slate, 2016; Burney & Blake, 2008; Davis, 2014; Hernandez, 2014). Despite the large volume of data in which the influence of economic status on mathematical experiences, has been documented, some educational systems have been unable to overcome the constraints of ensuring students in poverty are academically successful. Expansive gaps in mathematical skills and abilities continue to exist at varied degrees of poverty (i.e., Extremely Poor, Moderately Poor, and Not Poor). For Black boys who are Extremely Poor, existing disparate rates in mathematical skill development demonstrates the need for specific programs to assist this at-risk group. Mitigating the effects of poverty and providing schools adequate resources to educate impoverished learners is critical to the growth and development of the students who need the most targeted and sustainable inventions and support.

Recommendations for Future Research

Competence in mathematics is vital to student success (Hernandez, 2014). To further support the research on the importance of the development of mathematical skills, extending this study to investigate the mathematical knowledge of Black girls at different levels of poverty could be informative when drawing conclusions about Black students as a group. Further, these data would be useful in identifying trends that exist among Black boys and girls who are Extremely Poor, Moderately Poor, and Not Poor.

Research regarding proficiency in mathematics for Texas high school Asian, White, and Hispanic boys at different levels of poverty could also be essential in identifying the differences in mathematical abilities among these groups of students. Conducting an analysis of different ethnic/racial groups (i.e., Asian, White, Hispanic, and Black) at different degrees of poverty (i.e., Extremely Poor, Moderately Poor, and Not Poor) could provide educators with comprehensive data to make decisive decisions about the types of student interventions needed. Additionally, these data could bring greater awareness to the instructional practices that have not been effectively addressing the gaps in student performance.

The transition to the new assessment system in Texas has been cumbersome. Inconsistent data reporting has yielded unreliable data. As more consistent and dependable data become available, scores from the State of Texas Assessments of Academic Readiness and End of Course examinations will become accessible by researchers. The degree to which differences exist in mathematical skill development by level of poverty for EOC exams could be analyzed. For this investigation, statistically significant differences in mathematical skill development were revealed by level of poverty (i.e., Extremely Poor, Moderately Poor, and Not Poor). It is recommended that the relationship between economic status and postsecondary success be investigated. Additional variables that could be considered are whether differences are evident in mathematical competence for girls by level of poverty.

Conclusion

The purpose of this research investigation was to examine the degree to which differences were present in mathematical skill development by level of poverty (i.e., Extremely Poor, Moderately Poor, and Not Poor) for Texas high school Black boys. An analysis of 8 years of statewide data revealed the presence of statistically significant differences in TAKS Exit-Level Mathematics skill development among Extremely Poor, Moderately Poor and Not Poor Black boys. For the 2004-2005 through the 2011-2012 school years, Black boys who were Not Poor exhibited better mathematics skill development than did Moderately Poor and Extremely Poor Black boys on each of the 10 TAKS Exit-level Mathematics objectives. As noted by multiple researchers (e.g., Alford-Stephens & Slate, 2016; Balfanz & Byrnes, 2006; Davis, 2014; Educational Testing Service, 2011; Hernandez, 2014; National Center for Education Statistics, 2015), gaps in mathematical skill development exist among Black boys who are Extremely Poor, Moderately Poor, and Not Poor.

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Table 4.1

Descriptive Statistics for TAKS Exit Level Mathematics Objective 1 by Level of Poverty for the 2004-2005 Through the 2011-2012 School Years

School Year and Level of Poverty	*n*	*M*	*SD*
2004-2005			
Not Poor	7,191	2.80	1.76
Moderately Poor	496	1.74	1.88
Extremely Poor	4,883	1.88	1.84
2005-2006			
Not Poor	7,215	2.93	1.70
Moderately Poor	519	1.75	1.85
Extremely Poor	5,688	2.22	1.81
2006-2007			
Not Poor	7,500	3.27	1.65
Moderately Poor	529	2.19	1.98
Extremely Poor	5,666	2.51	1.84
2007-2008			
Not Poor	6,460	3.73	1.39
Moderately Poor	469	3.51	1.46
Extremely Poor	4,560	3.30	1.53
2008-2009			
Not Poor	6,904	3.63	1.35
Moderately Poor	382	3.42	1.31
Extremely Poor	5,321	3.12	1.46
2009-2010			
Not Poor	6,394	3.63	1.19
Moderately Poor	561	3.61	1.17
Extreme Poverty	6,004	3.30	1.30
2010-2011			
Not Poor	5,677	3.79	1.26
Moderately Poor	355	3.68	1.44
Extremely Poor	6,037	3.41	1.39
2011-2012			
Not Poor	5,463	3.77	1.84
Moderately Poor	411	3.64	1.21
Extremely Poor	6,552	3.45	1.35

Table 4.2

Descriptive Statistics for TAKS Exit Level Mathematics Objective 2 by Level of Poverty for the 2004-2005 Through the 2011-2012 School Years

School Year and Level of Poverty	*n*	*M*	*SD*
2004-2005			
Not Poor	7,191	2.63	1.70
Moderately Poor	496	1.66	1.79
Extremely Poor	4,883	1.77	1.72
2005-2006			
Not Poor	7,215	2.91	1.69
Moderately Poor	519	1.77	1.84
Extremely Poor	5,688	2.18	1.79
2006-2007			
Not Poor	7,500	2.86	1.60
Moderately Poor	529	1.83	1.73
Extremely Poor	5,666	2.15	1.70
2007-2008			
Not Poor	6,460	3.25	1.30
Moderately Poor	469	3.09	1.37
Extremely Poor	4,560	2.91	1.38
2008-2009			
Not Poor	6,904	3.36	1.48
Moderately Poor	382	3.20	1.48
Extremely Poor	5,321	2.84	1.53
2009-2010			
Not Poor	6,394	3.56	1.21
Moderately Poor	561	3.57	1.19
Extreme Poverty	6,004	3.27	1.30
2010-2011			
Not Poor	5,677	3.82	1.22
Moderately Poor	355	3.72	1.42
Extremely Poor	6,037	3.51	1.36
2011-2012			
Not Poor	5,463	3.67	1.23
Moderately Poor	411	3.52	1.29
Extremely Poor	6,552	3.34	1.33

Table 4.3

Descriptive Statistics for TAKS Exit Level Mathematics Objective 3 by Level of Poverty for the 2004-2005 Through the 2011-2012 School Years

School Year and Level of Poverty	*n*	*M*	*SD*
2004-2005			
Not Poor	7,191	2.59	1.65
Moderately Poor	496	1.67	1.76
Extremely Poor	4,883	1.74	1.69
2005-2006			
Not Poor	7,215	2.63	1.65
Moderately Poor	519	1.54	1.67
Extremely Poor	5,688	1.95	1.69
2006-2007			
Not Poor	7,500	2.95	1.69
Moderately Poor	529	1.95	1.89
Extremely Poor	5,666	2.21	1.79
2007-2008			
Not Poor	6,460	3.41	1.43
Moderately Poor	469	3.26	1.47
Extremely Poor	4,560	3.00	1.51
2008-2009			
Not Poor	6,904	3.37	1.44
Moderately Poor	382	3.26	1.45
Extremely Poor	5,321	2.93	1.52
2009-2010			
Not Poor	6,394	3.30	1.30
Moderately Poor	561	3.22	1.29
Extreme Poverty	6,004	2.93	1.37
2010-2011			
Not Poor	5,677	3.53	1.33
Moderately Poor	355	3.32	1.46
Extremely Poor	6,037	3.16	1.43
2011-2012			
Not Poor	5,463	3.52	1.37
Moderately Poor	411	3.36	1.33
Extremely Poor	6,552	3.14	1.46

Table 4.4

Descriptive Statistics for TAKS Exit Level Mathematics Objective 4 by Level of Poverty for the 2004-2005 Through the 2011-2012 School Years

School Year and Level of Poverty	*n*	*M*	*SD*
2004-2005			
Not Poor	7,191	2.77	1.69
Moderately Poor	496	1.68	1.77
Extremely Poor	4,883	1.88	1.76
2005-2006			
Not Poor	7,215	2.88	1.69
Moderately Poor	519	1.74	1.81
Extremely Poor	5,688	2.18	1.79
2006-2007			
Not Poor	7,500	3.03	1.70
Moderately Poor	529	2.04	1.96
Extremely Poor	5,666	2.25	1.81
2007-2008			
Not Poor	6,460	3.39	1.38
Moderately Poor	469	3.30	1.49
Extremely Poor	4,560	2.95	1.47
2008-2009			
Not Poor	6,904	3.70	1.33
Moderately Poor	382	3.58	1.35
Extremely Poor	5,321	3.27	1.45
2009-2010			
Not Poor	6,394	3.68	1.35
Moderately Poor	561	3.64	1.38
Extreme Poverty	6,004	3.25	1.47
2010-2011			
Not Poor	5,677	3.63	1.31
Moderately Poor	355	3.48	1.43
Extremely Poor	6,037	3.21	1.42
2011-2012			
Not Poor	5,463	3.76	1.31
Moderately Poor	411	3.73	1.28
Extremely Poor	6,552	3.41	1.44

Table 4.5

Descriptive Statistics for TAKS Exit Level Mathematics Objective 5 by Level of Poverty for the 2004-2005 Through the 2011-2012 School Years

School Year and Level of Poverty	*n*	*M*	*SD*
2004-2005			
Not Poor	7,191	2.81	1.73
Moderately Poor	496	1.68	1.79
Extremely Poor	4,883	1.90	1.79
2005-2006			
Not Poor	7,215	3.00	1.75
Moderately Poor	519	1.75	1.85
Extremely Poor	5,688	2.25	1.86
2006-2007			
Not Poor	7,500	2.96	1.68
Moderately Poor	529	1.92	1.86
Extremely Poor	5,666	2.22	1.78
2007-2008			
Not Poor	6,460	3.48	1.33
Moderately Poor	469	3.34	1.40
Extremely Poor	4,560	3.13	1.42
2008-2009			
Not Poor	6,904	3.52	1.41
Moderately Poor	382	3.36	1.36
Extremely Poor	5,321	3.02	1.53
2009-2010			
Not Poor	6,394	3.87	1.22
Moderately Poor	561	3.79	1.23
Extreme Poverty	6,004	3.56	1.35
2010-2011			
Not Poor	5,677	3.89	1.13
Moderately Poor	355	3.68	1.40
Extremely Poor	6,037	3.61	1.27
2011-2012			
Not Poor	5,463	4.00	1.21
Moderately Poor	411	3.91	1.25
Extremely Poor	6,552	3.65	1.37

Table 4.6

Descriptive Statistics for TAKS Exit Level Mathematics Objective 6 by Level of Poverty for the 2004-2005 Through the 2011-2012 School Years

School Year and Level of Poverty	*n*	*M*	*SD*
2004-2005			
Not Poor	7,191	3.06	2.06
Moderately Poor	496	1.82	2.04
Extremely Poor	4,883	2.07	2.05
2005-2006			
Not Poor	7,215	3.26	2.00
Moderately Poor	519	1.85	1.95
Extremely Poor	5,688	2.50	2.08
2006-2007			
Not Poor	7,500	3.61	2.12
Moderately Poor	529	2.40	2.27
Extremely Poor	5,666	2.67	2.18
2007-2008			
Not Poor	6,460	4.01	1.87
Moderately Poor	469	3.74	1.82
Extremely Poor	4,560	3.51	1.86
2008-2009			
Not Poor	6,904	4.28	1.87
Moderately Poor	382	3.97	1.80
Extremely Poor	5,321	3.60	1.89
2009-2010			
Not Poor	6,394	4.62	1.70
Moderately Poor	561	4.46	1.74
Extreme Poverty	6,004	4.08	1.80
2010-2011			
Not Poor	5,677	4.69	1.66
Moderately Poor	355	4.41	1.85
Extremely Poor	6,037	4.20	1.73
2011-2012			
Not Poor	5,463	4.63	1.76
Moderately Poor	411	4.49	1.75
Extremely Poor	6,552	4.09	1.88

Table 4.7

Descriptive Statistics for TAKS Exit Level Mathematics Objective 7 by Level of Poverty for the 2004-2005 Through the 2011-2012 School Years

School Year and Level of Poverty	*n*	*M*	*SD*
2004-2005			
Not Poor	7,191	3.87	2.27
Moderately Poor	496	2.46	2.52
Extremely Poor	4,883	2.63	2.40
2005-2006			
Not Poor	7,215	3.88	2.20
Moderately Poor	519	2.36	2.41
Extremely Poor	5,688	2.96	2.37
2006-2007			
Not Poor	7,500	3.69	2.08
Moderately Poor	529	2.36	2.27
Extremely Poor	5,666	2.75	2.16
2007-2008			
Not Poor	6,460	4.77	1.80
Moderately Poor	469	4.48	1.85
Extremely Poor	4,560	4.25	1.86
2008-2009			
Not Poor	6,904	4.79	1.72
Moderately Poor	382	4.52	1.75
Extremely Poor	5,321	4.18	1.85
2009-2010			
Not Poor	6,394	4.71	1.65
Moderately Poor	561	4.58	1.64
Extreme Poverty	6,004	4.25	1.73
2010-2011			
Not Poor	5,677	5.10	1.59
Moderately Poor	355	4.88	1.89
Extremely Poor	6,037	4.71	1.75
2011-2012			
Not Poor	5,463	4.97	1.70
Moderately Poor	411	4.85	1.75
Extremely Poor	6,552	4.47	1.83

Table 4.8

Descriptive Statistics for TAKS Exit Level Mathematics Objective 8 by Level of Poverty for the 2004-2005 Through the 2011-2012 School Years

School Year and Level of Poverty	*n*	*M*	*SD*
2004-2005			
Not Poor	7,191	3.05	2.07
Moderately Poor	496	1.85	2.10
Extremely Poor	4,883	2.06	2.07
2005-2006			
Not Poor	7,215	3.20	2.02
Moderately Poor	519	1.88	2.01
Extremely Poor	5,688	2.36	2.02
2006-2007			
Not Poor	7,500	3.62	2.11
Moderately Poor	529	2.31	2.23
Extremely Poor	5,666	2.66	2.16
2007-2008			
Not Poor	6,460	3.99	1.95
Moderately Poor	469	3.64	1.94
Extremely Poor	4,560	3.38	1.96
2008-2009			
Not Poor	6,904	4.30	1.89
Moderately Poor	382	4.08	1.83
Extremely Poor	5,321	3.67	1.88
2009-2010			
Not Poor	6,394	4.20	1.90
Moderately Poor	561	4.08	1.88
Extreme Poverty	6,004	3.64	1.92
2010-2011			
Not Poor	5,677	4.39	1.83
Moderately Poor	355	4.05	1.94
Extremely Poor	6,037	3.89	1.86
2011-2012			
Not Poor	5,463	4.65	1.79
Moderately Poor	411	4.46	1.85
Extremely Poor	6,552	4.15	1.89

Table 4.9

Descriptive Statistics for TAKS Exit Level Mathematics Objective 9 by Level of Poverty for the 2004-2005 Through the 2011-2012 School Years

School Year and Level of Poverty	*n*	*M*	*SD*
2004-2005			
Not Poor	7,191	2.46	1.58
Moderately Poor	496	1.52	1.68
Extremely Poor	4,883	1.65	1.62
2005-2006			
Not Poor	7,215	2.62	1.65
Moderately Poor	519	1.52	1.68
Extremely Poor	5,688	1.89	1.68
2006-2007			
Not Poor	7,500	2.65	1.57
Moderately Poor	529	1.66	1.69
Extremely Poor	5,666	1.92	1.57
2007-2008			
Not Poor	6,460	3.31	1.37
Moderately Poor	469	3.13	1.41
Extremely Poor	4,560	2.88	1.43
2008-2009			
Not Poor	6,904	3.29	1.41
Moderately Poor	382	3.13	1.43
Extremely Poor	5,321	2.85	1.49
2009-2010			
Not Poor	6,394	3.38	1.26
Moderately Poor	561	3.22	1.25
Extreme Poverty	6,004	2.97	1.32
2010-2011			
Not Poor	5,677	3.09	1.31
Moderately Poor	355	2.85	1.36
Extremely Poor	6,037	2.75	1.34
2011-2012			
Not Poor	5,463	3.38	1.27
Moderately Poor	411	3.18	1.30
Extremely Poor	6,552	3.04	1.34

Table 4.10

Descriptive Statistics for TAKS Exit Level Mathematics Objective 10 by Level of Poverty for the 2004-2005 Through the 2011-2012 School Years

School Year and Level of Poverty	*n*	*M*	*SD*
2004-2005			
Not Poor	7,191	4.10	2.48
Moderately Poor	496	2.61	2.72
Extremely Poor	4,883	2.82	2.61
2005-2006			
Not Poor	7,215	4.20	2.63
Moderately Poor	519	2.36	2.55
Extremely Poor	5,688	3.05	2.62
2006-2007			
Not Poor	7,500	4.58	2.56
Moderately Poor	529	2.98	2.79
Extremely Poor	5,666	3.40	2.63
2007-2008			
Not Poor	6,460	5.36	2.29
Moderately Poor	469	5.01	2.34
Extremely Poor	4,560	4.58	2.35
2008-2009			
Not Poor	6,904	5.59	2.21
Moderately Poor	382	5.51	2.13
Extremely Poor	5,321	4.78	2.33
2009-2010			
Not Poor	6,394	5.42	2.18
Moderately Poor	561	5.15	2.16
Extreme Poverty	6,004	4.63	2.21
2010-2011			
Not Poor	5,677	5.62	2.11
Moderately Poor	355	5.28	2.29
Extremely Poor	6,037	4.96	2.19
2011-2012			
Not Poor	5,463	5.66	2.30
Moderately Poor	411	5.41	2.26
Extremely Poor	6,552	4.94	2.36

CHAPTER V

DISCUSSION

Decades of Texas and nationwide assessment data in mathematics have documented the presence of gaps in students' skills and abilities across ethnic/racial groups and by economic status. Thus, addressing these differences and reducing skill deficits in mathematics has been the focus of many school districts. Results from this longitudinal investigation reveal the trends in mathematics performance continue to be lowest for Black boys experiencing extreme poverty. Conversely, Asian boys and students who are not economically disadvantaged had the highest mathematics achievement scores. Given the importance of mathematics to high school completion, college-readiness, and financial stability, all students must be given the opportunity to become competent in this subject area (Siegler et al., 2012). Further, regardless of economic status or ethnicity, thoroughly developed mathematical skills are positively related to lifelong success and are necessary if students intend to pursue a career related to the science, technology, engineering, or mathematics areas (Siegler et al., 2012).

Discussion of Results for Mathematics Achievement by Ethnicity/Race

Presented in Table 5.1 are the results of the statistical analyses for Texas high school boys by ethnicity/race for each TAKS Exit Level Mathematics performance standard for the 2004-2005 through the 2011-2012 school years. For each year, statistically significant results were revealed. Effect sizes were small or moderate. Asian and White boys had higher levels of mathematics achievement than Hispanic and Black boys during each year of the investigation. Black boys had the lowest scores for the Met

Standard, Commended Performance, and HERC performance measures for the 8-year time period.

Table 5.1

Summary of Mathematics Performance for the TAKS Exit Level Mathematics Exam as a Function of Ethnicity/Race for the 2004-2005 Through the 2011-2012 School Years

Mathematics Standard	Statistically Significant	Effect Size	Lowest Performing Group
2004-2005			
Met Standard	Yes	Small	Black
Commended Performance	Yes	Small	Black
HERC Standard	Yes	Moderate	Black
2005-2006			
Met Standard	Yes	Small	Black
Commended Performance	Yes	Small	Black
HERC Standard	Yes	Moderate	Black
2006-2007			
Met Standard	Yes	Small	Black
Commended Performance	Yes	Small	Black
HERC Standard	Yes	Moderate	Black
2007-2008			
Met Standard	Yes	Small	Black
Commended Performance	Yes	Small	Black
HERC Standard	Yes	Moderate	Black
2008-2009			
Met Standard	Yes	Small	Black
Commended Performance	Yes	Small	Black
HERC Standard	Yes	Moderate	Black
2009-2010			
Met Standard	Yes	Small	Black
Commended Performance	Yes	Small	Black
HERC Standard	Yes	Moderate	Black
2010-2011			
Met Standard	Yes	Small	Black
Commended Performance	Yes	Small	Black
HERC Standard	Yes	Small	Black
2011-2012			
Met Standard	Yes	Small	Black
Commended Performance	Yes	Small	Black
HERC Standard	Yes	Small	Black

Discussion of Results for Mathematics Skills by Ethnicity/Race

Presented in Table 5.2 are the results of the statistical analyses for Texas high school boys by ethnicity/race for each TAKS Exit Level Mathematics objective for the 2004-2005 through the 2006-2007 school years. During each year of the 3-year analyses, statistically significant results were revealed for the TAKS Exit Level Mathematics assessment by performance objective. For all school years, the effect sizes were small or medium. Asian and White boys outperformed Hispanic and Black boys on each mathematics objective during each year of the investigation. Additionally, Black boys had the lowest scores for each of the 10 TAKS Exit Level Mathematics objectives for the 3-year time period.

Table 5.2

Summary of Mathematics Performance by Objective for the TAKS Exit Level Mathematics Exam as a Function of Ethnicity/Race for the 2004-2005 Through the 2006-2007 School Years

School Year and Mathematics Objective	Statistically Significant	Effect Size	Lowest Performing Group
2004-2005			
Mathematics Objective 1	Yes	Medium	Black
Mathematics Objective 2	Yes	Medium	Black
Mathematics Objective 3	Yes	Medium	Black
Mathematics Objective 4	Yes	Medium	Black
Mathematics Objective 5	Yes	Medium	Black
Mathematics Objective 6	Yes	Medium	Black
Mathematics Objective 7	Yes	Medium	Black
Mathematics Objective 8	Yes	Medium	Black
Mathematics Objective 9	Yes	Medium	Black
Mathematics Objective 10	Yes	Medium	Black
2005-2006			
Mathematics Objective 1	Yes	Small	Black
Mathematics Objective 2	Yes	Small	Black
Mathematics Objective 3	Yes	Medium	Black
Mathematics Objective 4	Yes	Medium	Black
Mathematics Objective 5	Yes	Small	Black
Mathematics Objective 6	Yes	Medium	Black
Mathematics Objective 7	Yes	Medium	Black
Mathematics Objective 8	Yes	Medium	Black
Mathematics Objective 9	Yes	Medium	Black
Mathematics Objective 10	Yes	Medium	Black
2006-2007			
Mathematics Objective 1	Yes	Small	Black
Mathematics Objective 2	Yes	Small	Black
Mathematics Objective 3	Yes	Small	Black
Mathematics Objective 4	Yes	Small	Black
Mathematics Objective 5	Yes	Medium	Black
Mathematics Objective 6	Yes	Medium	Black
Mathematics Objective 7	Yes	Medium	Black
Mathematics Objective 8	Yes	Medium	Black
Mathematics Objective 9	Yes	Medium	Black
Mathematics Objective 10	Yes	Medium	Black

Presented in Table 5.3 are the results of the statistical analyses for Texas high school boys by ethnicity/race for each TAKS Exit Level Mathematics objective for the 2007-2008 through the 2009-2010 school years. During each year of the 3-year analyses, statistically significant results were revealed for the TAKS Exit Level Mathematics assessment by performance objective. For all school years, the effect sizes were small or medium. Again, Asian and White boys outperformed Hispanic and Black boys on each mathematics objective during each year of the investigation. During the 3-year time span, Black boys had the lowest scores for each of the 10 TAKS Exit Level Mathematics objectives.

Table 5.3

Summary of Mathematics Performance by Objective for the TAKS Exit Level Mathematics Exam as a Function of Ethnicity/Race for the 2007-2008 Through the 2009-2010 School Years

School Year and Mathematics Objective	Statistically Significant	Effect Size	Lowest Performing Group
2007-2008			
Mathematics Objective 1	Yes	Medium	Black
Mathematics Objective 2	Yes	Small	Black
Mathematics Objective 3	Yes	Small	Black
Mathematics Objective 4	Yes	Medium	Black
Mathematics Objective 5	Yes	Small	Black
Mathematics Objective 6	Yes	Medium	Black
Mathematics Objective 7	Yes	Medium	Black
Mathematics Objective 8	Yes	Medium	Black
Mathematics Objective 9	Yes	Medium	Black
Mathematics Objective 10	Yes	Medium	Black
2008-2009			
Mathematics Objective 1	Yes	Medium	Black
Mathematics Objective 2	Yes	Medium	Black
Mathematics Objective 3	Yes	Small	Black
Mathematics Objective 4	Yes	Small	Black
Mathematics Objective 5	Yes	Small	Black
Mathematics Objective 6	Yes	Medium	Black
Mathematics Objective 7	Yes	Medium	Black
Mathematics Objective 8	Yes	Medium	Black
Mathematics Objective 9	Yes	Medium	Black
Mathematics Objective 10	Yes	Medium	Black
2009-2010			
Mathematics Objective 1	Yes	Small	Black
Mathematics Objective 2	Yes	Small	Black
Mathematics Objective 3	Yes	Small	Black
Mathematics Objective 4	Yes	Small	Black
Mathematics Objective 5	Yes	Small	Black
Mathematics Objective 6	Yes	Small	Black
Mathematics Objective 7	Yes	Medium	Black
Mathematics Objective 8	Yes	Medium	Black
Mathematics Objective 9	Yes	Medium	Black
Mathematics Objective 10	Yes	Medium	Black

Presented in Table 5.4 are the results of the statistical analyses for Texas high school boys by ethnicity/race for each TAKS Exit Level Mathematics objective for the 2010-2011 and the 2011-2012 school years. During both years of the analyses, statistically significant results were revealed for the TAKS Exit Level Mathematics assessment by performance objective. For both school years, the effect sizes were small or medium. Asian and White boys outperformed Hispanic and Black boys on each of the 10 mathematics objectives during each year of the investigation. Again, Black boys had the lowest scores for each of the 10 TAKS Exit Level Mathematics objectives for the 2-year time period.

Table 5.4

Summary of Mathematics Performance by Objective for the TAKS Exit Level Mathematics Exam as a Function of Ethnicity/Race for the 2010-2011 and the 2011-2012 School Years

School Year and Mathematics Objective	Statistically Significant	Effect Size	Lowest Performing Group
2010-2011			
Mathematics Objective 1	Yes	Small	Black
Mathematics Objective 2	Yes	Small	Black
Mathematics Objective 3	Yes	Small	Black
Mathematics Objective 4	Yes	Small	Black
Mathematics Objective 5	Yes	Small	Black
Mathematics Objective 6	Yes	Small	Black
Mathematics Objective 7	Yes	Small	Black
Mathematics Objective 8	Yes	Small	Black
Mathematics Objective 9	Yes	Medium	Black
Mathematics Objective 10	Yes	Medium	Black
2011-2012			
Mathematics Objective 1	Yes	Small	Black
Mathematics Objective 2	Yes	Small	Black
Mathematics Objective 3	Yes	Small	Black
Mathematics Objective 4	Yes	Small	Black
Mathematics Objective 5	Yes	Small	Black
Mathematics Objective 6	Yes	Small	Black
Mathematics Objective 7	Yes	Small	Black
Mathematics Objective 8	Yes	Small	Black
Mathematics Objective 9	Yes	Small	Black
Mathematics Objective 10	Yes	Medium	Black

Discussion of Results for Mathematics Skills by Level of Poverty

Presented in Table 5.5 are the results of the statistical analyses for Texas high school Black boys by level of poverty for each TAKS Exit Level Mathematics objective for the 2004-2005 through the 2006-2007 school years. During each year of the 3-year analyses, statistically significant results were revealed for the TAKS Exit Level Mathematics assessment by performance objective. For the 3 school years, the effect sizes were small or medium. During each year of this 3-year time span, Moderately Poor Black boys outperformed Extremely Poor Black boys on each mathematics objective. Black boys who were Not Poor had the best scores on each TAKS Exit Level Mathematics objective during each year of this investigation.

Table 5.5

Summary of Mathematics Performance by Objective for the TAKS Exit Level Mathematics Exam as a Function of Economic Status for the 2004-2005 Through the 2006-2007 School Years

School Year and Mathematics Objective	Statistically Significant	Effect Size	Lowest Performing Group
2004-2005			
Mathematics Objective 1	Yes	Medium	Moderately Poor
Mathematics Objective 2	Yes	Medium	Moderately Poor
Mathematics Objective 3	Yes	Medium	Moderately Poor
Mathematics Objective 4	Yes	Medium	Moderately Poor
Mathematics Objective 5	Yes	Medium	Moderately Poor
Mathematics Objective 6	Yes	Medium	Moderately Poor
Mathematics Objective 7	Yes	Medium	Moderately Poor
Mathematics Objective 8	Yes	Medium	Moderately Poor
Mathematics Objective 9	Yes	Medium	Moderately Poor
Mathematics Objective 10	Yes	Medium	Moderately Poor
2005-2006			
Mathematics Objective 1	Yes	Medium	Moderately Poor
Mathematics Objective 2	Yes	Medium	Moderately Poor
Mathematics Objective 3	Yes	Small	Moderately Poor
Mathematics Objective 4	Yes	Small	Moderately Poor
Mathematics Objective 5	Yes	Small	Moderately Poor
Mathematics Objective 6	Yes	Small	Moderately Poor
Mathematics Objective 7	Yes	Medium	Moderately Poor
Mathematics Objective 8	Yes	Medium	Moderately Poor
Mathematics Objective 9	Yes	Medium	Moderately Poor
Mathematics Objective 10	Yes	Medium	Moderately Poor
2006-2007			
Mathematics Objective 1	Yes	Medium	Moderately Poor
Mathematics Objective 2	Yes	Medium	Moderately Poor
Mathematics Objective 3	Yes	Small	Moderately Poor
Mathematics Objective 4	Yes	Small	Moderately Poor
Mathematics Objective 5	Yes	Small	Moderately Poor
Mathematics Objective 6	Yes	Small	Moderately Poor
Mathematics Objective 7	Yes	Small	Moderately Poor
Mathematics Objective 8	Yes	Small	Moderately Poor
Mathematics Objective 9	Yes	Small	Moderately Poor
Mathematics Objective 10	Yes	Small	Moderately Poor

Presented in Table 5.6 are the results of the statistical analyses for Texas high school Black boys by level of poverty for each TAKS Exit Level Mathematics objective for the 2007-2008 through the 2009-2010 school years. During each year of the 3-year analyses, statistically significant results were revealed for the TAKS Exit Level Mathematics assessment by performance objective. For the 3 school years, the effect sizes were small or medium. During each year of this 3-year time span, Black boys who were Not Poor outperformed Moderately Poor and Extremely Poor Black boys on each TAKS Exit Level Mathematics objective during each year of this investigation.

Table 5.6

Summary of Mathematics Performance by Objective for the TAKS Exit Level Mathematics Exam as a Function of Economic Status for the 2007-2008 Through the 2009-2010 School Years

School Year and Mathematics Objective	Statistically Significant	Effect Size	Lowest Performing Group
2007-2008			
Mathematics Objective 1	Yes	Small	Extremely Poor
Mathematics Objective 2	Yes	Small	Extremely Poor
Mathematics Objective 3	Yes	Small	Extremely Poor
Mathematics Objective 4	Yes	Small	Extremely Poor
Mathematics Objective 5	Yes	Small	Extremely Poor
Mathematics Objective 6	Yes	Small	Extremely Poor
Mathematics Objective 7	Yes	Small	Extremely Poor
Mathematics Objective 8	Yes	Small	Extremely Poor
Mathematics Objective 9	Yes	Small	Extremely Poor
Mathematics Objective 10	Yes	Small	Extremely Poor
2008-2009			
Mathematics Objective 1	Yes	Small	Extremely Poor
Mathematics Objective 2	Yes	Small	Extremely Poor
Mathematics Objective 3	Yes	Small	Extremely Poor
Mathematics Objective 4	Yes	Small	Extremely Poor
Mathematics Objective 5	Yes	Small	Extremely Poor
Mathematics Objective 6	Yes	Small	Extremely Poor
Mathematics Objective 7	Yes	Small	Extremely Poor
Mathematics Objective 8	Yes	Small	Extremely Poor
Mathematics Objective 9	Yes	Small	Extremely Poor
Mathematics Objective 10	Yes	Small	Extremely Poor
2009-2010			
Mathematics Objective 1	Yes	Small	Extremely Poor
Mathematics Objective 2	Yes	Small	Extremely Poor
Mathematics Objective 3	Yes	Small	Extremely Poor
Mathematics Objective 4	Yes	Small	Extremely Poor
Mathematics Objective 5	Yes	Small	Extremely Poor
Mathematics Objective 6	Yes	Small	Extremely Poor
Mathematics Objective 7	Yes	Small	Extremely Poor
Mathematics Objective 8	Yes	Small	Extremely Poor
Mathematics Objective 9	Yes	Small	Extremely Poor
Mathematics Objective 10	Yes	Small	Extremely Poor

Presented in Table 5.7 are the results of the statistical analyses for Texas high school Black boys by level of poverty for each TAKS Exit Level Mathematics objective for the 2010-2011 and the 2011-2012 school years. During both years, statistically significant results were revealed for the TAKS Exit Level Mathematics assessment by performance objective. For both school years, the effect sizes were small or medium. During each year, Black boys who were Not Poor outperformed Moderately Poor and Extremely Poor Black boys on each TAKS Exit Level Mathematics objective during each year of this investigation.

Table 5.7

Summary of Mathematics Performance by Objective for the TAKS Exit Level Mathematics Exam as a Function of Economic Status for the 2010-2011 and the 2011-2012 School Years

School Year and Mathematics Objective	Statistically Significant	Effect Size	Lowest Performing Group
2010-2011			
Mathematics Objective 1	Yes	Small	Extremely Poor
Mathematics Objective 2	Yes	Small	Extremely Poor
Mathematics Objective 3	Yes	Small	Extremely Poor
Mathematics Objective 4	Yes	Small	Extremely Poor
Mathematics Objective 5	Yes	Small	Extremely Poor
Mathematics Objective 6	Yes	Small	Extremely Poor
Mathematics Objective 7	Yes	Small	Extremely Poor
Mathematics Objective 8	Yes	Small	Extremely Poor
Mathematics Objective 9	Yes	Small	Extremely Poor
Mathematics Objective 10	Yes	Small	Extremely Poor
2011-2012			
Mathematics Objective 1	Yes	Small	Extremely Poor
Mathematics Objective 2	Yes	Small	Extremely Poor
Mathematics Objective 3	Yes	Small	Extremely Poor
Mathematics Objective 4	Yes	Small	Extremely Poor
Mathematics Objective 5	Yes	Small	Extremely Poor
Mathematics Objective 6	Yes	Small	Extremely Poor
Mathematics Objective 7	Yes	Small	Extremely Poor
Mathematics Objective 8	Yes	Small	Extremely Poor
Mathematics Objective 9	Yes	Small	Extremely Poor
Mathematics Objective 10	Yes	Small	Extremely Poor

Summary of Results

Proficiency in mathematics has been regarded as an essential factor that contributes to student academic achievement. Revealed in these three empirical research investigations were vast differences in the mathematical competence of boys by ethnic/racial groups and level of poverty. Hispanic and Black boys consistently displayed underdeveloped mathematical abilities in comparison to their Asian and White counterparts. Asian boys represented the smallest population of Texas high school boys and had the highest mathematics achievement.

According to Balfanz and Byrnes (2006), high school mathematics is vital to academic success. Statistical analyses of the TAKS Exit Level Mathematics assessment data identified large differences in mathematical skill development among Asian, White, Hispanic, and Black boys. Black boys consistently demonstrated lower levels of skill development on the TAKS Exit Level Mathematics exam than their peers from other racial/ethnic groups for each year of this study.

Poverty continues to be a critical factor that can influence student academic experiences (Hernandez, 2014). Specifically, Black boys who were economically disadvantaged were continuously outperformed by Black boys who were not economically disadvantaged. Results were consistent for all 8 school years for each of the 10 TAKS Exit Level Mathematics objectives.

Implications for Policy and Practice

Policymakers and educators have years of assessment data and research that identifies the need for improved instructional practices for Hispanic and Black students, particularly those who are in poverty. Hispanic students account for the majority (51%) of the state's student population, however this group's mathematic achievement scores remain lower than the scores of Asian and White students. Hispanic student performance, however, on state assessments exceeds the academic performance of Black students (Texas Education Agency, 2015). Given the increasing population of Hispanic students and their poor levels of mathematics achievement as compared to their Asian and White counterparts, changes must be made to reduce the gaps in mathematics achievement among Asian, White, Hispanic, and Black students.

A thorough understanding of various mathematical concepts is needed for secondary and post-secondary success (Achieve, 2008). Results from this study could be used to encourage educational leaders to examine the instructional delivery models currently in place and implement practices that foster improved learning opportunities for students with skill deficits. Further, understanding the implications of poorly developed mathematics skills on future life outcomes for different ethnic/racial groups could allow educators to intervene with each specific group more effectively. As acknowledged by Davis-Kean and Jager (2014), improving the educational experiences and outcomes for all students should be one of the primary goals of educators.

The National Center for Education Statistics (2015) reported that children living in poverty are more likely to have poorer academic performance as compared to students not living in poverty. Considering the persistent gap in mathematical skill development between Black boys who were Extremely Poor, Moderately Poor, and Not Poor, results from this investigation could provide educators the data needed to restructure their instructional approaches. Overcoming the barriers associated with educating students in poverty and providing schools with the resources to educate these at-risk youth adequately should be one of the primary goals of policymakers and educational systems if improved outcomes for all learners is expected.

Recommendations for Future Research

Examined in this study was the relationship between ethnic/racial group membership and the overall mathematics performance and skill development of each group, as determined by the TAKS Exit Level Mathematics examination. Additionally, the degree to which differences exist in mathematical skill development for Black boys by level of poverty was examined. Results from this investigation could be used to encourage future researchers to expand this study by examining multiple content areas to (e.g., reading, science, and social studies) to determine if trends exist for different ethnic/racial groups. Further, expanding this study to include mathematics assessment data from multiple states could support the notion that alarming gaps in mathematics achievement continue to exist among different racial/ethnic groups.

Research regarding the mathematics proficiency of girls by ethnicity/race (i.e., Asian, White, Hispanic, and Black) and level of poverty could also be instrumental in examining overall mathematics achievement for this group. These analyses could also be useful in drawing conclusions and further identifying trends in mathematics achievement on the TAKS Exit-Level Mathematics assessment. With this awareness, educational systems could implement targeted instructional practices to improve the quality of education provided to girls.

With the implementation of the new assessment system in Texas, data from the State of Texas Assessment of Academic Readiness (STAAR) and End of Course (EOC) assessments would be used for future investigations. As more dependable data become available, researchers could analyze the extent to which differences exist in mathematical competence for students as measured by STAAR and EOC assessments. Further, differences in skill development as identified by STAAR Readiness Standards and Supporting Standards by gender, economic status, and ethnic/racial group could be analyzed.

Conclusion

The purpose of this journal-ready dissertation was to examine the degree to which differences were present in overall mathematics achievement and skill development by ethnicity/race (i.e., Asian, White, Hispanic, and Black) for Texas high school boys. Additionally, the extent to which differences were present in mathematical skill development by level of poverty for Texas high school Black boys was analyzed. An analysis of 8 years of statewide data was conducted and revealed the presence of statistically significant differences in TAKS Exit-Level Mathematics proficiency among Asian, White, Hispanic, and Black boys. Statistically significant differences were yielded in mathematical skill development for Black boys by level of poverty. For the 2004-2005 through the 2011-2012 school years, Asian and White boys outperformed Hispanic and Black boys in overall mathematics achievement and skill development. Similarly, for the 2004-2005 school years through the 2011-2012 school years, Black boys who were not economically disadvantaged demonstrated higher levels of competence in mathematical concepts than Black boys who were economically disadvantaged.

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APPENDIX

Institutional Review Board
Office of Research and Sponsored Programs
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Fax: 936.294.3622
irb@shsu.edu
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Sam Houston
STATE UNIVERSITY
A Member of The Texas State University System

DATE:	July 5, 2016
TO:	Tamika Alford-Stephens [Faculty Sponsor: Dr. John Slate]
FROM:	Sam Houston State University (SHSU) IRB
PROJECT TITLE:	*Differences in Mathematics Skills of Texas High School Boys as a Function of Ethnicity/Race and Economic Status: A Multiyear Statewide Study [T/D]*
PROTOCOL #:	2016-06-30308
SUBMISSION TYPE:	INITIAL REVIEW
ACTION:	DETERMINATION OF EXEMPT STATUS
DECISION DATE:	July 5, 2016
REVIEW CATEGORY:	Category 4—research involving existing, publicly available data usually has little, if any, associated risk, particularly if subject identifiers are removed from the data or specimens.

Thank you for your submission of Initial Review materials for this project. The Sam Houston State University (SHSU) IRB has determined this project is EXEMPT FROM IRB REVIEW according to federal regulations.

We will retain a copy of this correspondence within our records.

*** What should investigators do when considering changes to an exempt study that could make it nonexempt?**

It is the PI's responsibility to consult with the IRB whenever questions arise about whether planned changes to an exempt study might make that study nonexempt human subjects research. In this case, please make available sufficient information to the IRB so it can make a correct determination.

If you have any questions, please contact the IRB Office at 936-294-4875 or irb@shsu.edu. Please include your project title and protocol number in all correspondence with this committee.

Sincerely,

Donna Desforges
IRB Chair, PHSC
PHSC-IRB

This letter has been electronically signed in accordance with all applicable regulations, and a copy is retained within Sam Houston State University IRB's records

VITA

TAMIKA ALFORD-STEPHENS

EDUCATIONAL HISTORY

Doctorate of Education – Educational Leadership (December 2016)
Sam Houston State University, Huntsville, TX
Dissertation: Differences in Mathematics Skills of Texas High School Boys as a Function of Ethnicity/Race and Economic Status: A Multiyear Statewide Study

Master of Business Administration, August 2009
University of St. Thomas, Houston, TX

Master of Education Administration, August, 2003
Prairie View A&M University, Prairie View, TX

Bachelor of Arts, Business Management, May 1999
Dillard University, New Orleans, Louisiana

PROFESSIONAL EXPERIENCE:

2014-Present	Executive Director of Finance, Aldine Independent School District, Houston, TX
2013-2014	Director of Grant Accounting, Aldine Independent School District, Houston, TX
2011-2013	Director of Consolidated Programs, Aldine Independent School District, Houston TX
2007-2011	Director of Special Initiatives, Aldine Independent School District, Houston, TX
2005-2007	Instructional Skills Specialist, Aldine Independent School District, Houston, TX
2004-2005	Parent Involvement Coordinator, Aldine Independent School District, Houston, TX
2001-2004	Third Grade Teacher, Aldine Independent School District, Houston, TX

PROFESSIONAL LICENSES:
Generalist Certification EC-4
Mid-management Certification EC-12
Superintendent Certification

SCHOLARLY RESEARCH ACTIVITY:
Alford-Stephens, T., & Slate, J. R. (2016a). Differences in mathematics performance for Grade 6-8 Black boys by economic status in Texas. *Journal of Basic and Applied*

Research International, 12(3), 135-139. Retrieved from http://www.ikpress.org/issue/624

Alford-Stephens, T., & Slate, J. R. (2016b). Differences in mathematics skills as a function of economic status for Grade 6-8 Black boys in Texas. *Progress in Education, Volume 40*. Hauppauge, NY: Nova Publishers.

PRESENTATIONS:

Alford-Stephens, T. (2016, March). *Differences in mathematics skills as a function of economic status for Grade 6-8 Black boys in Texas.* Paper presented at the Academic and Business Research Institute, San Antonio, TX.

PROFESSIONAL MEMBERSHIPS:

Association for the Compensatory Educators of Texas (ACET), 2007 - Present
Texas Association of School Business Officials (TASBO), 2008 - Present
Association of School Business Officials International (ASBO), 2015 - Present
Government Finance Officers Association (GFOA), 2015 - Present