8-2020

Gender Differences at the Highest Levels of Mathematics Achievement: A Texas Based Study

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GENDER DIFFERENCES AT THE HIGHEST LEVELS OF MATHEMATICS ACHIEVEMENT: A TEXAS BASED STUDY

by

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Presented to the Faculty of the Graduate School of

Stephen F. Austin State University

In Partial Fulfillment

of the Requirements

For the Degree of

Doctor of Education

STEPHEN F. AUSTIN STATE UNIVERSITY
(August 2020)

ABSTRACT

The purpose of this ex post facto study was to determine if gender differences exist in the top quartile of mathematics achievement in Texas as measured by STAAR. Performance data for 6,358,500 Texas students on the mathematics STAAR in grades 3-6 for the years 2016-2019 were examined in this quantitative study. The percentage of male and female students scoring in three different score bands, the 75^{th}-89^{th} percentile, the 90^{th}-95^{th} percentile, and the 95^{th}-100^{th} percentile, were presented. The Chi-square was utilized to determine if any difference in the percentage of male and female students scoring within these score bands was significant. The percentage of male students scoring in the top quartile was greater than the percentage of male students in the overall sample for 14 of the 16 data sets analyzed. The gap between the percentage of male and female students scoring in the top quartile grew wider in higher score bands for 14 of the 16 data sets. Further, the Chi-square yielded a p value indicating such differences are significant in 14 out of the 16 data sets.

ACKNOWLEDGEMENTS

Crossing the finish line of my doctoral studies journey could not have become a reality without the support of a large group of cheerleaders. I’d like to take a moment to not only acknowledge each of these supporters, but thank them for their investment in my personal and professional growth.

To my classmates, Asia, Codi, Derrick, Abbey, Max, Rachel, Jessica, and Andre, thank you. Our class discussions helped me become a better person. You taught me what it means to truly listen and helped me see the world through others’ eyes.

To my professors, Dr. Pauline M. Sampson, Dr. Patrick M. Jenlink, Dr. Scott Bailey, Dr. Ali Hachem, Dr. Karen Embry-Jenlink, Dr. Chance Mays, and Dr. Kerry Roberts, thank you for creating a space for personal and professional reflection to develop our leadership abilities. I’d like to acknowledge and thank Dr. Jenlink, Dr. Embry-Jenlink, Dr. Hachem, and Dr. Sampson for their guidance at various stages of the development of this dissertation. I’d also like to thank and acknowledge Dr. Sampson’s contributions as chair in the final stages, as well as, Dr. Paula Griffin and Dr. Brain Uriegas for their feedback and guidance as committee members.

To my husband, Jonathan, thank you for nurturing this dream every step of the way. Not only did you make sure I had the time to commit by taking on more than your fair share of the responsibilities at home, you continually encouraged me. Your steadfast

faith in my ability to finish this degree gave me the confidence to continue on the most challenging of days. I love you, Jonathan!

DEDICATION

This dissertation is dedicated to my daughters, Elizabeth and Samantha.

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CHAPTER I

Introduction to the Study

Background of the Problem

The Elementary and Secondary Education Act (ESEA) of 1965 provided "financial assistance to local education agencies for the education of children from low income families" (Elementary and Secondary Education Act, 1965, Title I). Title I of ESEA has continued to provide funding intended to supplement the education of students from low socioeconomic families (Anderson, 2007). With the passage of ESEA, American policy acknowledged the importance of an equitable education for its citizens.

The reauthorization of ESEA in 2001, known as No Child Left Behind, introduced accountability (Anderson, 2007). This idea that students are entitled to similar outcomes regardless of race or family economic status has continued with the most recent reauthorization of ESEA, the Every Student Success Act, signed into law in 2015 (Skinner & Library of Congress. Congressional Research Service, 2018).

Further recognizing the value of access to an equitable education, Title IX of the Educational Amendments of 1972 provided Americans with a policy stating in part that "No person in the United States shall, on the basis of sex, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any education program or activity receiving federal financial assistance" (Educational Amendments, 1972, Sec. 901). Although many often think of Title IX as providing legislation increasing female students' access to extracurricular sports, the original intention was to offer equal access to Institutes of Higher Education (Rose, 2015). In the decade prior to the enactment of Title IX women earned 43% of the Bachelor's degrees, 36% of the Maser's degrees, and 11% of the Doctoral degrees. (National Center for Educational Statistics. (NCES), 2018). In the 2016-2017 academic year, women earned 57% of the Bachelor's degrees, 59% of the Maser's degrees, and 53% of the Doctoral degrees (NCES, 2018).

Ensuring that all children have the opportunity to fully develop their talents provides for ". . . the promotion of the best possible realization of humanity as humanity" (Dewey, 1916, p. 96). Developing such talents through formal education has played a role in workforce preparation, particularly for fields that require post-secondary degrees and certifications (Fayer, Lacey & Watson, 2017). Yet, despite legislation promoting such egalitarian ideals regarding educational opportunities, men and women have not been equally represented in all fields of the U.S. workforce (U.S. Bureau of Labor Statistics, 2017). Science, technology, engineering, and math (STEM) fields is one example. In 2015, women accounted for 28.4% of the science and engineering workforce (National Science Foundation, 2018). Further, women represented 26.4% of workers in computer and mathematical sciences, 47.9% of workers in the biological, agricultural, and environmental life sciences, 27.8% of the workers in the physical sciences, 59.8% of the workers in the social sciences, and 14.5% of engineers (NSF, 2018).

Although men and women are earning equal numbers of the science and engineering Bachelor's degrees, men and women are not equally represented when science and engineering degrees are disaggregated by area of study (NSF, 2018). According to the National Science Foundation (2018), women outnumber men in earning Bachelor's degrees in biological and agricultural sciences, psychology, and the social sciences. Yet, in the more mathematics intensive areas of study, men outnumber women. In 2015, women earned 38.7% of the Bachelor's degrees awarded in the physical sciences, 42.9% of the Bachelor's degrees awarded in mathematics, 18% of the Bachelor's degrees awarded in computer science, and 20.1% of the Bachelor's degrees awarded in engineering (NSF, 2018).

Several studies have indicated that gender parity in mathematics achievement in the U.S. has been realized at the 50th percentile, or mean level of performance (Hyde et al., 2008; Hyde, Mertz & Schekman, 2009; Lindberg et al., 2010; Scafidi & Bui, 2010). Hyde et al.'s (2009) study investigated the overall math gender gap, finding that "U.S. girls now perform as well as boys on standardized mathematics tests at all grade levels" (p. 8806). Further, Scafidi and Bui (2010) utilized student performance data in Grades 8, 10, and 12 from the National Education Longitudinal Study (NELS) to conduct an analysis of the influence of gender on mathematics performance, revealing that "gender did not have an overall effect" (p. 254). Lindberg et al.'s (2010) meta-analysis indicated ". . . gender differences close to 0 for elementary and middle school students and small effects favoring male high school and college students" (p. 1132). Additionally, the 2019 National Assessment of Educational Progress (NAEP) results for Texas showed average male and female scores in grade eight mathematics to be similar (NCES, 2019a; NCES, 2019b). Female eighth grade students' average score on the 2019 mathematics NAEP was 280 and the male average was 279 (NCES, 2019b). Further, the average female score for the 2019 mathematics NAEP in fourth grade was 242, while the male average was 245 (NCES, 2019a).

While these studies suggest that the gender gap in average performance has closed (Hyde et al., 2008; Hyde et al. 2009; Lindberg et al., 2010; Pope & Sydnor, 2010; Scafidi & Bui, 2010), Reilly, Neumann and Andrews's (2015) study suggested that gender parity has yet to be achieved. "Small mean sex differences favoring males were observed in science and mathematics performance, making claims of their absence premature" (Reilly et al., 2015, p. 655). Further, Anderson's (2016) Texas based study revealed a slight female advantage in fifth grade mathematics. However, in three of the four years studied, males scored slightly higher in mathematics than females in grade 8. Additionally, males showed an advantage in science for both fifth and eighth grade in all four years studied. While mathematics scores showed a female advantage in grade 5, ". . . Science test scores of boys were consistently higher than for girls. . ." (Anderson, 2016, p. 70).

A gender gap at the highest levels of mathematics achievement has remained (Cimpian et al., 2016; Hyde et al., 2009; Machin & Pekkarinen, 2008; Pope & Sydnor, 2010). "Among the mathematically gifted, there may be as many as 2- to 4-fold more boys than girls. . ." (Hyde et al., 2009, p. 8806). An analysis of Programme for International Student Assessment (PISA) scores across 41 countries found that "In mathematics, the gender difference at the 95th quantile favors boys in 36 countries. . ."

(Machin & Pekkarinen, 2008, p. 1332). Hyde et al. (2009) also examined the ratio of male to female students that scored at or above the 95th percentile in mathematics on PISA. However, Hyde et al.'s (2009) analysis added a correlation between a country's Gender Gap Index (GGI) as issued by the World Economic Forum. The comparison of male and female performance in the right tail revealed ". . . the gender ratio favoring boys above the 99th percentile is not ubiquitous and correlates well with measures of a country's gender equity" (Hyde et al., 2009, p. 8806).

Reilly et al.'s (2015) study further indicated greater male variability in both mathematics and science performance with a male advantage at the highest levels of performance. Furthermore, this male advantage in higher percentiles of mathematics and science achievement increased as students matriculated into higher grades, leaving fewer females in the right tail of the distribution as students matured. "Additionally we found that the performance of males was more variable than that of females, which has implications for the proportion of males to females in the upper-right tail of the ability distribution" (Reilly et al., 2015, p. 655).

Theoretical framework

While the male advantage in mathematics has been found across nations, the size of this advantage varies (Guiso, Monte, Sapienza & Zingales, 2008; Penner, 2008). Such a variance implies social constructs are at play. "Finding consistent gender differences around the world would indicate either that differences have a biological basis or that gender socialization is remarkably constant" (Penner, 2008, Supplement, p. 162). However, Guiso et al. (2008) and Penner (2008) found that the gender gap in mathematics performance varies across nations, suggesting social constructs underpin the mathematics performance gender gap.

Many of the potential causes of this gender gap rely on theories of socialization (Reinking & Martin, 2018). “During socialization, one learns to take on an identity associated with a particular group and perform it in a competent manner” (Fritz, 2010, p. 753). The theory of gendered socialization was based on the idea that “. . . girls and boys are socialized differently. . .” (Reinking & Martin, 2018, p. 149). Gendered socialization has been seen through the influence of families as well as teachers. “It has been found that these mentalities and stereotypes are communicated to girls at a young age through their parents and teachers, sometimes unconsciously” (Reinking & Martin, 2018, p. 149). Further, with a large number of players contributing to the gendered socialization of both boys and girls, such as family members, teachers, and peers, as well as the larger cultural context, socialization is a complex web (Halpern, 2014).

This study was grounded in the concept of gender as a socialized notion. Within gendered socialization, boys and girls are taught to behave in ways that are congruent with culturally acceptable male and female behavior (Neimand, 2016). The idea that “. . . gender is a social category that organizes virtually every segment of society. . .” (Leaper, 2014, p. 4) underpins this study.

Statement of the Problem

STEM occupations have been focused on understanding the world and creating solutions to advance humanity. “Diversity in the workforce contributes to creativity, productivity, and innovation” (Hill & Corbett, 2015, p. 1). With the current underrepresentation of women in STEM occupations, gender diversity is not our current reality (NSF, 2018; Noonan, 2017; Powers, 2017). The near absence of women in the problem solving processes of many STEM occupations has resulted in a negative effect. “For instance, a predominately male group of engineers tailored the first generation of automotive airbags to adult male bodies, resulting in avoidable deaths for women and children” (Margolis & Fisher, 2002, p. 3). More recently, while some car manufactures have examined vehicle safety through the use of crash test dummies to fit the diversity of the human form, the crash test dummy simulating the average male body remains the most commonly used (Gendered Innovations, n.d.). Therefore, “Women must be part of the design team who are reshaping the world, if the reshaped world is to fit women as well as men” (Margolis & Fisher, 2002, p. 3).

Many careers in STEM require postsecondary degrees and certifications. “Over 99 percent of STEM employment was in occupations that typically require some type of postsecondary education for entry, compared with 36 percent of overall employment” (Fayer et al., 2017, p. 13). While both men and women have earned STEM Bachelor’s degrees in equal numbers, women have earned fewer Bachelor’s degrees than men in the more mathematics intensive areas of study (NSF, 2018). It has been suggested that those who enter into a mathematics intensive area of study are amongst the highest achieving math students (Ceci & Williams, 2010).

Although legislation such as ESEA and Title IX promote equal opportunities for students, male and female students are not equally represented in the highest levels of mathematics performance (Cimpian et al., 2016; Hyde et al., 2009; Machin & Pekkarinen, 2008; Pope & Sydnor, 2010). Yet, the size of this gender gap has varied across contexts (Penner, 2008). This variance suggests social constructs have influenced the mathematics achievement gender gap (Penner, 2008).

Purpose Statement

While some studies have indicated there are no longer gender differences in mathematics achievement, these studies considered overall mathematics achievement as measured by state assessments (Hyde et al, 2008), PISA (Hyde et al., 2009), NAEP (Pope & Sydnor, 2010), and NELS (Scafidi & Bui, 2010). Yet, Anderson's (2016) study indicated a slight female advantage in overall State of Texas Assessments of Academic Readiness (STAAR) mathematics achievement in a sample of Texas students. Other studies investigating mathematics achievement at the highest levels have indicated a male favoring achievement gap in samples consisting of U.S. students in the Early Childhood Longitudinal Study (Cimpian et al., 2016) and the National Assessment of Educational Progress (Pope & Sydnor, 2010) achievement data. The purpose of this study was to determine if gender differences in the top quartile of STAAR mathematics achievement are present in Texas.

Research Questions and Hypotheses

Broadly, this study sought to determine if gender differences were evident in mathematics achievement in the right tail of the distribution in Texas. The following questions were employed to guide this quantitative study:

1. Are there differences in the percent of male and female students scoring at and above the 75^{th} percentile of the mathematics STAAR for grade 3 in the years 2016, 2017, 2018, and 2019?
2. Are there differences in the percent of male and female students scoring at and above the 75^{th} percentile of the mathematics STAAR for grade 4 in the years 2016, 2017, 2018, and 2019?
3. Are there differences in the percent of male and female students scoring at and above the 75^{th} percentile of the mathematics STAAR for grade 5 in the years 2016, 2017, 2018, and 2019?
4. Are there differences in the percent of male and female students scoring at and above the 75^{th} percentile of the mathematics STAAR for grade 6 in the years 2016, 2017, 2018, and 2019?
5. If differences in the percentage of male and female students scoring at and above the 75^{th} percentile are present, how does the gap change over time for the cohort of students assessed in grade 3 in 2016, grade 4 in 2017, grade 5 in 2018, and grade 6 in 2019?

The analysis of data was guided by two hypotheses; a null hypothesis and an alternative hypothesis.

1. Null hypothesis: There is not a relationship between gender and mathematics STAAR scores in the top quartile.
2. Alternative hypothesis: Gender influences mathematics STAAR scores in the top quartile.

Significance

Several studies have investigated the average mathematics achievement for male and female students utilizing PISA (Hyde et al., 2009), NAEP (Pope & Sydnor, 2010), and NELS (Scafidi & Bui, 2010). These studies have examined a national sample. Hyde et al.'s (2008) study also investigated gender differences at the 50th percentile. However, Hyde et al.'s (2008) study used data from ten different state's assessments. Anderson's (2016) study also considered the average mathematics achievement for male and female students as measured by the State of Texas Assessments of Academic Readiness, making Anderson's (2016) study specific to Texas.

Other studies have analyzed the mathematics achievement of male and female students in the right tail of the distribution using student performance data provide via the Early Childhood Longitudinal Study-Kindergarten (Cimpian et al., 2016) and NAEP (Pope & Sydnor, 2010). These studies have also utilized a national sample. An investigation into gender differences among Texas' high achieving mathematics students as measured by STAAR had not yet been conducted. This study contributed to the literature by filling a gap in the research. This quantitative study sought to determine if gender differences were present in the mathematics achievement of male and female students in the right tail of the distribution in Texas as measured by STAAR.

Assumptions

This ex post facto study made three assumptions. One assumption made in this study was that all schools across the state of Texas accurately reported students' gender. It is also assumed that the score code on students' STAAR tests were appropriately marked. Another assumption made in this study was that schools administered the STAAR in accordance with the STAAR Test Administrator Manual, ensuring ". . . that all testing conditions are uniform statewide" (TEA, 2019a, p. 6).

Limitations

This quantitative study was conducted utilizing existing data. Such an ex post facto study is inherently limited by the inability of the researcher to manipulate the variables (Salkind, 2010). Within ex post facto research ". . . the researcher may not be sure that all independent variables that caused the facts observed were included in the analysis. . ." (Salkind, 2010, p. 466).

Delimitations

This study focused on gender differences in mathematics achievement in Texas as measured by the STAAR. STAAR is administered to students in grades three through eight attending publicly funded schools in Texas (TEA, n.d.-a). Therefore, students attending traditional public schools and charter schools were included in this study (Swaby, 2019). However, students educated through private funding sources, such as homeschooling, parochial schools, and private schools were not included in the data set. Further, this quantitative study considered the mathematics STAAR scores of male and female students in grades three-six from 2016-2019. Student scores from the STAAR Alternative 2 were not included in analysis.

Definitions

Alternative hypothesis. The alternative or research hypothesis “makes a prediction about the relationship between the independent and dependent variables. . .” (Greasley, 2008, p. 87).

Ex post facto. Ex post facto research is a “. . . design in which the investigation starts after the fact has occurred without interference from the researcher” (Salkind, 2010, p. 465).

Gendered socialization. Gendered socialization is the process in which boys and girls learn to behave in ways that are consistent with social norms for masculine and feminine behavior (Neimand, 2016).

Null hypothesis. A null hypothesis states “. . . the absence of a relationship between the independent variable and the dependent variable. . .” (Greasley, 2008, p. 87).

Chi-square. The chi-square is a statistical test “. . . which seeks to determine if some pattern of frequencies is significantly different than would be expected based on some criteria” (Geher & Hall, 2014, p. 306).

Percentile. Percentile can be described as where a score falls in comparison to others in the same group. For example, scoring in the 80th

percentile describes a student that ". . . performed as well or better than 80% of the other test takers" (Salkind, 2010, p. 1028).

P value. A p value indicates ". . . the probability of the outcomes occurring by chance. . . "(Greasley, 2008, p. 134).

SPSS. SPSS is the acronym for the Statistical Package for the Social Sciences (Greasley, 2008).

STAAR. STAAR is the acronym for the State of Texas Assessments of Academic Readiness (Texas Education Agency (TEA), n.d.-b).

STAAR A. STAAR A was an accommodated version of STAAR, testing the same curriculum. STAAR A was last administered in 2016 (TEA, n.d.-i).

STAAR Alternative 2. STAAR Alternative 2 is the STAAR program's assessment administered to students served in the Special education program (TEA, n.d.-g).

STAAR L. STAAR L was administered in English with linguistic accommodations. STAAR L was intended for students acquiring English and was last administered in 2016 (TEA, n.d.-h).

Stereotype threat. Stereotype threat occurs when one feels pressure to confirm a negative stereotype regarding a group in which the individual belongs (Steele & Aronson, 1995).

STEM. STEM is the acronym for science, technology, engineering, and math (Vilorio, 2014).

The right tail of the distribution. The right tail of the distribution describes the portion of the distribution representing the highest scores, such as ". . . the top 10%, 5%, 1%, 0.1%, and 0.01%. . ." (Ceci & Williams, 2010, p. x).

Top quartile. Quartiles separate data into four equal parts. The top quartile is above the 75th percentile (Salkind, 2010).

Organization of the Study

Chapter I detailed the history of U.S. education legislation as well as the increase in postsecondary degrees held by women in the years since the passage of Title IX. Chapter I also described the underrepresentation of women in mathematics intensive careers and mathematics intensive Bachelor's degrees earned (NSF, 2018). The effect of this unequal representation was illustrated in this chapter as well (Margolis & Fisher, 2002). Considering the K-12 setting, fewer female than male students were achieving at high levels in mathematics (Cimpian et al., 2016; Hyde et al., 2009; Machin & Pekkarinen, 2008; Pope & Sydnor, 2010). Further, Chapter I identified high achieving mathematics students as those most likely to be prepared for mathematically intensive college course work and subsequent STEM careers (Ceci & Williams, 2010). Additionally, Chapter I presented the theoretical lens employed by the researcher.

Chapter II offered a review of relevant literature. The literature review presented in Chapter II defines STEM in Elementary School, Middle School, and High School. Chapter II also identified potential causes of the male favoring gender gap, as well as possible solutions.

Chapter III outlines the design of this quantitative study. Within Chapter III, a description of the instrumentation and sample is provided. Chapter III also describes the quantitative methods utilized to analyze the existing data of male and female mathematics STAAR scores in grades three-six across four years.

Chapter IV presents the data. Within Chapter IV, the reader will find the mathematics STAAR scores for male and female students in the top quartile in grades 3-6 for the years 2016-2019. Further, Chapter IV offers comparisons across grades 3-6 in mathematics STAAR scores at the top quartile by gender.

Chapter V provides a summary of the study, as well as an analysis of the findings and conclusions. Further, Chapter V offers implications for practitioners and recommendations for further research.

CHAPTER II

Review of Related Literature

Introduction

Studies utilizing student performance data from state assessments (Hyde et al., 2008), PISA (Hyde et al., 2009), NAEP (Pope & Sydnor, 2010), and NELS (Scafidi & Bui, 2010) have indicated male and female students have similar overall mathematics achievement. Such studies have considered a comparison of the mean male score to the mean female score, in some cases utilizing a meta- analytic approach in which “The effect size is computed as. . . a measure of the distance between the male and female means in standard deviation units” (Hyde et al., 2009, p. 8801). Further, Lindberg et al’s (2010) meta-analyses of studies utilizing “. . . large national data sets. . .” (p. 1126) suggested that “. . .there is no longer a gender difference” (p. 1131).

Yet, female students are underrepresented among the highest achieving mathematics students in the United States (Cimpian et al., 2016; Hyde et al., 2009; Machin & Pekkarinen, 2008; Pope & Sydnor, 2010). Such studies have considered the number of students achieving at or above a certain percentile and determined the ratio, or percentage, of male to female students making up the group of students achieving at or above the target percentile. While studies have identified a male favoring gender gap in mathematics performance when considering the right tail of the distribution, many of these studies have included a national sample (Cimpian et al., 2016; Pope & Sydnor, 2010). The purpose of this study was to determine if gender differences at the highest levels of mathematics achievement are present in Texas.

The following review of the literature addressed five major topics. The review opened with a description of STEM in Elementary School, Middle School, and High School. Next the literature review identified possible causes of gender gaps as well as potential solutions.

STEM in elementary school

The mathematics achievement gender gap at the highest levels of performance favoring male students has been identified as early as Kindergarten (Cimpian et al., 2016; Penner & Paret, 2008). There have been conflicting studies; some have indicated this particular gap narrows as students age in elementary school (Robinson & Lubienski, 2011) and others have suggested a widening of this gap in the elementary years (Cimpian et al., 2016; Penner & Paret, 2008).

Yet, when considering the mean level of performance, some studies have indicated that differences at the beginning of Kindergarten have been small and have grown in favor of male students through the elementary years (Fryer & Levitt, 2010; Robinson & Lubienski, 2011); while others have suggested no gender gap in mathematics performance (Reardon, Fahle, Kalogrides, Podolsky & Zárate, 2019; Hyde et al., 2008) or a slight female favoring gender gap in the elementary years (Anderson, 2016). “Girls begin school with a clear advantage in reading and rough parity with boys in math performance. Over time, boys catch up somewhat in reading and gain an advantage in mathematics, at least as measured by standardized test scores" (DiPrete & Buchmann, 2013, p. 10).

Female mathematics achievement in elementary school. Cimpian et al. (2016) analyzed the mathematics performance of the youngest students via the Early Childhood Longitudinal Study-Kindergarten Class of 2011 (ECLS-K:2011). The ECLS-K:2011 data set included student achievement in Kindergarten, Grade 1, and Grade 2 for the cohort of students beginning Kindergarten in 2011. Utilizing a logistic regression to estimate the percentage of male and female students at various percentiles, Cimpian et al. (2016) found fewer female than male students amongst the highest mathematics achievement beginning in Kindergarten. Further, this gender gap widened as students matriculated into first and second grade. While female Kindergarteners made up one third of the students above the 99^{th} percentile; as these students aged, female students accounted for 20% of the students above the 99^{th} percentile in second grade (Cimpian et al., 2016).

The smaller percentage of female students than male students at the highest levels of mathematics achievement in elementary school was also observed in Penner and Paret's (2008) analysis. Penner and Paret (2008) utilized the ECLS-K and employed quantile regression. This analysis revealed female students scoring higher than boys below the 40^{th} percentile, but male students scoring higher in the highest percentiles; with the 50^{th} percentile showing no gender differences as early as the fall semester of Kindergarten. As students aged, the achievement gap between male and female students became wider. "By the spring of third grade the female advantage at the bottom of the distribution is gone, and there is a relatively consistent male advantage from about the 35th percentile up" (Penner & Paret, 2008, p. 246). The larger percentage of male than female students in the highest levels of achievement becomes constant by fifth grade. "Fifth grade exhibits a strikingly stable gender difference across the distribution from the 10th percentile up" (Penner & Paret, 2008, p. 246).

Fryer and Levitt (2010) utilized the ECLS-K data set to analyze the mathematics performance amongst the youngest students. The ECLS-K data analyzed included the mathematics performance for ". . . over 20,000 children entering kindergarten in 1998" (Fryer & Levitt, 2010, p. 7). Although female kindergarteners slightly outperformed their male classmates at the beginning of kindergarten, by the end of grade 5 male student performance was higher than that of female students (Fryer & Levitt, 2010; Robinson & Lubienski, 2011).

This end of fifth grade performance gap was approximately 0.2 of a standard deviation (Fryer & Levitt, 2010). "Given the progress of a typical student over the course of a school year, this amounts to roughly 2.5 months of schooling" (Fryer & Levitt, 2010, p. 12). Conversely, while the male favoring gender gap widened at the mean level of performance during the elementary years, Robinson and Lubienski's (2011) study revealed a narrowing of the mathematics gender gap at the highest levels of performance. At the end of grade 1, 15% of the students scoring at the 99^{th} percentile and higher were female. Female representation at the 99^{th} percentile and higher grew to 25% at the end of grade 3 and 37% by the end of grade 8.

The influence of family and school characteristics. Penner and Paret (2008) further analyzed gender gaps in students' mathematics achievement, finding that parents' level of education as well as the student's gender predicted where a student fell in the distribution. This ". . . male advantage at the top of the distribution is most pronounced among students whose parents have a college or advanced degree" (Penner & Paret, 2008, p. 250). Such a finding ". . . is interesting in that it indicates that the male advantage at the top of the distribution is mediated by socioeconomic factors in a way that the female advantage at the bottom does not appear to be" (Penner & Paret, 2008, p. 250).

Fryer and Levitt (2010) also identified community characteristics in which girls were more likely to experience this widening gender gap in mathematics performance over the elementary years. Of the participants in Fryer and Levitt's (2010) study, the female students living in high socioeconomic status communities with highly educated parents experienced the greatest gender achievement gap. Further, Fryer and Levitt (2010) found that schools located within cities and suburbs had a larger male favoring gender gap than the schools located in towns and rural areas.

An inquiry into the influence of socioeconomic factors on the gender gap revealed a variance in gender performance across U.S. schools (Reardon et al., 2019). A gender gap with a male advantage in mathematics performance was observed in schools where a higher percentage of students came from families with higher incomes. "In wealthier school districts and in school districts with more socioeconomic gender inequity, math gaps favor males more, on average" (Reardon, et. al., 2019, pp. 20-22). Further, high performing schools were found to be more likely to also have a male favoring gender gap in mathematics achievement “Districts with higher math performance tend to have more male-favoring math gaps” (Reardon, et. al., 2019, p. 20).

STEM in middle school

The male favoring gender gap at the highest levels of mathematics achievement found at the end of the elementary years continued to widen through the middle school years (McGraw, Lubienski & Strutchens, 2006; Meinck & Brese, 2019). Gender differences in self-efficacy at it relates to mathematics have also been seen in the middle school years (Louis & Mistele, 2012). Further, studies suggest stereotype threat influences female performance in mathematics (Casad, Hale & Wachs, 2017).

Female mathematics achievement in middle school. The male advantage in mathematics performance has also been seen within the NAEP scores (McGraw et al., 2006). McGraw et al. (2006) analyzed NAEP scores for students enrolled in fourth grade, eighth grade, and twelfth grade, illuminating a gender gap at the higher percentiles. “Overall, we found that gaps in scores were largest at the upper end, i.e., the 75th and 90th percentiles” (McGraw et al., 2006, p. 139). Further, this gender gap in mathematics achievement grew wider as students matriculated into higher grades. “As grade level increased, gaps became larger and more concentrated at the upper end of the percentile range” (McGraw et al., 2006, p. 146).

Meinck and Brese’s (2019) investigation into 20 years of Trends in International Mathematics and Science Study (TIMMS) data also indicated a persistent male advantage at the highest percentiles in mathematics achievement. Meinck and Brese’s (2019) analysis took a close look at students scoring above the 80th percentile and below the 20th percentile. This analysis revealed more male than female students scoring in the top 20% in fourth grade mathematics. Further, this ". . . gender gap in favor of boys widened over the last 20 years. . ." (Meinck & Brese, 2019, p. 8). Meinck and Brese's (2019) study also revealed a consistent male advantage in eighth grade mathematics over the 20 years studied. Yet, fewer female students appeared below the 20th percentile in recent years.

Pope and Sydnor (2010) compared NAEP scores for both male and female eighth grade students across three years. This comparison showed a familiar pattern of male and female students having similar mean scores, yet with male students ". . . disproportionately represented at the top of test scores in math and science" (Pope & Sydnor, 2010, p. 107). Pope and Sydnor (2010) further analyzed the male to female ratio at the highest levels of achievement, finding that this ratio varied by geographic location across the U. S. "Across states and regions, there is substantial variation in these high-end gender ratios, and this variation tends to be geographically clustered" (Pope & Sydnor, 2010, p. 107).

Self-efficacy and mathematics. Louis and Mistele's (2012) study of 8th grade students' performance on TIMMS revealed a gender difference by mathematics subject. The male participants in Louis and Mistele's (2012) study scored higher than the female students in Geometry, Data, and Number. However, ". . . Algebra showed a statistically significant difference in the achievement scores between females and males, where female's achievement scores were higher than males" (Louis & Mistele, 2012, p. 1175). Further, Louis and Mistele (2012) found a gender difference in self-efficacy as it related to mathematics. "We found that males exhibit statistically significant higher self-efficacy levels when compared to females in mathematics" (Louis & Mistele, 2012, p. 1174). Self-efficacy in STEM related subjects can have an influence on STEM outcomes (United Nations Educational, Scientific and Cultural Organization (UNESCO), 2017) and the gender gap (Cheema & Galluzzo, 2013). "Those who have a strong sense of self-efficacy in mathematics or science are more likely to perform well and to choose related studies and careers" (UNESCO, 2017, p. 46).

The influence of gender identity and stereotype threat. Pope and Sydnor's (2010) analysis included creating ". . . a state-level "stereotype adherence index" by averaging a state's male - female ratio in math and science with the state's female-male ratio in reading using the top – 5 – percent cutoff" (p. 101). The greater the stereotype adherence index, the greater the gender gap. Pope and Sydnor (2010) discovered ". . . a negative correlation between a state's stereotype adherence index and its median income level" (p. 104). Such a correlation suggested a connection between the gender gap in mathematics achievement and the income level of a community.

The concept of a stereotype impeding performance is commonly called "stereotype threat" and was introduced by Claude Steele's (1997) seminal study. Steele (1997) studied the impact of the stereotype that mathematics is a male activity through the use of Graduate Record of Examination (GRE) sample questions. Before working the sample questions, participants in the experimentation group were informed that the exam revealed differences in performance by gender; while the control group were told that the exam showed no differences in performance by gender. The results of Steele's (1997) experiment revealed that "... women performed worse than men when they were told that the test produced gender differences. . ." (p. 619). Further, women ". . . performed equal to men when the test was represented as insensitive to gender differences. . ." (Steele, 1997, p. 620).

Twenty years later, Casad, Hale, and Wachs (2017) investigated the effects of stereotype threat coupled with gender identity among adolescent girls, finding that ". . . gender identity may operate differently depending on math education context" (p. 523). Within Casad, et al.'s (2017) study, female students that strongly identified with their gender performed lower on questions requiring spatial abilities when the stereotype threat was applied in an honors, or advanced, math class. The UNESCO (2017) points out that "Girls who assimilate such stereotypes have lower levels of self-efficacy and confidence in their ability than boys" (p. 46).

However, female students in an on-level mathematics class in which grade level mathematics was taught, as opposed to an honors or advanced mathematics class, who strongly identified with their gender under the stereotype threat condition showed higher performance than female students in the same group with a weaker connection to their gender (Casad et al., 2017). Female students for which the stereotype threat was not applied in either the honors or on level mathematics classes did not show such differences in performance. "Stereotype threat may help explain the discrepancy between female students' higher grades in math and science and their lower performance on high-stakes tests in these subjects. . ." (Hill et al. 2010, p. 38).

STEM in high school

The gender gap in mathematics achievement at the highest levels seen from elementary school on into middle school continued into high school (College Board, 2015; Ellison & Swanson, 2010; Ellison & Swanson, 2018). Further, PISA data suggested a narrower gender gap in science performance than in mathematics performance (Tsai, Smith, & Hauser, 2018). However, the gender gap in mathematics achievement as measured by SAT has remained steady for decades (Halpern et al., 2007).

Female mathematics achievement in high school. The 2015 SAT scores revealed a gender gap in mathematics achievement (College Board, 2015). Fifty-six percent of college bound male students scored above the 50th percentile, while 44% of female test takers scored above the 50th percentile. Further, female students accounted for 35% of the students scoring at the 99th percentile, while male students made up 65% of testers at the 99th percentile (College Board, 2015). This male favoring gender gap in mathematics performance on the SAT has existed for decades. “The average difference between males and females on the SAT-M test has remained unchanged for over 35 years” (Halpern et al., 2007, p. 10).

A closer examination of the highest achieving U.S. mathematics high school students revealed a wider gender gap amongst the most elite mathematics performers (Ellison & Swanson, 2010). Ellison and Swanson (2010) analyzed the scores of students participating in the American Mathematics Completions’ (AMC) qualifying exam, AMC 12. This examination showed 14% of the students scoring in the 99th percentile were female. Further, the gender achievement gap widened at the 99.9th percentile, with 10%

female students. “The top 46 scores were all male” (Ellison & Swanson, 2010, p. 116). Yet, the gender gap varied across high schools, revealing a narrower gap among schools with a higher number of high achieving students, suggesting “. . . schools that have very large numbers of high-achieving students can be places where girls can join a community learning advanced material” (Ellison & Swanson, 2010, p. 226).

Nearly a decade later, Ellison and Swanson (2018) further examined AMC 12 as well as AMC 10 scores. “The AMC 10 is open to students in grades 10 and below. The AMC 12 is open to students in grades 12 and below” (Ellison & Swanson, 2018, p. 5). Including the performance of younger students provided data to consider how high achieving male and female mathematics students’ progress over the course of high school. Ellison and Swanson (2018) found that more girls participated in the AMC in 10^{th} grade than in 9^{th} grade. This level of participation remained steady from 10^{th} to 11^{th} grade and then dropped between 11^{th} and 12th grade. “At the end of high school about 35 percent more 12th grade boys than 12th grade girls are taking the AMC12” (Ellison & Swanson, 2018, p. 8). Ellison and Swanson (2018) found that female students are 2.3% more likely than boys to drop out of the AMC from one year to the next. Further, this drop out gap was found to be largest between 11th and 12th grades. Ellison and Swanson’s (2018) study indicated that “. . . the gender gap in high math achievement widens substantially over the high school years” (p. 34).

Tsai et al.’s (2018) cross-national study analyzed PISA data for both male and female 15-year-old students. Within this analysis, Tsai et al (2018) found a male favoring achievement gap in both mathematics and science. However, “. . . the female disadvantage in math is larger than the female disadvantage in science in all cases. . ." (Tsai et al., 2018, p. 192). Liu and Wilson (2009) also utilized PISA data to investigate gender differences in mathematics performance. Liu and Wilson's (2009) investigation revealed gender differences by mathematics content and assessment item type. Specifically, male students scored higher than female students on assessment questions related to space and shape for the two years studied. Further, the analysis of two years of data revealed a male advantage on all assessment item types except multiple-choice items, finding, ". . . no performance difference has been observed on traditional multiple-choice items. . ." (Liu & Wilson, 2009, p. 176).

However, Haciomeroglu, Chicken and Dixon's (2013) study of Advanced Placement Calculus students found ". . . no significant differences between male and female students on cognitive ability and performance in calculus" (p. 185). Haciomeroglu et al. (2013) examined the relationship between performance in calculus among the participants enrolled in an Advanced Placement Calculus course and cognitive processing. While Haciomeroglu et al.'s (2013) study found ". . . that spatial ability, verbal-logical reasoning ability, and preference for visual processing significantly correlated with calculus performance measures" (p. 185), it did not find that male and female students differed significantly in these cognitive abilities or preferences.

STEM aspirations, orientations, and attitudes in high school. Although adolescent girls have been found to be about 60% less likely than their male peers to report an intention to study STEM in college, "This gender gap varies substantially across high schools" (Legewie & DiPrete, 2014, p. 268). High school students could find themselves attending a school on one end of the continuum where ". . . the odds for girls having STEM interest are only 18% lower than the odds for boys. . ." (Legewie & DiPrete, 2012, p. 21) whereas other students might find themselves attending a high school on the other end of the continuum in which the odds of female students expressing a STEM orientation can be as much as 80% lower than that of male students.

Such a variance in STEM orientation has been associated with the strength of the high school's mathematics and science curriculum (Legewie & DiPrete, 2012; Legewie & DiPrete, 2014), the overall performance level of students (Mann, Legewie & DiPrete, 2015), and the level of gender segregation in extracurricular activities (Legewie & DiPrete, 2014). "Simply put, our results suggest that the local environment in which adolescents spend their high school years plays an important role in the strengthening or weakening of gender stereotypes" (Legewie & DiPrete, 2014, p. 276).

Cheema and Galluzzo's (2013) analysis of 15-year-old students' responses to the PISA questionnaire and the students' mathematics performance on PISA suggested math anxiety and math self-efficacy influence the mathematics achievement gender gap. Math anxiety and math self-efficacy appeared to be intimately related. Cheema and Galluzzo's (2013) results indicated ". . . that high scores on self-efficacy and low scores on anxiety tended to occur simultaneously, and that low scores on self-efficacy tended to be accompanied by high scores on anxiety" (p. 105). The effect of math anxiety and math self-efficacy on mathematics achievement was such that an increase in math anxiety predicted a decrease in mathematics achievement (Cheema & Galluzzo, 2013), while an increase in math self-efficacy predicted an increase in mathematics achievement (Cheema

& Galluzzo, 2013; Organisation for Economic Co-operation and Development (OECD), 2009). The results of Cheema and Galluzzo's (2013) analysis indicated ". . . that gender achievement gap disappeared once math anxiety and math self-efficacy were controlled for . . ." (p. 110).

In a study including 367 high school students in a Northeastern city, Else-Quest, Mineo and Higgins (2013) found that although gender did not predict students' grades in math and science, the students' attitudes toward mathematics and science was a predictor of students' grades in these courses. Further, Amelink (2009) asserted that "Science achievement may be related to students' self-concept and interest" (p. 15). While male participants in Else-Quest et al.'s (2013) study ". . . reported more positive math attitudes than female adolescents. . ." (p. 300), "Female adolescents reported greater science task value than males. . ." (p. 300). Overall, male students indicated a higher expectation that they would be successful in math and science, as well as a greater self-concept in science and mathematics than did female students. "Our findings indicate that self-concept, task value, and expectations of success are all predictive of achievement. . ." (Else-Quest et al., 2013, p. 303).

Alkhadrawi's (2015) study of twelfth grade students' perceptions included interviews in which students shared their perspective on gender in relation to math and science. While the female students interviewed overall perceived that both male and female students perform similarly in mathematics, male students believed that female students were higher mathematics achievers than male students. Conversely, the female students perceived that females performed the same or better than male students in science, while male students believed that male students performed higher than female students in science. When asked about participation in mathematics and science, the students interviewed in Alkhadrawi’s (2015) study expressed a perception that both genders participated at similar levels.

Further, Yavorsky, Buchmann and Miles (2015) studied the effects of adhering to gender norms on male students’ academic achievement, finding a detrimental relationship between masculinity and overall academic achievement. This negative relationship between masculinity and GPA existed even after controlling for parents’ education, income, and a father figure at home. This detrimental effect was seen in overall GPA and English, “. . . but not in the subject of Math. Because Math is typically seen as a subject in which boys inherently excel, achievement in this subject can bolster or, at the very least, not undermine boys' masculine status” (Yavorsky et al., 2015, p. 20). Such a finding suggested that students’ gender norm beliefs influence academic performance.

However, Rinn, McQueen, Clark and Rumsey’s (2008) investigation into the self-concept of gifted male and female high school students indicated similar levels of achievement and self-concept for both genders. “Results from the current study do not suggest gender differences. . .” (Rinn et al., 2008, p. 47). Rinn et al. (2008) found that this group of gifted teens scored higher on the verbal section of the SAT than the math section. Similarly, the participants indicated a higher self-concept for verbal skills than for mathematics, suggesting a relationship between performance and self-concept. “Math achievement was found to be positively associated with math self-concept. . .” (Rinn et al., 2008, p. 45).

High school STEM enrollment and course completion. In Texas, the site of this study, House Bill 5 of the 83rd Texas Legislature established high school endorsements (TEA, n.d.-c). Although Texas students in ninth through 12th grade have been required to complete a minimum number of science and mathematics courses to be eligible for graduation, students also completed an endorsement. These endorsements have been thought of as similar to a college major in that students had an opportunity to focus on additional courses in one area of study. “Endorsements consist of a related series of courses that are grouped together by interest or skill set” (TEA, 2014a, p. 6). Texas high school endorsements included: STEM, business and industry, public service, arts and humanities, and multi-disciplinary studies (TEA, 2014a). Contained within each of these endorsements are pathways or more concentrated areas of study.

Although House Bill 5 requires Texas public high school to offer endorsements, schools may opt to only offer the multi-disciplinary studies endorsement (TEA, 2014a). Terry, Gammon, Mullen, Dearmon, & Alexander’s (2016) study identified the limitations of schools in offering endorsements. Terry, et al’s (2016) study included rural, suburban, and urban high schools representing both large and small schools across the state. Most of the schools participating in Terry, et al’s (2016) study did offer all five endorsements. However, 75% of the schools that reported offering fewer than five endorsements were classified as small schools located in rural areas (Terry, et al., 2016). “One small rural K-12 school reported limited ability to offer specific courses because of the inflexibility of the master schedule, since the district has such a small number of teachers overall” (Terry, et al, 2016, p. 49).

The Texas high school STEM endorsement comprised five pathways. These pathways included; career and technical education related to STEM, computer science, mathematics, science, or a combination of two of the previously stated pathways (TEA, 2014a). The career and technical education pathway required students to complete an additional four or more career and technical education courses in which at least one course is an advanced level course (Texas Classroom Teachers Association (TCTA), 2018). The computer science pathway required students to complete at minimum four courses in computer science (TCTA, 2018). While the minimum mathematics requirements included completion of algebra I, geometry, and one other mathematics course, the mathematics pathway required algebra I, geometry, algebra II, and two additional mathematics courses for which algebra II is a prerequisite (TCTA, 2018; TEA, 2014a). Therefore, the mathematics pathway required a total of five mathematics courses. The minimum science requirement for graduation included three science courses. However, with the science pathway, a student completed five science courses, and three of these must have included biology, chemistry, and physics (TCTA, 2018; TEA, 2014a). For Texas students who wished to complete a STEM endorsement that is a combination of disciplines, they must have completed the math and science graduation requirements as well as algebra II, chemistry, physics and three additional courses from the other pathways (TCTA, 2018).

Title 19 of the Texas Administrative Code included the Texas Essential Knowledge and Skills or TEKS (Texas Secretary of State, n.d.). The TEKS outlined what students in Texas are expected to learn for each grade and subject (TEA, n.d.-d). These standards detailed what students should learn in each grade from kindergarten through eighth grade. The TEKS for high school were provided by course rather than by grade (TEA, n.d.-d; Texas Secretary of State, n.d). Educators in Texas were provided these standards through the TEKS for science, mathematics, and technology applications for grades kindergarten through eighth grades and the required high school courses, as well as those additional courses required for a STEM endorsement (TEA, n.d.-d; Texas Secretary of State, n.d). However, currently, there are no state standards for engineering in grades kindergarten through eighth grade (TEA, n.d.-d; Texas Secretary of State, n.d).

Yoon and Strobel's (2017) analysis of Texas high school students' enrollment in science, mathematics, and Career and Technical Education – STEM (CTE–STEM) courses from 2008-2013 indicated a gender gap in enrollment in STEM related high school courses. Enrollment in the required Algebra I, Geometry, and Biology decreased over the six years analyzed, suggesting ". . . that students' course preparation already started in middle school" (Yoon & Strobel, 2017, p. 16). More female students than male students appeared to be earning credit for these required courses outside of high school. Further, more female students than male students enrolled in Algebra II, PreCalculus, Physics, Chemistry, Advanced Biology, and Advanced Statistics. Yet, more male students than female students enrolled in CTE–STEM courses, Advanced Physics, and Advanced Calculus. "Collectively, gender gap in CTE-STEM courses increased greater than advanced mathematics and advanced science courses" (Yoon & Strobel, 2017, p. 18).

This gender gap in STEM enrollment in Texas high schools was also seen since the enactment of House Bill 5 (TEA, n.d.-e). Beginning with 2014, Texas students can earn a STEM focused endorsement along with a high school diploma. In the 2014-2015 academic year, 37% of the students enrolled in the STEM endorsement were female. With a slight increase to 38% in both 2015-2016 and 2016-2017, this number grew to 42% in 2017-2018 (TEA, n.d.-e).

Yet, the gender gap in STEM course enrollment varied across contexts (Riegle-Crumb & Moore, 2014). Amelink (2009) argued that female interest in STEM may be influenced by "School characteristics such as school size and availability of school resources. . ." (p. 16). Riegle-Crumb and Moore (2014) examined gendered enrollment in high school physics. Across 63 schools, Riegle-Crumb and Moore (2014) found that 62% of the schools represented had a larger number of male students than female students complete high school physics. Although ". . . taking the average across all schools, females are significantly less likely than male students to enroll in physics" (Riegle-Crumb & Moore, 2014, p. 265), 21% of the schools in the study showed a female advantage in high school physics enrollment, with the remaining 17% of the schools showing gender parity in enrollment in high school physics.

Sparks-Wallace's (2007) transcript study of male and female graduates in a ". . . rural, economically depressed area. . . " (p. 8) further suggested the influence of a community on student outcomes. Sparks-Wallace (2007) found that in two of the three years studied, female students enrolled in a higher number of advanced mathematics and science courses than male students. Additionally, in all three years studied, female students earned higher grades in mathematics and science than did male students. Sparks-Wallace (2007) also noted that "In all three groups there are noticeably more females than males, an indirect indication of a greater dropout rate among male students in this county" (p. 21). Based on personal communications with community members, Sparks-Wallace (2007) speculated this difference in enrollment was influenced by the gender segregation within the community's workforce. Within this particular area, the job opportunities typically sought after by males required little education and commanded relatively high salaries; while work for females with little education had a much lower salary. Thus, for females within this particular area, the promise of a higher salary required higher levels of education.

Cunningham, Hoyer, and Sparks' (2015) study examined the transcripts of high school graduates, class of 2009, alongside NAEP scores. This transcript study revealed that for both mathematics and science, the average scores ". . . were lowest among students who earned credits in health science/technology. . ." (Cunningham et al., 2015, p. 9) and ". . . highest among students who earned credits in calculus. . ." (Cunningham et al., 2015, p. 9). While male and female students took calculus in relatively equal numbers, ". . . males had higher average NAEP mathematics and NAEP science scale scores than females. . . " (Cunningham et al., 2015, p. 4).

High school STEM performance and gender equity. Mann and DiPrete's (2016) cross-national study analyzed math and science PISA scores in relation to a country's GGI and Gender Empowerment Measure (GEM), as well as student's self-assessment of their performance. The self-assessment data showed that female participants rated themselves lower than male participants. This gender gap in self-assessment widened in higher performing countries. However, higher performing countries had a larger portion of both male and female students expressing a STEM orientation.

Further, higher performing countries also tended to be countries characterized by greater gender equity (Mann & DiPrete, 2016), thus creating a puzzling gender gap in STEM aspirations within more egalitarian countries. Yet, when controlled for achievement, this gap narrowed. “We show that this paradoxical result comes from the fact that national indices of gender egalitarianism correlate positively with national performance in science and math, which produces a larger gender gap in STEM aspirations even as it raises the female slope on own performance relative to the male slope” (Mann & DiPrete, 2016, p. 596).

Stoet and Geary (2018) also conducted a cross-national study utilizing GGI and PISA scores, as well as students’ responses to questions regarding attitudes toward science. Within Stoet and Geary’s (2018) study students’ relative academic strength was identified based on PISA data. Across all participating countries, 24% of the female students exhibited science as their academic strength, while 25% showed math as their academic strength, with 51% of the female scores indicating reading as the relative academic strength. By contrast, 38% of the male students’ PISA scores showed science as their academic strength, while 42% exhibited math as their academic strength, with 20% of the male scores indicating reading as the relative academic strength. While PISA data indicated that male students exhibited a strength in STEM studies, Stoet and Geary

(2018) noted that the number of female students entering into STEM studies and later STEM careers was lower than the percentage showing a strength in STEM related academic areas. Paradoxically, “. . . more gender-equal countries were more likely than less gender-equal countries to lose those girls from an academic STEM track who were most likely to choose it on the basis of personal academic strengths” (Stoet & Geary, 2018, p. 585).

In analyzing students’ responses to questions regarding “. . . science self-efficacy, broad interest in science, and enjoyment of science” (Stoet & Geary, 2018, p. 583), a male advantage in these attitudes was revealed. Male students indicated a higher science self-efficacy in 58% of the countries, a higher interest in science in 76% of the countries, and greater joy from science in 43% of the countries (Stoet & Geary, 2018). Again, this was “. . . particularly true in more gender-equal countries. . .” (Stoet & Geary, 2018, p. 588).

Else-Quest, Hyde and Linn’s (2010) cross-national meta-analysis examined gender differences in mathematics performance, as well as attitude and affect utilizing both TIMMS and PISA data. This meta-analysis also uncovered a counter intuitive gender gap in more egalitarian nations. “In nations with greater gender equity, gender differences in valuing math, extrinsic motivation, intrinsic motivation, self-concept, and self-efficacy were larger (favoring males) than in nations with less gender equity” (Else-Quest et al., 2010, p. 120). Further, Fryer and Levitt’s (2010) analysis of TIMMS data and GGI revealed some countries “. . . among the worst in terms of gender equity, girls are actually outperforming boys on math. . . “ (p. 20).

Additionally, TIMMS data indicated similar mathematics achievement for male and female participants (Else-Quest et al., 2010). However, PISA data indicated a slight male advantage in mathematics performance (Else-Quest et al., 2010). Further, Else-Quest et al. (2010) found a significant correlation between mathematics achievement and self-confidence in mathematics and level of value placed on mathematics. Additionally, males indicated a more positive attitude toward math than females and females reported higher levels of math anxiety than males. This gender gap revealed via Else-Quest et al.'s (2010) meta-analysis was larger than for achievement.

K-12 Gender gap influencers

Although male and female students performed similarly at the mean level of achievement (Hyde, et al., 2008; Hyde et al., 2009; Lindberg, et al., 2010; Pope & Sydnor, 2010; Scafidi & Bui, 2010), male students appeared in the right tail of the distribution in greater numbers than female students (Ceci & Williams, 2010; Cimpian, et al., 2016; Hyde, Mertz & Schekman, 2009; Pope & Sydnor, 2010). "Males are often overrepresented in the top 1% by 2 to 1, and in the top 0.1%, they are sometimes overrepresented by a factor of 7 or more to 1" (Ceci & Williams, 2010, p. x). Reinking & Martin (2018) cited three social theories in explaining the dearth of female students amongst the highest performers and subsequent underrepresentation of women in mathematics intensive professions. These theories included gender socialization, the influence of peer groups, and STEM field stereotypes.

Gender socialization. Families and parents have influenced their children's gendered socialization through their own gender beliefs (Avolio, Vilchez & Chávez, 2019). These beliefs may have effected parents' choices in toys, books, and educational experiences (Reinking & Martin, 2018). Further, Maltese & Cooper (2017) found that parents were more likely to encourage their daughters' non-STEM interests than their daughters' STEM interests. "These socialization practices feed into the concept of stereotype threat. . ." (Reinking & Martin, 2018, p. 149).

Stereotype threat, as defined by Claude Steele (1997) ". . . is the social-psychological threat that arises when one is in a situation or doing something for which a negative stereotype about one's group applies" (p. 614). It is theorized that this threat caused by a ". . . stereotype that women are not good at math" impedes performance (Hill et al., 2010, p. 39). Since the introduction of the concept of stereotype threat, several studies investigating its effects have been conducted (Hill et al., 2010; Nguyen & Ryan, 2008; Stoet & Geary, 2012). Nguyen and Ryan's (2008) meta-analysis of such studies revealed that stereotype threat ". . . manifests differently under various conditions" (p. 1330). Stoet and Geary (2012) also conducted a meta-analysis concluding that although female mathematics performance can be negatively affected by stereotypes, ". . . less than half of the studies from which clear and unconfounded conclusions can be drawn did not show such an effect" (p. 99).

Schools may have been another source of gendered socialization. Within the classroom ". . . the hidden curriculum reproduces gender stereotypes. . ." (Avolio et al., 2019, p. 16). These stereotypes may have been felt in speeches, pedagogy, and textbooks (Avolio et al., 2019). Further, teachers tended to attribute female achievement in mathematics to hard work, while citing innate talent for male students' mathematical successes (Espinoza, Arêas da Luz Fontes & Arms-Chavez, 2014). Yet, there has been a tendency among teachers to attribute girls' low achievement to a lack of ability, while males' low achievement has been attributed to a lack of effort (Espinoza et al., 2014). This idea of innate ability versus working toward increased abilities has been seen in the theory of fixed versus growth mindset.

Carol Dweck's work regarding the growth mindset versus the fixed mindset examined the impact of how we view abilities (Dweck, 2006). Dweck (2006) suggested that a growth mindset, viewing our abilities as something that is malleable, leads to the ability to not only face challenges, but to overcome them. A growth mindset encourages persistence (Hill et al., 2010). Conversely, female students holding a fixed mindset ". . . are more likely to believe the stereotype, lose confidence, and disengage from STEM as a potential career when they encounter difficulties in their course work" (Hill et al., 2010, p. 35). Further, high achieving students more often hold a growth mindset (Hendricks, 2012).

Perez-Felkner, Nix & Thomas (2017) examined ". . . the relationship between gender, growth mindset, and mathematics perceived ability under challenge" (p. 3). This examination revealed gender differences in growth mindset and perceptions of one's own mathematics abilities under challenging circumstances. This difference is such that ". . . boys hold a growth mindset more often than girls and perceive their mathematics ability to be stronger than do girls. . ." (Perez-Felkner et al., 2017, p. 8).

Males also exhibited higher levels of math and science self-efficacy than females (Bachman, Nebl, Martinez & Rittmayer, 2009). High levels of mathematics and science achievement have been linked to high levels of self-efficacy in math and science (Bachman et al., 2009; UNESCO, 2017). “Self-efficacy affects both STEM education outcomes and aspirations for STEM careers to a considerable extent” (UNESCO, 2017, p. 46).

The adults in children’s lives influence how both males and females are socialized. Both “. . . parents’ and teachers’ expectancies for children’s math competence are often gender-biased and can influence children’s math attitudes and performance” (Gunderson, Ramirez, Levine & Beilock, 2012, p. 153). The concept that teachers and parents pass on their own ideas about gender and gender stereotypes to the next generation that underpins the gendered socialization theory. Within the theory of gendered socialization “. . . these gendered stereotypes shape girls’ math attitudes and ultimately diminish their interest in STEM fields. . .” (Reinking & Martin, 2018, p. 149).

The influence of peers. Reinking & Martin (2018) identified the influence of students’ peers as another socializing force in turning female students away from STEM. Gendered socialization may have been reinforced by peers. You (2011) asserted “. . . that peers have an important influence on the behavior and development of adolescents” (p. 833). Such an influence may have sent the message to girls that STEM is not a female activity. “Therefore, when very few girls enter STEM content courses, the peer feedback, through words or inaction, can be perceived as negative” (Reinking & Martin, 2018, p. 150).

STEM field stereotypes. Stereotypes in which STEM is seen as masculine (Avolio et al, 2019) and “. . . involve the characteristic of social isolation” (Reinking &

Martin, 2018, p. 150) are misaligned with the gender socialization of girls. Studies indicated that more females than males preferred work that is communal, or people orientated; while more males than females preferred work that is things oriented (Eccles & Wang, 2016; Su & Rounds, 2015; Su, Rounds & Armstrong, 2009). Maltese & Cooper (2017) further stated that ". . . STEM interest in females appears to be more strongly associated with activities that involve others" (p. 6).

STEM stereotypes in which math and science have been seen as things orientated, contributed to the lack of knowledge of how STEM fields contribute to society. This lack of knowledge combined with a tendency to be interested in communal goals represents how stereotypes about STEM contributed to the gender gap (Avolio et al., 2019; Microsoft, n.d.).

Additionally, Dasgupta and Stout (2014) highlighted that the underrepresentation of women in STEM creates an effect on future female would be STEM workers in that there are few role models to illustrate that STEM is an available career for women. This lack of female role models further perpetuates the stereotype of STEM as a masculine field (Avolio et al., 2019).

The theory of role coherence suggested that both boys and girls gravitate toward interests that reinforce their socialized gender roles. By adhering to gender roles ". . . persons are rewarded and feel more positive when they assume social roles consistent with cultural expectation" (Avolio et al., 2019, p. 13). Stereotypes about STEM as masculine and socially isolating is contrary to the socialization of females as people orientated (Avolio et al., 2019; Reinking & Martin, 2018). Therefore, the theory of role coherence may shed some light on the underrepresentation of female students amongst the highest achievers in mathematics and science.

Thus, “There is no single factor by itself that has been shown to determine sex differences in science and math” (Halpern et al., 2007). Rather the causes of the gender gap in math and science achievement are a complex web of influencers, each connected to the other (Halpern, 2014). “Human beings live within interpersonal networks and cultural contexts that shape their development, behavior, opportunities and choices” (Avolio et al., 2019, p. 11).

Narrowing the gender gap

Just as the causes of the math and science gender gap are a complex web of intertwined influencers, so too are the possible solutions (Halpern, 2014). “The answer to questions about gender ratios will depend on a multitude of variables that combine in complex, nonlinear ways” (Halpern, 2014, p. 73). The possible strategies regarding narrowing the math and science gender gap centers around addressing three main environmental influencers; female role models in STEM (Alkhadrawi, 2015; Dasgupta & Stout, 2014; Hill et al., 2010; UNESCO, 2017), increasing female interest in STEM (Dasgupta & Stout, 2014; Su & Rounds, 2015), reducing detrimental beliefs (Cheryan, Master and Meltzoff., 2015) and promoting beliefs that support STEM success (Perez-Felkner et al., 2017).

Role models and mentors. The 12^{th} grade students interviewed within Alkhadrawi’s (2015) study suggested the need for role models in STEM fields and areas of study as a means of encouragement. Dasgupta & Stout (2014) suggest Institutes of

Higher Education as a possible source for such role models. By fostering relationships between K-12 schools and universities, students would have opportunities to better understand STEM before entering college. “The goal is to create opportunities for STEM faculty to visit K-12 classes and talk about their research in age-appropriate and interesting ways, so that young people can see concrete examples of what scientists and engineers do and meet real scientists and engineers especially women” (Dasgupta & Stout, 2014, p. 23).

STEM interest. Several studies indicated that men tend to express interest in careers related to things while women have a tendency to gravitate toward professions that support community, are altruistic in nature, and are centered on people (Eccles & Wang, 2016; Su & Rounds, 2015; Su et al., 2009). Therefore, one possible intervention is to promote the ways in which STEM fields benefit people (Eccles & Wang, 2016). “We call for more interventions that integrate students' people interests into STEM education and that increase students' perception of task values of STEM activities and careers. . .” (Su & Rounds, 2015, p. 16). Dasgupta and Stout (2014) suggest a relationship between schools and science museums as one way to highlight the ways in which STEM fields contribute to the lives of others. “Museum examples demonstrate how science and technology improve people’s lives, solve real-world problems, and require collaboration – thereby highlighting STEM’s communal and altruistic aspects” (Dasgupta & Stout, 2014, p. 23).

Informal STEM activities, such as outside of the school day may also increase female students’ interest in STEM careers (Dasgupta & Stout, 2014; Naizer, Hawthorne

& Henley, 2014; Perez-Felkner et al., 2017; UNESCO, 2017). “By emphasizing creativity and hands-on activity, with grades off the table, these activities allow girls to explore science and technology as hobbies not linked to academics” (Dasgupta & Stout, 2014, p. 23). Naizer et al.’s (2014) study investigated the effects of a Summer STEM program. Naizer et al.’s (2014) study suggests “. . . that the program contributed to reducing the gender gap regarding interest in math, science, and technology” (Naizer et al., 2014, p. 32).

STEM beliefs. Female students have been shown to hold a growth mindset less frequently than male students (Perez-Felkner et al., 2017). Hill et al. (2010) argues that a growth mindset can protect against the negative influences of stereotype threat and encourages persistence. Therefore, “. . . enhancing girls' beliefs about their mathematics ability - in particular when encountering challenging math - can have meaningful consequences for their opportunities. . .” (Perez-Felkner et al., 2017, p. 8). Hill et al. (2010) suggests that directly teaching about stereotype threat and a growth mindset can increase female achievement in mathematics and science.

Cheryan et al. (2015) suggest that combating stereotypes can increase girls’ interest in STEM fields. One possible strategy is to ensure students have an opportunity to see a diverse group of people in these fields. Cheryan et al. (2015) suggests “If there is diversity in who is presented, it sends the message that a variety of people can be successful” (p. 6).

Females tend to have a lower self-efficacy in mathematics and science than do male students (Bachman et al., 2009). Self-efficacy is a predictor of achievement

(Bachman et al., 2009; UNESCO, 2017). Therefore, increasing the self-efficacy of female students in mathematics and science is one possible strategy to increase the number of women entering STEM fields. UNESCO (2017) suggests that an increase in self-efficacy can be promoted through ". . . a strong science and mathematics curriculum and opportunities for concrete experiences and gender-integrated extra-curricular activities" (p. 67).

Nosek et al. (2009) found that a country's level of implicit gender bias is a predictor of the math and science gender gap. Addressing hidden gender bias may narrow the gender gap (Hill et al., 2010). One possible strategy to address such bias is to increase teacher ". . . access to professional development that enhances gender-responsive STEM pedagogy" (UNESCO, 2017, p. 65). Other suggestions for reducing gender bias include removing ". . . gender bias from textbooks and other learning materials" (UNESCO, 2017, p. 68) and setting clear guidelines for grading (Hill et al., 2010). "Women and others facing bias are likely to do better in institutions with clear criteria for success, clear structures for evaluation, and transparency in the evaluation process" (Hill et al., 2010, p. 96).

Summary

While some studies have indicated that the gender gap in mathematics achievement has closed, these studies have analyzed gender gaps at the 50th percentile (Hyde et al, 2008; Hyde et al., 2009; Lindberg et al., 2010; Pope & Sydnor, 2010; Scafidi & Bui, 2010). However, a male favoring gender gap has been identified among the highest achieving mathematics students (Cimpian et al, 2016; Hyde et al., 2009; Machin

& Pekkarinen, 2008; Pope & Sydnor, 2010). A gender gap in the right tail of the distribution has been identified utilizing a national sample (Cimpian et al., 2016; Pope & Sydnor, 2010). The purpose of this study was to determine if gender differences at the highest levels of mathematics achievement are present in Texas.

CHAPTER III

Methodology

Introduction

This quantitative research sought to determine if gender differences in the top quartile of mathematics achievement are present in Texas as measured by the State of Texas Assessments of Academic Readiness (STAAR). Chapter III opens with a statement of the purpose as well as the research questions, followed by a description of the sample and STAAR. The methodology design and data analysis are also presented in Chapter III.

Purpose

Studies analyzing data from state assessments (Hyde et al, 2008), Programme for International Student Assessment (PISA) (Hyde et al., 2009), National Assessment of Educational Progress (NAEP) (Pope & Sydnor, 2010), and National Education Longitudinal Study (NELS) (Scafidi & Bui, 2010) have suggested that the gender gap in overall mathematics achievement have closed. However, Anderson's (2016) study of Texas students indicated that, on average, girls performed slightly higher than boys on the mathematics portion of State of Texas Assessments of Academic Readiness (STAAR). Yet, other studies have indicated a male favoring gender gap in mathematics in the right tail of the distribution in Early Childhood Longitudinal Study (Cimpian et al., 2016) and National Assessment of Educational Progress (Pope & Sydnor, 2010) performance data utilizing U. S. samples. The purpose of this study was to determine if gender differences in Texas in the top quartile of mathematics achievement are present as measured by STAAR.

Research Questions and Hypotheses

Generally, this study sought to determine if gender differences are evident at the highest levels of mathematics achievement in Texas. The following questions were utilized to guide this quantitative study:

1. Are there differences in the percent of male and female students scoring at and above the 75th percentile of the mathematics STAAR for grade 3 in the years 2016, 2017, 2018, and 2019?
2. Are there differences in the percent of male and female students scoring at and above the 75th percentile of the mathematics STAAR for grade 4 in the years 2016, 2017, 2018, and 2019?
3. Are there differences in the percent of male and female students scoring at and above the 75th percentile of the mathematics STAAR for grade 5 in the years 2016, 2017, 2018, and 2019?
4. Are there differences in the percent of male and female students scoring at and above the 75th percentile of the mathematics STAAR for grade 6 in the years 2016, 2017, 2018, and 2019?

5. If differences in the percentage of male and female students scoring at and above the 75th percentile are present, how does the gap change over time for the cohort of students assessed in grade 3 in 2016, grade 4 in 2017, grade 5 in 2018, and grade 6 in 2019?

Two hypotheses guide the analysis of data. These hypotheses include a null hypothesis and an alternative hypothesis.

1. Null hypothesis: There is not a relationship between gender and mathematics STAAR scores in the top quartile.
2. Alternative hypothesis: Gender influences mathematics STAAR scores in the top quartile.

Sample

Students in Texas public schools are administered the mathematics STAAR for the grade level content in which they were instructed (TEA, 2018). The sample for this study includes Texas public school students that received mathematics instruction in grades 3-6 during the years 2016-2019. According to the 2018-2019 Texas Academic Performance Report, there were a total of 5,416,400 students enrolled in grades PK-12 in Texas public schools, with 1,642,417 of these students enrolled in grades 3-6 (TEA, 2019b). Of the total number Texas public school students, 684,349 were African American, 2,847,629 were Hispanic, 1,484,069 were White, 20,362 were American Indian, 242,247 were Asian, 8,254 were Pacific Islander, and 129,490 identified as two or more races (TEA, 2019b). Further, 60.6% of the total number of students enrolled in Texas public schools were identified as economically disadvantaged, 19.5% were English learners, and 50.1% were at-risk (TEA, 2019b). Table 1 presents a summary of the students enrolled in Texas public schools for the year 2018-2019.

Table 1

Summary of students enrolled in Texas public schools for the year 2018-2019

Characteristic	Number	Percent
African American	684,349	12.6%
Hispanic	2,847,629	52.6%
White	1,484,069	27.4%
American Indian	20,362	0.4%
Asian	242,247	4.5%
Pacific Islander	129,490	0.2%
two or more races	129,490	2.4%
Economically Disadvantaged	3,283,812	60.6%
English Language Learners	1,054,596	19.5%
At-Risk	2,713,848	50.1%

(TEA, 2019b)

Instrumentation

Texas began its statewide assessment program in 1980 with the Texas Assessment of Basic Skills (TABS) for grades 3, 5, and 9 in reading, writing, and mathematics (TEA, 2017). The Texas Educational Assessment of Minimum Skills (TEAMS) was introduced in 1986 (TEA, 2017). A passing score on TEAMS became a graduation requirement (TEA, 2017). The Texas Assessment of Academic Skills (TAAS) became the state assessment in 1990. (TEA, 2017). With the passage of Senate Bill 103 in 1999, the Texas Assessment of Knowledge and Skills (TAKS) replaced TAAS (TEA, 2017). In 2012, the current assessment program, the State of Texas Assessments of Academic Readiness (STAAR) was administered for the first time (TEA, 2017). The STAAR assessments are available in Spanish for grades 3-5, STAAR Spanish (TEA, n.d.-f). The STAAR program also provides assessments for students served in the Special Education program, the STAAR Alternative 2 (TEA, n.d.-g).

Texas' assessment program has changed in its 40 years of existence to now include students enrolled in grades 3-8 as well as specific high school courses (TEA, 2014b; TEA, 2017). The current statewide assessment program assesses students in mathematics and reading in grades 3-8, science in grades 5 and 8 and social studies in grade 8 as well as the end of course exams for specific English, mathematics, science, and social studies high school courses (TEA, 2014b). The mathematics STAAR is an annual assessment required by Texas and federal law in grades 3-8 (TEA, 2014b).

Design

This study will utilize a longitudinal, ex post facto design. An ex post facto study examines a relationship after the event (Salkind, 2010). The after the fact nature of an ex post facto study does not allow the researcher to manipulate the variables or randomly assign participants to an experimental group or a control group (Rasmussen & Salkind, 2008). In the case of this particular study, the relationship between gender and mathematics achievement will be investigated. Gender is ". . . the variable that distinguishes the groups from one another. . ." (Rasmussen & Salkind, 2008, p. 375). In this study, gender ". . . is not manipulated by the experimenter but instead is a preexisting subject characteristic. . ." (Rasmussen & Salkind, 2008, p. 375).

Seeking an answer to the research questions will require a longitudinal approach. "The longitudinal design typically involves a large cohort of subjects who are repeatedly evaluated in order to determine whether or not change occurs with respect to a variable of interest with the passage of time" (Rasmussen & Salkind, 2008, p. 378). This longitudinal ex post facto study seeks to identify any gender differences at the highest achievement in mathematics and examine any such differences as students matriculate from third grade through sixth grade.

Data Collection

An application for exempt research was submitted to the Internal Review Board (see Appendix A). Upon approval from the Internal Review Board (see Appendix B), a public information request was submitted to the Texas Education Agency (see Appendix C). This request included students' mathematics STAAR scale scores for students administered the grades 3-6 mathematics STAAR during the years 2016-2019. Students' gender and the version of STAAR administered was also requested. Students administered the STAAR and STAAR Spanish were included in the data analysis. Students administered the STAAR Alternate 2 were not included in the data analysis.

Data Analysis

Using the Statistical Package for the Social Sciences (SPSS), descriptive statistics are presented. For each grade and year, the STAAR score at the 75^{th}, 90^{th}, and 95^{th} percentiles were identified. The scores at each of these points in the distribution were calculated for male and female test takers combined.

Once the score at the 75^{th}, 90^{th}, and 95^{th} percentile is determined, these scores were used to create score bands. These score bands indicate the scores between the 75^{th} and 89^{th} percentile, the 90^{th} and 94^{th} percentile, and the 95^{th} percentile and above. Cross-tabs were run to identify the number and percentage of males and females within each of these score bands.

The chi-square was utilized to compare any differences between the actual number of males and females at each of the score bands and the expected number. The chi-square ". . . applies a statistical test to cross-tabulation comparing the actual *observed* frequencies in each cell of tables with *expected* frequencies" (Greasley, 2008, p. 63). The conventional probability value, or p value, in which a p value less than 0.05 is significant was utilized to determine significance (Greasley, 2008).

Summary

Through analysis of mathematics STAAR scores for students enrolled in grades 3-6 in the years 2016-2019, this longitudinal ex post facto study sought to determine if gender differences at high levels of mathematics achievement exist in Texas. The chi-square was employed to determine if any gender differences in mathematics performance are significant. Chapter IV presents the results of the data analysis.

CHAPTER IV

Findings

Introduction

A public information request was submitted to the Texas Education Agency (TEA) on May 2, 2020 (see Appendix C). Sixteen data sets were received as a result of this request on May 13, 2020. Each data set contained the State of Texas Assessments of Academic Readiness (STAAR) scores for students administered in the grades 3, 4, 5, or 6 assessment in the years 2016, 2017, 2018, or 2019.

The 2016 data sets for grades 3-6 included students administered the STAAR L and STAAR A. STAAR L was a linguistically accommodated English version of the STAAR offered in the online format. STAAR L was intended for students acquiring English as a second language and was administered for the last time in 2016 (TEA, n.d.-h). STAAR A was also administered for the last time in 2016. STAAR A was an online assessment addressing the same curriculum as STAAR, but offered students supports such as ". . . visual aids, graphic organizers, clarifications of construct-irrelevant terms, and text-to-speech functionality" (TEA, n.d.-i, paragraph 1).

Students without a gender identified in each data set were removed from analysis. Also removed from analysis were students in which the assessment had not been marked to be scored and students without a reportable score. Combined, the cleaned data sets included 6,358,500 student scores.

Grade 3 mathematics STAAR

The grade 3 data sets represent the assessment in the years 2016-2019. One data set is analyzed per year for a total of four data sets. Across all four sets of data 1,602,490 student scores are included in this analysis.

Grade 3, 2016. The data set for the grade 3 mathematics STAAR administered in 2016 represented 404,769 students. The cleaned data set included 403,141 student scores for analysis. While 95.7% of students in this data set took the STAAR in English, 4.3% were administered the assessment in Spanish. Approximately 97% of students were administered the assessment in a paper format, while 3.2% took the mathematics STAAR online. The data set for grade 3 in 2016 includes 197,037 female students, representing 48.9% of student scores analyzed; and 206,104 male students, representing 51.1% of the student scores utilized for analysis. STAAR L represents 1.1% of the assessments included in this analysis. Approximately 2% of the students included in this analysis took the STAAR A assessment. Table 2 presents a summary of the 2016 grade 3 data set.

Table 2

Summary of 2016, grade 3 data set

Characteristic	Number	Percent
English	385,792	95.7%
Spanish	17,349	4.3%
Paper assessment	390,080	96.8%
Online assessment	13,061	3.2%
STAAR A	8,618	2.1%
STAAR L	4,383	1.1%
STAAR	390,140	96.8%
Female students	197,037	48.9%
Male students	206,104	51.1%

SPSS was employed to determine the student scale scores at the 75th percentile, 90th percentile, and 95th percentile for all 403,141 students in this data set. The scale score at the 75th percentile was 1554. The scale score at the 90th percentile was 1660. The scale score at the 95th percentile was 1707. Table 3 presents a summary of the scale score at and above the 75th percentile.

Table 3

Summary of 2016, grade 3 scale scores at and above the 75th percentile

Percentile	Scale score
75th	1554
90th	1660
95th	1707

The scale scores at the 75th percentile, 90th percentile, and 95th percentile were used to determine the scale scores between each of the percentiles, creating score bands. Students scoring at or above the 75th percentile were then identified by score band. A cross tabulation was run via SPSS to identify the number and percentage of male and female students scoring within each of the score bands, as well as the expected number of male and female students scoring within each of these score bands.

Of the 107,345 students scoring at or above the 75th percentile, 46.8% were female and 53.2% were male. Crosstabs revealed more female than male students scoring in the 75th-89th percentile score band than expected and fewer female than male students scoring at or above the 90th percentile than expected. The Chi-square test yielded a p value of .000, indicating such differences are significant. Table 4 shows the number of male and female students scoring within each of the score bands, the percentage of male and female students scoring within each score band, and the expected number of male and female students scoring within each of the score bands.

Table 4

Summary of 2016, grade 3 male and female students scoring within each score band

	Male			Female		
Score bands	Percent within score band	Actual number	Expected number	Percent within score band	Actual number	Expected number
75th-89th percentile	52.6%	34,807	35,234	47.4%	31,370	30,953
90th-94th percentile	53.7%	8,161	8,090.5	46.3%	7,037	7,107.5
95th-100th percentile	54.6%	14,166	13,819.5	45.4%	11,794	12,140.5

Grade 3, 2017. The grade 3 2017 data set included 407,961 students. Cleaning the data set yielded 406,459 student scores for analysis. Although 96.5% of these students took a paper version of the assessment, 3.5% were administered an online version of the test. While 95.9% of these students were administered the STAAR in English, 4.1% were administered the assessment in Spanish. The grade 3 2017 data set was 49% female and 51% male. Table 5 presents a summary of the grade 3 2017 sample.

Table 5

Summary of 2017, grade 3 data set

Characteristic	Number	Percent
English	389,652	95.9%
Spanish	16,807	4.1%
Paper assessment	392,136	96.5%
Online assessment	14,323	3.5%
Female students	199,034	49%
Male students	207,425	51%

All 407,961 student scale scores were used to determine the scale score at the 75th percentile, 90th percentile, and 95th percentile. The scale score at the 75th percentile was 1559. The scale score at the 90th percentile was 1675. The scale score at the 95th percentile was 1755. Table 6 presents a summary of the scale score at and above the 75th percentile.

Table 6

Summary of 2017, grade 3 scale scores at and above the 75th percentile

Percentile	Scale score
75th	1559
90th	1675
95th	1755

Female students accounted for 47.8% of the 126,192 students scoring at or above the 75th percentile, while male students represented 52.2% of the students scoring at or above the 75th percentile. Crosstabs revealed more female students scoring in the 75th-89th percentile score band than expected and more male students scoring at or above the 90th percentile than expected. The Chi-square test generated a p value of .000, indicating these differences are significant. Table 7 shows the actual number, the percentage, and expected number of male and female students scoring within each of the score bands.

Table 7

Summary of 2017, grade 3 male and female students scoring within each score band

	Male			Female		
Score bands	Percent within score band	Actual number	Expected number	Percent within score band	Actual number	Expected number
75th-89th percentile	51.6%	39,088	39,523.3	48.4%	36,655	36,219.7
90th-94th percentile	52.4%	12,226	12,166.5	47.6%	11,090	11,149.5
95th-100th percentile	53.6%	14,534	14,158.2	46.4%	12,599	12,974.8

Grade 3, 2018. The data set for the grade 3 mathematics STAAR administered in 2018 represented 404,449 students. The cleaned data set included 402,978 student scores for analysis. While 95.9% of students in this data set took the STAAR in English, 4.1% were administered the assessment in Spanish. Over 95% of students were administered the assessment in a paper format, while 3.3% took the mathematics STAAR online. The data set for grade 3 in 2018 includes 197,794 female students, representing 49.1% of student scores analyzed; and 205,184 male students, representing 50.9% of the student scores utilized for analysis. Table 8 presents a summary of the 2018 grade 3 data set.

Table 8

Summary of 2018, grade 3 data set

Characteristic	Number	Percent
English	386,322	95.9%
Spanish	16,656	4.1%
Paper assessment	389,503	96.7%
Online assessment	13,475	3.3%
Female students	197,794	49.1%
Male students	205,184	50.9%

SPSS was employed to determine the student scale scores at the 75th percentile, 90th percentile, and 95th percentile for all 402,978 students in this data set. The scale score at the 75th percentile was 1561. The scale score at the 90th percentile was 1675. The scale score at the 95th percentile was 1755. Table 9 presents a summary of the scale score at and above the 75th percentile.

Table 9

Summary of 2018, grade 3 scale scores at and above the 75th percentile

Percentile	Scale score
75th	1561
90th	1675
95th	1755

Of the 114,609 students scoring at or above the 75th percentile, 47.5% were female and 52.5% were male. Crosstabs revealed more female than male students scoring in the 75th-89th percentile score band than expected and fewer female than male students scoring at or above the 90th percentile than expected. The Chi-square test yielded a p value of .000, indicating such differences are significant. Table 10 shows the number of male and female students scoring within each of the score bands, the percentage of male and female students scoring within each score band, and the expected number of male and female students scoring within each of the score bands.

Table 10

Summary of 2018, grade 3 male and female students scoring within each score band

	Male			Female		
Score bands	Percent within score band	Actual number	Expected number	Percent within score band	Actual number	Expected number
75th-89th percentile	51.6%	37,335	37,995.3	48.4%	34,973	34,312.7
90th-94th percentile	53.9%	10,828	10,565	46.1%	9,278	9,541
95th-100th percentile	54.3%	12,060	11,662.7	45.7%	10,135	10,532.3

Grade 3, 2019. The grade 3, 2019 data set included 391,155 students. The cleaned data set comprised 389,912 student scores for analysis. Ninety-six percent of students analyzed in the 2019 data set for grade 3 were administered the assessment in English; while 4% were administered the assessment in Spanish. Ninety-six percent of students took the paper version of the test and 4% took the online version. The data set for grade 3 in 2019 included 191,120 female students, representing 49% of student scores

analyzed; and 198,792 male students, representing 51% of the student scores utilized for analysis. Table 11 presents a summary of the 2019 grade 3 data set.

Table 11

Summary of 2019, grade 3 data set

Characteristic	Number	Percent
English	374,160	96%
Spanish	15,752	4%
Paper assessment	374,351	96%
Online assessment	15561	4%
Female students	191,120	49%
Male students	198,792	51%

SPSS was utilized to determine the student scale scores at the 75th percentile, 90th percentile, and 95th percentile for all 389,912 students in this data set. The scale score at the 75th percentile was 1561. The scale score at the 90th percentile was 1681. The scale score at the 95th percentile was 1762. Table 12 presents a summary of the scale score at and above the 75th percentile.

Table 12

Summary of 2019, grade 3 scale scores at and above the 75th percentile

Percentile	Scale score
75th	1561
90th	1681
95th	1762

Of the 115,794 students scoring at or above the 75th percentile, 46.2% were female and 53.8% were male. Crosstabs revealed more female students scoring in the 75th-89th percentile score band than expected and more male students scoring at or above the 90th percentile than expected. The Chi-square test yielded a p value of .000, indicating such differences are significant. Table 13 shows the number of male and female students scoring within each of the score bands and the expected number of male and female students scoring within each of the score bands.

Table 13

Summary of 2019, grade 3 male and female students scoring within each score band

	Male			Female		
Score bands	Percent within score band	Actual number	Expected number	Percent within score band	Actual number	Expected number
75^{th}-89^{th} percentile	52%	35,770	37,005.4	48%	33,008	31,772.6
90^{th}-94^{th} percentile	55.3%	11,357	11,054.6	44.7%	9,189	9,491.4
95^{th}-100^{th} percentile	57.3%	15,175	14,242	42.7%	11,295	12,228

Grade 3 summary. The samples for the four years studied were each approximately 49% female and 51% male. All four years studied had a greater percentage of male students in the top quartile than female students. The smallest gap between male and female students in the top quartile was in 2017 with 47.8% female and 52.2% male. The largest gap between male and female students in the top quartile was in 2019 with 46.2% female and 53.8% male. The gap between the percentage of female and male students in the top quartile became wider in higher score bands for all four years studied.

All four analysis revealed more female students than expected scoring in the 75th percentile-89th percentile score band and more male students than expected scoring in the 90th percentile-94th score band, as well as the 95th percentile-100th percentile score band. Further, the Chi-square test yielded a p value of .000 for all four years, indicating these differences are significant.

Grade 4 mathematics STAAR

The grade 4 data sets represent the assessment in the years 2016-2019. One data set is analyzed per year for a total of four data sets. Across all four sets of data 1,608,211 student scores are included in this analysis.

Grade 4, 2016. The data set for the grade 4 mathematics STAAR administered in 2016 represented 395,168 students. The cleaned data set included 391,255 student scores for analysis. While 97.6% of students in this data set took the STAAR in English, 2.4% were administered the assessment in Spanish. Approximately 96% of students were administered the assessment in a paper format, while 3.8% took the mathematics STAAR online. The data set for grade 4 in 2016 includes 191,678 female students, representing 49% of student scores analyzed; and 199,577 male students, representing 51% of the student scores utilized for analysis. STAAR L represents .5% of the assessments included in this analysis. Approximately 3% of the students included in this analysis took the STAAR A assessment. Table 14 presents a summary of the 2016 grade 4 data set.

Table 14

Summary of 2016, grade 4 data set

Characteristic	Number	Percent
English	381,875	97.6%
Spanish	9,380	2.4%
Paper assessment	376,498	96.2%
Online assessment	14,757	3.8%
STAAR A	12,595	3.2%
STAAR L	1,980	.5%
STAAR	376,680	96.3%
Female students	191,678	49%
Male students	199,577	51%

SPSS was employed to determine the student scale scores at the 75th percentile, 90th percentile, and 95th percentile for all 391,255 students in this data set. The scale score at the 75th percentile was 1640. The scale score at the 90th percentile was 1741. The scale score at the 95th percentile was 1806. Table 15 presents a summary of the scale score at and above the 75th percentile.

Table 15

Summary of 2016, grade 4 scale scores at and above the 75th percentile

Percentile	Scale score
75th	1640
90th	1741
95th	1806

Of the 107,020 students scoring at or above the 75th percentile, 47.4% were female and 52.6% were male. Crosstabs revealed more female than male students scoring in the 75th-89th percentile score band than expected and fewer female than male students scoring at or above the 90th percentile than expected. The Chi-square test yielded a p value of .004, indicating such differences are significant. Table 16 shows the number of male and female students scoring within each of the score bands, the percentage of male and female students scoring within each score band, and the expected number of male and female students scoring within each of the score bands.

Table 16

Summary of 2016, grade 4 male and female students scoring within each score band

	Male			Female		
Score bands	Percent within score band	Actual number	Expected number	Percent within score band	Actual number	Expected number
75th-89th percentile	52.3%	33,762	34,005.4	47.7%	30,852	30,608.6
90th-94th percentile	52.9%	11,397	11,339.3	47.1%	10,149	10,206.7
95th-100th percentile	53.5%	11,164	10,978.3	46.5%	9,696	9,881.7

Grade 4, 2017. The data set for the grade 4 mathematics STAAR administered in 2017 represented 408,434 students. The cleaned data set included 404,678 student scores for analysis. While 97.7% of students in this data set took the STAAR in English, 2.3% were administered the assessment in Spanish. Over 95% of students were administered the assessment in a paper format, while 4.4% took the mathematics STAAR online. The data set for grade 4 in 2017 includes 197,787 female students, representing 48.9% of student scores analyzed; and 206,891 male students, representing 51.1% of the student scores utilized for analysis. Table 17 presents a summary of the 2017 grade 4 data set.

Table 17

Summary of 2017, grade 4 data set

Characteristic	Number	Percent
English	395,249	97.7%
Spanish	9,429	2.3%
Paper assessment	386,869	95.6%
Online assessment	17,809	4.4%
Female students	197,787	48.9%
Male students	206,891	51.1%

SPSS was employed to determine the student scale scores at the 75th percentile, 90th percentile, and 95th percentile for all 404,678 students in this data set. The scale score at the 75th percentile was 1670. The scale score at the 90th percentile was 1785. The scale score at the 95th percentile was 1864. Table 18 presents a summary of the scale score at and above the 75th percentile.

Table 18

Summary of 2017, grade 4 scale scores at and above the 75th percentile

Percentile	Scale score
75th	1670
90th	1785
95th	1864

Of the 106,176 students scoring at or above the 75th percentile, 47.8% were female and 52.2% were male. Crosstabs revealed more female than male students scoring in the 75th-89th percentile score band than expected. Nearly the same number of male and female students scored within the 75th percentile-89th percentile score band as the expected number. Fewer female than male students scored at or above the 95th percentile than expected. The Chi-square test yielded a p value of .735, indicating such differences are not significant. Table 19 shows the number of male and female students scoring within each of the score bands, the percentage of male and female students scoring within each score band, and the expected number of male and female students scoring within each of the score bands.

Table 19

Summary of 2017, grade 4 male and female students scoring within each score band

	Male			Female		
Score bands	Percent within score band	Actual number	Expected number	Percent within score band	Actual number	Expected number
75^{th}-89^{th} percentile	52.1%	32,824	32,875.2	47.9%	30,129	30,077.8
90^{th}-94^{th} percentile	52.2%	10,005	10,005.7	47.8%	9,155	9,154.3
95^{th}-100^{th} percentile	52.4%	12,618	12,566.1	47.6%	11,445	11,496.9

Grade 4, 2018. The grade 4, 2018 data set included 410,366 students. The cleaned data set comprised 407,011 student scores for analysis. Approximately 98% of students analyzed in the 2018 data set for grade 4 were administered the assessment in English; while 2.3% were administered the assessment in Spanish. Over 95% of students took the paper version of the test and 4.2% took the online version. The data set for grade 4 in 2018 included 199,516 female students, representing 49% of student scores

analyzed; and 207,495 male students, representing 51% of the student scores utilized for analysis. Table 20 presents a summary of the 2018 grade 4 data set.

Table 20

Summary of 2018, grade 4 data set

Characteristic	Number	Percent
English	397,845	97.7%
Spanish	9,166	2.3%
Paper assessment	389,846	95.8%
Online assessment	17,165	4.2%
Female students	199,516	49%
Male students	207,495	51%

SPSS was utilized to determine the student scale scores at the 75th percentile, 90th percentile, and 95th percentile for all 407,011 students in this data set. The scale score at the 75th percentile was 1670. The scale score at the 90th percentile was 1733. The scale score at the 95th percentile was 1862. Table 21 presents a summary of the scale score at and above the 75th percentile.

Table 21

Summary of 2018, grade 4 scale scores at and above the 75th percentile

Percentile	Scale score
75th	1670
90th	1733
95th	1862

Of the 106,185 students scoring at or above the 75th percentile, 46.9% were female and 53.1% were male. Crosstabs revealed more female students scoring in the 75th-89th percentile score band and the 90th-94th percentile score band than expected. More male students scored at or above the 95th percentile than expected. The Chi-square test yielded a p value of .000, indicating such differences are significant. Table 22 shows the number of male and female students scoring within each of the score bands and the expected number of male and female students scoring within each of the score bands.

Table 22

Summary of 2018, grade 4 male and female students scoring within each score band

	Male			Female		
Score bands	Percent within score band	Actual number	Expected number	Percent within score band	Actual number	Expected number
75th-89th percentile	51.1%	22,962	23,845.5	48.9%	21,941	21,057.5
90th-94th percentile	52.3%	11,151	11,313.9	47.7%	10,154	9,991.1
95th-100th percentile	55.7%	22,276	21,229.6	44.3%	17,701	18,747.4

Grade 4, 2019. The grade 4 2019 data set included 408,660 students. Cleaning the data set yielded 405,267 student scores for analysis. Although 95.3% of these students took a paper version of the assessment, 4.7% were administered an online version of the test. While 97.4% of these students were administered the STAAR in English, 2.6% were administered the assessment in Spanish. The grade 4 2019 data set was 49.1% female and 50.9% male. Table 23 presents a summary of the grade 4 2019 sample.

Table 23

Summary of 2019, grade 4 data set

Characteristic	Number	Percent
English	394,923	97.4%
Spanish	10,344	2.6%
Paper assessment	386,408	95.3%
Online assessment	18,859	4.7%
Female students	198,858	49.1%
Male students	206,409	50.9%

All 405,267 student scale scores were used to determine the scale score at the 75th percentile, 90th percentile, and 95th percentile. The scale score at the 75th percentile was 1670. The scale score at the 90th percentile was 1770. The scale score at the 95th percentile was 1770. Table 24 presents a summary of the scale score at and above the 75th percentile.

Table 24

Summary of 2019, grade 4 scale scores at and above the 75th percentile

Percentile	Scale score
75th	1670
90th	1770
95th	1770

Female students accounted for 45.5% of the 110,428 students scoring at or above the 75th percentile, while male students represented 54.5% of the students scoring at or above the 75th percentile. Crosstabs revealed more female students scoring in the 75th-89th percentile score band than expected and more male students scoring at or above the 90th percentile than expected. The Chi-square test generated a p value of .000, indicating these differences are significant. Table 25 shows the actual number, the percentage, and expected number of male and female students scoring within each of the score bands.

Table 25

Summary of 2019, grade 4 male and female students scoring within each score band

	Male			Female		
Score bands	Percent within score band	Actual number	Expected number	Percent within score band	Actual number	Expected number
75th-89th percentile	52.4%	29,278	30,449.7	47.6%	26,559	25,387.3
90th-94th percentile	55.4%	18,598	18,299.7	44.6%	14,959	15,257.3
95th-100th percentile	58.7%	12,344	11,470.5	41.3%	8,690	9,563.5

Grade 4 summary. The samples for the four years studied were each approximately 49% female and 51% male. All four years studied had a greater percentage of male students in the top quartile than female students. The smallest gap between male and female students in the top quartile was in 2017 with 47.8% female and 52.2% male. The largest gap between male and female students in the top quartile was in 2019 with 45.5% female and 54.4% male. The gap between the percentage of female and male students in the top quartile remained roughly the same in the 75th percentile-94th

percentile, but grew slightly wider in the 95th-100th percentile in 2016. The gap between male and female students in the top quartile for 2017 remained roughly the same in all three score bands. The gap between the percentage of male and female students in the top quartile became wider in higher score bands for 2018 and 2019.

All four analysis revealed more female students than expected scoring in the 75th percentile-89th percentile score band. In 2017, approximately the same number of male and female students scored in the 90th-94th percentile as expected, while in 2018 more female students scored in this score band than expected. More male students than expected scored in the 90th percentile-94th score band, as well as the 95th percentile-100th percentile score band in 2016 and 2019. In 2017 and 2018 more male students than expected scored in the 95th-100 percentile than expected. The Chi-square test yielded a p value indicating such differences are significant in three out of the four years studied.

Grade 5 mathematics STAAR

The grade 5 data sets represent the assessment in the years 2016-2019. One data set is analyzed per year for a total of four data sets. Across all four sets of data 1,596,463 student scores are included in this analysis.

Grade 5, 2016. The data set for the grade 5 mathematics STAAR administered in 2016 represented 390,256 students. The cleaned data set included 387,615 student scores for analysis. While 98.8% of students in this data set took the STAAR in English, 1.2% were administered the assessment in Spanish. Approximately 96% of students were administered the assessment in a paper format, while 4.3% took the mathematics STAAR online. The data set for grade 5 in 2016 includes 189,476 female students, representing

48.9% of student scores analyzed; and 198,139 male students, representing 51.1% of the student scores utilized for analysis. STAAR L represents .6% of the assessments included in this analysis. Approximately 4% of the students included in this analysis took the STAAR A assessment. Table 26 presents a summary of the 2016 grade 5 data set.

Table 26

Summary of 2016, grade 5 data set

Characteristic	Number	Percent
English	383,012	98.8%
Spanish	4,603	1.2%
Paper assessment	370,803	95.7%
Online assessment	16,812	4.3%
STAAR A	14,663	3.8%
STAAR L	2,155	.6%
STAAR	370,797	95.7%
Female students	189,476	48.9%
Male students	198,139	51.1%

SPSS was employed to determine the student scale scores at the 75^{th} percentile, 90^{th} percentile, and 95^{th} percentile for all 387,615 students in this data set. The scale score at the 75^{th} percentile was 1693. The scale score at the 90^{th} percentile was 1771. The scale score at the 95^{th} percentile was 1833. Table 27 presents a summary of the scale score at and above the 75^{th} percentile.

Table 27

Summary of 2016, grade 5 scale scores at and above the 75th percentile

Percentile	Scale score
75th	1693
90th	1771
95th	1833

Of the 100,032 students scoring at or above the 75^{th} percentile, 48.4% were female and 51.6% were male. Crosstabs revealed more female than male students scoring in the 75^{th}-89^{th} percentile score band than expected and more male than female students scoring at or above the 90^{th} percentile than expected. The Chi-square test yielded a p value of .000 indicating such differences are significant. Table 28 shows the number of male and female students scoring within each of the score bands, the percentage of male and female students scoring within each score band, and the expected number of male and female students scoring within each of the score bands.

Table 28

Summary of 2016, grade 5 male and female students scoring within each score band

	Male			Female		
Score bands	Percent within score band	Actual number	Expected number	Percent within score band	Actual number	Expected number
75th-89th percentile	50.7%	25,294	25,762.1	49.3%	24,633	24,164.9
90th-94th percentile	52%	11,745	11,648.1	48%	10,829	10,925.9
95th-100th percentile	52.9%	14,577	14,205.9	47.1%	12,954	13,325.1

Grade 5, 2017. The grade 5, 2017 data set included 395,364 students. The cleaned data set comprised 392,775 student scores for analysis. Approximately 99% of students analyzed in the 2017 data set for grade 5 were administered the assessment in English; while 1.3% were administered the assessment in Spanish. Over 95% of students took the paper version of the test and 4.6% took the online version. The data set for grade 5 in 2017 included 192,639 female students, representing 49% of student scores

analyzed; and 200,136 male students, representing 51% of the student scores utilized for analysis. Table 20 presents a summary of the 2017 grade 5 data set.

Table 29

Summary of 2017, grade 5 data set

Characteristic	Number	Percent
English	387,543	98.7%
Spanish	5,232	1.3%
Paper assessment	374,579	95.4%
Online assessment	18,196	4.6%
Female students	192,639	49%
Male students	200,136	51%

SPSS was utilized to determine the student scale scores at the 75th percentile, 90th percentile, and 95th percentile for all 392,775 students in this data set. The scale score at the 75th percentile was 1710. The scale score at the 90th percentile was 1800. The scale score at the 95th percentile was 1929. Table 30 presents a summary of the scale score at and above the 75th percentile.

Table 30

Summary of 2017, grade 5 scale scores at and above the 75th percentile

Percentile	Scale score
75th	1710
90th	1800
95th	1929

Of the 112,958 students scoring at or above the 75th percentile, 47.8% were female and 52.2% were male. Crosstabs revealed more female students scoring in the 75th-89th percentile score band than expected and more male students scoring at or above the 90th percentile than expected. The Chi-square test yielded a p value of .000, indicating such differences are significant. Table 31 shows the number of male and female students scoring within each of the score bands and the expected number of male and female students scoring within each of the score bands.

Table 31

Summary of 2017, grade 5 male and female students scoring within each score band

	Male			Female		
Score bands	Percent within score band	Actual number	Expected number	Percent within score band	Actual number	Expected number
75th-89th percentile	51%	29,415	30,133.5	49%	28,318	27,599.5
90th-94th percentile	53.2%	18,113	17,783.2	46.8%	15,958	16,287.8
95th-100th percentile	54%	11,430	11,041.3	46%	9,724	10,112.7

Grade 5, 2018. The grade 5 2018 data set included 408,896 students. Cleaning the data set yielded 405,996 student scores for analysis. Although 95.1% of these students took a paper version of the assessment, 4.9% were administered an online version of the test. While 98.7% of these students were administered the STAAR in English, 1.3% were administered the assessment in Spanish. The grade 5 2018 data set was 48.9% female and 51.1% male. Table 32 presents a summary of the grade 5 2018 sample.

Table 32

Summary of 2018, grade 5 data set

Characteristic	Number	Percent
English	400,588	98.7%
Spanish	5,408	1.3%
Paper assessment	386,273	95.1%
Online assessment	19,723	4.9%
Female students	198,568	48.9%
Male students	207,428	51.1%

All 405,996 student scale scores were used to determine the scale score at the 75th percentile, 90th percentile, and 95th percentile. The scale score at the 75th percentile was 1724. The scale score at the 90th percentile was 1802. The scale score at the 95th percentile was 1851. Table 33 presents a summary of the scale score at and above the 75th percentile.

Table 33

Summary of 2018, grade 5 scale scores at and above the 75th percentile

Percentile	Scale score
75th	1724
90th	1802
95th	1851

Female students accounted for 49.5% of the 119,250 students scoring at or above the 75th percentile, while male students represented 50.5% of the students scoring at or above the 75th percentile. Crosstabs revealed more female students scoring in the 75th-89th percentile score band and the 90th-94th percentile score band than expected. More male students scored at or above the 95th percentile than expected. The Chi-square test generated a p value of .000, indicating these differences are significant. Table 34 shows the actual number, the percentage, and expected number of male and female students scoring within each of the score bands.

Table 34

Summary of 2018, grade 5 male and female students scoring within each score band

	Male			Female		
Score bands	Percent within score band	Actual number	Expected number	Percent within score band	Actual number	Expected number
75th-89th percentile	50%	33,661	33,995.1	50%	33,634	33,299.9
90th-94th percentile	50.4%	9,625	9,655.2	49.6%	9,488	9,457.8
95th-100th percentile	51.6%	16,955	16,590.6	48.4%	15,887	16,251.4

Grade 5, 2019. The data set for the grade 5 mathematics STAAR administered in 2019 represented 412,982 students. The cleaned data set included 410,077 student scores for analysis. While 98.5% of students in this data set took the STAAR in English, 1.5% were administered the assessment in Spanish. Approximately 95% of students were administered the assessment in a paper format, while 5.4% took the mathematics STAAR online. The data set for grade 5 in 2019 includes 201,004 female students, representing 49% of student scores analyzed; and 209,073 male students, representing 51% of the student scores utilized for analysis. Table 35 presents a summary of the 2019 grade 5 data set.

Table 35

Summary of 2019, grade 5 data set

Characteristic	Number	Percent
English	404,031	98.5%
Spanish	6,046	1.5%
Paper assessment	387,983	94.6%
Online assessment	22,094	5.4%
Female students	201,004	49%
Male students	209,073	51%

SPSS was employed to determine the student scale scores at the 75th percentile, 90th percentile, and 95th percentile for all 410,077 students in this data set. The scale score at the 75th percentile was 1739. The scale score at the 90th percentile was 1860. The scale score at the 95th percentile was 1943. Table 36 presents a summary of the scale score at and above the 75th percentile.

Table 36

Summary of 2019, grade 5 scale scores at and above the 75th percentile

Percentile	Scale score
75th	1739
90th	1860
95th	1943

Of the 123,058 students scoring at or above the 75th percentile, 48% were female and 52% were male. Crosstabs revealed more female than male students scoring in the 75th-89th percentile score band than expected and fewer female than male students scoring at or above the 90th percentile than expected. The Chi-square test yielded a p value of .000, indicating such differences are significant. Table 37 shows the number of male and female students scoring within each of the score bands, the percentage of male and female students scoring within each score band, and the expected number of male and female students scoring within each of the score bands.

Table 37

Summary of 2019, grade 5 male and female students scoring within each score band

	Male			Female		
Score bands	Percent within score band	Actual number	Expected number	Percent within score band	Actual number	Expected number
75^{th}-89^{th} percentile	51.3%	36,274	36,733.6	48.7%	34,371	33,911.4
90^{th}-94^{th} percentile	52.1%	11,736	11,714	47.9%	10,792	10,814
95^{th}-100^{th} percentile	53.5%	15,977	15,539.4	46.5%	13,908	14,345.6

Grade 5 summary. The samples for the four years studied were each approximately 49% female and 51% male. All four years studied had a greater percentage of male students in the top quartile than female students. However, in 2018 the total sample was 48.9% female and the percent of female students in the top quartile was 49.5%. The largest gap between male and female students in the top quartile was in 2017 with 47.8% female and 52.2% male. The gap between the percentage of female and male students in the top quartile grew wider in higher score bands for all four years studied.

All four analysis revealed more female students than expected scoring in the 75th percentile-89th percentile score band. In three of the four years studied, more male students than expected scored at or above the 90th percentile. In 2018 more female students than expected scored in the 90th percentile-94th percentile score band, while more male students than expected scored in the 95th percentile-100th percentile score band. The Chi-square test yielded a p value indicating such differences are significant in all four years studied.

Grade 6 mathematics STAAR

The grade 6 data are in four data sets, one for each year between 2016 and 2019. Combined, 1,551,336 student scores were included in this analysis. All grade 6 students during the years 2016-2019 were administered the STAAR in English.

Grade 6, 2016. The 2016 grade 6 mathematics STAAR data set represented 386,758 students. Cleaning the data set yielded 378,089 student scores included in analysis. While 6.8% of these students were administered the assessment online, 93.2% took a paper version of the mathematics STAAR. The data set analyzed for 2016 in grade 6 included 185,653 female students, or 49.1% of student scores; and 192,436 male students, or 50.9% of the student scores. STAAR L represents 1.5% of the assessments included in this analysis. Five percent of the students included in this analysis took the STAAR A assessment. Table 38 presents a summary of the 2016 grade 6 data set.

Table 38

Summary of 2016, grade 6 data set

Characteristic	Number	Percent
Paper assessment	352,546	93.2%
Online assessment	25,543	6.8%
STAAR A	19,063	5%
STAAR L	5,505	1.5%
STAAR	353,521	93.5%
Female students	185,653	49.1%
Male students	192,436	50.9%

Student scale scores at the 75th percentile, 90th percentile, and 95th percentile for all 378,089 students was determined via SPSS. The scale score at the 75th percentile for grade 6 in 2016 was 1712. The scale score at the 90th percentile was 1807. The scale score at the 95th percentile was 1868. Table 39 presents a summary of the scale score at and above the 50th percentile.

Table 39

Summary of 2016, grade 6 scale scores at and above the 75th percentile

Percentile	Scale score
75th	1712
90th	1807
95th	1868

Female students accounted for 48.1% of the 97,390 students scoring at or above the 75th percentile, while male students represents 51.9% of the students scoring at or above the 75th percentile. Crosstabs revealed fewer male students scoring in the 75th-89th percentile score band than expected and more female students scoring in the 75th-89th percentile score band than expected. More male students scored at or above the 90thth percentile than expected and fewer female students scored at or above the 90th percentile than expected. The Chi-square test generated a p value of .000, indicating these differences are significant. Table 40 shows the actual number and expected number of male and female students scoring within each of the score bands.

Table 40

Summary of 2016, grade 6 male and female students scoring within each score band

	Male			Female		
Score bands	Percent within score band	Actual number	Expected number	Percent within score band	Actual number	Expected number
75th-89th percentile	50.8%	27,226	27,804.2	49.2%	26,328	25,749.8
90th-94th percentile	52.2%	10,412	10,346.8	47.8%	9,517	9,582.2
95th-100th percentile	54.1%	12,883	12,370	45.9%	10,943	11,456

Grade 6, 2017. The data set for the grade 6 mathematics STAAR administered in 2017 represented 394,312 students. The cleaned data set included 384,517 student scores for analysis. Approximately 93% of the students were administered a paper version of the assessment; while almost 7% took the mathematics STAAR online. The data set for grade 6 in 2017 included 187,870 female students, representing 48.9% of student scores analyzed; and 196,647 male students, representing 51.1% of the student scores utilized for analysis. Table 41 presents a summary of the 2017 grade 6 data set.

Table 41

Summary of 2017, grade 6 data set

Characteristic	Number	Percent
Paper assessment	358,319	93.2%
Online assessment	26,198	6.8%
Female students	187,870	48.9%
Male students	196,647	51.1%

SPSS was utilized to determine the student scale scores at the 75th percentile, 90th percentile, and 95th percentile for all 384,517 students in this data set. The scale score at the 75th percentile was 1722. The scale score at the 90th percentile was 1817. The scale score at the 95th percentile was 1879. Table 42 presents a summary of the scale score at and above the 75th percentile.

Table 42

Summary of 2017, grade 6 scale scores at and above the 75th percentile

Percentile	Scale score
75th	1722
90th	1817
95th	1879

Of the 99,373 students scoring at or above the 75th percentile, 48.1% were female and 51.9% were male. Crosstabs revealed more female students scoring in the 75th-89th percentile score band than expected and more male students scoring at or above the 90th percentile than expected. The Chi-square test yielded a p value of .000, indicating such differences are significant. Table 43 shows the number of male and female students scoring within each of the score bands and the expected number of male and female students scoring within each of the score bands.

Table 43

Summary of 2017, grade 6 male and female students scoring within each score band

	Male			Female		
Score bands	Percent within score band	Actual number	Expected number	Percent within score band	Actual number	Expected number
75th-89th percentile	51.3%	27,292	27,635.5	48.7%	25,915	25,571.5
90th-94th percentile	52.4%	10,147	10,048.8	47.6%	9,200	9,298.2
95th-100th percentile	52.9%	14,175	13,929.7	47.1%	12,644	12,889.3

Grade 6, 2018. The 2018 grade 6 mathematics STAAR data set represented 397,790 students. Cleaning the data set yielded 387,588 student scores included in analysis. While 7.4% of these students were administered the assessment online, 92.6% took a paper version of the mathematics STAAR. The data set analyzed for 2018 in grade 6 included 190,127 female students, or 49.1% of student scores; and 197,461 male students, or 50.9% of the student scores. Table 44 presents a summary of the 2018 grade 6 data set.

Table 44

Summary of 2018, grade 6 data set

Characteristic	Number	Percent
Paper assessment	358,743	92.6%
Online assessment	28,845	7.4%
Female students	190,127	49.1%
Male students	197,461	50.9%

Student scale scores at 75th percentile, 90th percentile, and 95th percentile for all 387,588 students was determined via SPSS. The scale score at the 75th percentile for grade 6 in 2018 was 1724. The scale score at the 90th percentile was 1821. The scale score at the 95th percentile was 1884. Table 45 presents a summary of the scale score at and above the 75th percentile.

Table 45

Summary of 2018, grade 6 scale scores at and above the 75th percentile

Percentile	Scale score
75th	1724
90th	1821
95th	1884

Female students accounted for 48.2% of the 102,274 students scoring at or above the 75th percentile, while male students represents 51.8% of the students scoring at or above the 75th percentile. Crosstabs revealed more male students scoring in the 75th-89th percentile score band and in the 95th-100th percentile score band than expected. More female students scored in the 90th-95th score band than expected. The Chi-square test generated a p value of .398, indicating these differences are not significant. Table 46 shows the actual number and expected number of male and female students scoring within each of the score bands.

Table 46

Summary of 2018, grade 6 male and female students scoring within each score band

	Male			Female		
Score bands	Percent within score band	Actual number	Expected number	Percent within score band	Actual number	Expected number
75^{th}-89^{th} percentile	52%	29,338	29,259.9	48%	27,097	27,175.1
90^{th}-94^{th} percentile	51.4%	10,391	10,475.2	48.6%	9,813	9,728.8
95^{th}-100^{th} percentile	51.9%	13,297	13,291	48.1%	12,338	12,344

Grade 6, 2019. The data set for the grade 6 mathematics STAAR administered in 2019 represented 413,123 students. The cleaned data set included 401,142 student scores for analysis. Ninety-one percent of the students were administered a paper version of the assessment; while 9% took the mathematics STAAR online. The data set for grade 6 in 2019 includes 196,049 female students, representing 48.9% of student scores analyzed; and 205,093 male students, representing 51.1% of the student scores utilized for analysis. Table 47 presents a summary of the 2019 grade 6 data set.

Table 47

Summary of 2019, grade 6 data set

Characteristic	Number	Percent
Paper assessment	364,915	91%
Online assessment	36,227	9%
Female students	196,049	48.9%
Male students	205,093	51.1%

SPSS was utilized to determine the student scale scores at the 75th percentile, 90th percentile, and 95th percentile for all 401,142 students in this data set. The scale score at the 75th percentile was 1740. The scale score at the 90th percentile was 1850. The scale score at the 95th percentile was 1919. Table 48 presents a summary of the scale score at and above the 75th percentile.

Table 48

Summary of 2019, grade 6 scale scores at and above the 75th percentile

Percentile	Scale score
75th	1740
90th	1850
95th	1919

Of the 106,474 students scoring at or above the 75th percentile, 48.9% were female and 51.1% were male. Crosstabs revealed more female than male students scoring in the 75th-89th percentile score band than expected and fewer female than male students scoring at or above the 90th percentile than expected. The Chi-square test yielded a p value of .000, indicating such differences are significant. Table 49 shows the number of male and female students scoring within each of the score bands and the expected number of male and female students scoring within each of the score bands.

Table 49

Summary of 2019, grade 6 male and female students scoring within each score band

	Male			Female		
Score bands	Percent within score band	Actual number	Expected number	Percent within score band	Actual number	Expected number
75^{th}-89^{th} percentile	50.6%	32,349	32,680.4	49.4%	31,625	31,293.6
90^{th}-94^{th} percentile	51.8%	10,778	10,623.9	48.2%	10,019	10,173.1
95^{th}-100^{th} percentile	51.9%	11,264	11,086.7	48.1%	10,439	10,616.3

Grade 6 summary. The samples for the four years studied were each approximately 49% female and 51% male. All four years studied had a greater percentage of male students in the top quartile than female students. However, three of the four years saw a greater percentage of male students in the top quartile than in the overall sample, with one of the four years having the same percentage of male students in the top quartile as in the overall sample. The largest of these gaps was in 2018 with 48.2% female and 51.8% male. In 2019, the percentage of male and female students scoring in the top quartile was the same as the percentage of male and female students in the overall sample. The gap between the percentage of female and male students in the top quartile grew wider in 2016 with the 75th percentile-89th percentile score band consisting of 49.2% female students and 50.8% male students and the 95th percentile-100th percentile score band including 45.9% female students and 54.1% female students. In 2017 and 2019 the gap grew slightly in higher score bands and in 2018 the percentage of male and female students remained the same in higher score bands.

Three of the four analysis revealed more female students than expected scoring in the 75th percentile-89th percentile score band and more male students than expected scoring in the 90th percentile and higher than expected. In 2018, more male students scored in the 75th percentile-89th percentile score band than expected, while more female students than expected scored in the 90th percentile-94th percentile score band. Approximately the same number of male and female students scored at the 95th percentile and higher as expected. The Chi-square test yielded a p value indicating such differences are significant in three out of the four years studied. The resulting p value for 2018 indicated that the differences between male and female sores for that year are not significant.

Grade 3, 2016-grade 6, 2019 cohort

The cohort of students beginning grade 3 in 2016 was approximately 51% male and 49% female for all four years studied. In 2016 and 2017 there was a larger percentage of male students scoring in the top quartile than there were in the overall sample. However, when this cohort was in grade 5 in 2018, a larger portion of female students scored in the top quartile than in the overall sample. As sixth graders in 2019 the same percentage of male and female students scored in the top quartile as was present in the overall sample.

The largest gap between male and female students appearing in the top quartile occurred in Grade 3. This gap continued to widen in higher score bands. The difference between the percentage of male and female students appearing in the top quartile became smaller in grade 4 and the gap remained roughly the same throughout the score bands.

In grade 5, more female students scored in the top quartile than appeared in the overall sample. This female advantage continued into the 75th percentile-89th percentile score band as well as the 90th percentile-94th percentile score band. Male and female students appeared in the 95th percentile-100th percentile score band in proportions similar to the overall sample.

In grade 6, male and female students appeared in the top quartile in the same proportions as the overall sample. These portions remained the same in the 75th percentile-89th percentile score band. The gap between male and female students grew slightly in the 90th percentile-94th percentile score band and remained approximately the same in the 95th percentile-100th percentile score band.

The Chi square test revealed a p value indicating such differences are significant in three out of the four years between grade 3 in 2016 and grade 6 in 2019. Overall, the male favoring gender gap seen when this cohort of students was in third grade narrowed as students matriculated into higher grades. Table 50 offers a summary of the percentage of male and female students scoring in the top quartile for the 2016-2019 cohort.

Table 50

Summary of 2016-2019 male and female students scoring in the top quartile

	Grade 3, 2016		Grade 4, 2017		Grade 5, 2018		Grade 6, 2019	
	Male	Female	Male	Female	Male	Female	Male	Female
Total Sample	51.1%	48.9%	51.1%	48.9%	51.1%	48.9%	51.1%	48.9%
Top quartile	53.2%	46.1%	52.2%	47.8%	50.5%	49.5%	51.1%	48.9%
Percent within 75th-89th percentile	52.6%	47.4%	52.1%	47.9%	50%	50%	50.6%	49.4%
Percent within 90th-94th percentile	53.7%	46.3%	52.2%	47.8%	50.4%	49.6%	51.8%	48.2%
Percent within 95th-100th percentile	54.6%	45.4%	52.4%	47.6%	51.6%	48.4%	51.9%	48.1%
P value	.000		.735		.000		.000	

Summary

Each of the 16 data sets were approximately 49% female and 51% male. The top quartile of each of the 16 data sets contained more male students than female students. The largest of these gaps occurred in 2019 with the grade 4 sample. In this data set, 45.5% of the top quartile were female and 54.5% were male. Such a difference resulted on 10,012 fewer female students scoring in the top quartile than male students. However, in 2018, the grade 5 data set revealed a greater proportion of female students scoring in the top quartile than in the total sample. Additionally, the grade 6 2019 data set had the same proportion of female students scoring in the top quartile as in the overall sample. The other 14 data sets had a greater proportion of male students scoring in the top quartile than in the overall sample.

The gap between the percentage of male and female students scoring in the top quartile continued to grow wider in higher score bands for 14 out of the 16 data sets analyzed. In the grade 4 2017 and grade 6 2018 data sets, the gap remained roughly the same across all three score bands.

Fifteen out of the 16 data sets had more female students scoring in the 75th percentile-89th percentile score band than expected. Thirteen out of the 16 data sets studied had more male students scoring in the 90th percentile-94th percentile score band than expected. Fifteen out of the 16 data sets had more male students scoring in the 95th percentile-100th percentile score band than expected, with one data set having approximately the same number of male and female students score in this score band as expected. The Chi square test yielded p values indicating these differences are significant for 14 out of the 16 data sets.

Male students consistently scored in the top quartile in higher numbers than female students. Further, male students were represented in larger numbers than female students in the higher score bands. Yet, in considering the grade 3 2016 cohort, this gap appeared to narrow as students moved into higher grades.

CHAPTER V

Conclusion

Introduction

The purpose of this ex post facto study was to determine if gender differences in the top quartile of mathematics performance exist in Texas as measured by STAAR. Chapter V opens with a summary of the study, followed by conclusions and implications of the findings. Recommendations for future research are also presented.

Summary of the study

Although men and women participate in similar numbers is the U.S. workforce (U.S. Bureau of Labor Statistics, 2017), women are underrepresented in the STEM workforce (NSF, 2018). The underrepresentation by women in the STEM workforce creates a lack of diversity. “With a more diverse workforce, scientific and technological products, services, and solutions are likely to be better designed and more likely to represent all users” (Hill, Corbett & St. Rose, 2010, p. 3).

Postsecondary degrees and certifications are required for many STEM careers (Fayer et al., 2017). While men and women are earning equal numbers of the overall STEM Bachelor’s degrees awarded, men are earning degrees in the mathematically intensive areas of study in greater numbers (NSF, 2018). Ceci and Williams (2010) suggested that those who enter into the mathematically intensive fields are among the highest achieving mathematics students.

Studies indicated that male and female students are performing similarly in mathematics (Hyde et al., 2008; Hyde, Mertz & Schekman, 2009; Lindberg et al., 2010; Scafidi & Bui, 2010). However, such studies examined the average scores of males as compared to the average scores of females. Although several studies indicated that the gap at the mean level of performance has closed, other studies indicate a male favoring gap at the highest levels of mathematics performance (Cimpian et al., 2016; Hyde et al., 2009; Machin & Pekkarinen, 2008; Pope & Sydnor, 2010). Such studies have considered the number of students achieving at or above a target percentile and determined the percentage of male and female students making up the group of students at or above a certain percentile.

The purpose of this study was to determine if gender differences in mathematics performance in Texas exist in the top quartile. With this purpose in mind, this study sought to answer questions regarding gender differences in the top quartile in grades 3-6 during the years 2016-2019 as measured by the State of Texas Assessments of Academic Readiness (STAAR).

This ex post facto quantitative study utilized existing student assessment data. Through a public information request submitted to the Texas Education Agency, students' gender and score on the mathematics STAAR was obtained. Sixteen data sets were analyzed; one for each of the four grades and four years. SPSS was used to consider the entire sample within each data set, both male and female students combined.

Descriptive statistics for each data set was utilized to identify the percentage of male and female students achieving at the 75^{th} percentile and higher. The number of students achieving at or above the 75^{th} percentile was considered as a whole group, with the percentages presented representing the male and female students that combined are the number of students achieving in the top quartile. The Chi-square test was employed to determine if any differences in the percentage of male and female students scoring at or above the 75^{th} percentile was significant.

The four data sets analyzed for grade 3 all had a greater percentage of male students than female students scoring in the top quartile. This gap between the percentage of male students and the percentage of female students became wider in higher percentiles for all four years studied in grade 3. Further, the p value generated by the Chi-square was .000 for all four data sets, indicating these differences are significant for the four grade 3 data sets.

All four of the grade 4 data sets had a greater percentage of male students in the top quartile than female students. The gap between the percentage of male and female students scoring in the top quartile to remain roughly the same throughout the top quartile in one of the four years analyzed. In three of the four years studied, the gap between the percentage of male and female students scoring in the top quartile grew wider in higher percentiles. Further, the p value generated by the Chi-square indicated these differences are significant three of the four grade 4 data sets.

The four data sets for grade 5 all had a greater percentage of male students than female students scoring in the top quartile. However, one year had a larger percentage of female students scoring in the top quartile than appeared in the total sample. The gap between the percentage of male and female students scoring in the top quartile grew wider in higher percentiles for all four years analyzed. Additionally, the Chi-square yielded a p value indicating such differences are significant for all four years.

All four grade 6 data sets had a greater percentage of male students scoring in the top quartile than female students. However, one of the data sets saw the same percentage of male students scoring in the top quartile as the overall sample. The gap between the percentage of male and female students scoring in the top quartile grew wider in higher percentiles for three of the four years studied, with one year seeing the gap remain the same throughout the top quartile. The Chi-square yielded a p value indicating such difference are significant in three of the four years analyzed.

The cohort of students assessed in grade 3 in 2016 had a larger percentage of male students than female students scoring in the top quartile for grade 3 in 2016, grade 4 in 2017, grade 5 in 2018 and grade 6 in 2019. This cohort saw a greater percentage of male students scoring in the top quartile than in the total sample for grade 3 in 2016 and grade 4 in 2017. However, when this cohort was in grade 5 in 2018 a larger percentage of female students scored in the top quartile than in the overall sample. When this cohort was in grade 6 in 2019, the percentage of male and female students scoring in the top quartile was the same as the overall sample.

In summary, all 16 data sets had more male students than female students scoring in the top quartile. However, 14 of the 16 data sets had a greater proportion of male students scoring in the top quartile than appeared in the total sample. The gap between the percentage of male and female students grew wider in higher percentiles for 14 of the data sets analyzed. The Chi-square test yielded a p value indicating such differences in performance are significant for 14 of the 16 data sets. The gap between the percentage of male and female students scoring in the top quartile narrowed as students matriculated into higher grades for the cohort assessed in grade 3 in 2016, grade 4 in 2017, grade 5 in 2018, and grade 6 in 2019.

Conclusions

Consistent with studies analyzing a national sample (Cimpian et al., 2016; Pope & Sydnor, 2010; Penner & Paret, 2008), this Texas specific study found a male advantage in the top quartile of mathematics performance. Cimpian et al.'s (2016) study analyzed the performance of students in Kindergarten- second grade, finding that 20% of the students scoring at or above the 99th percentile in grade 2 were female. Robinson and Lubienski's (2011) study also included determining the percentage of female students at or above the 99th percentile, finding 25% of the students scoring at or above the 99th percentile at the end of third grade were female. By contrast, this study included finding the percentage of male and female students scoring at or above the 95th percentile. Such analysis revealed that female students made up 42.7%-46.4% of the students scoring at or above the 95th percentile in third grade. Such a difference between a study utilizing a national sample and this study utilizing a Texas sample suggests a narrower gender gap in mathematics performance in Texas than at the national level.

Pope and Sydnor's (2010) study of NAEP data found that the ratio of male students to female students in the top quartile of grade 8 mathematics achievement to be

1.17. Further, Pope and Sydnor (2010) found this ratio to be 1.4 for students scoring at and above the 95th percentile. This Texas specific study also examined student achievement at and above the 75th percentile, as well as at and above the 95th percentile. However, the highest grade analyzed here was grade 6. In grade 6 the percentage of male students scoring in the top quartile was 51.1%-51.8% and the percentage of male students scoring at and above the 95th percentile was 51.9%-54.1%. By comparison, the ratio of male students to female students scoring in the top quartile in sixth grade was 1.04-1.08. At and above the 95th percentile, this ratio was 1.08-1.18 in grade 6. The difference in the gender gap between a study employing a national sample and this study of a Texas specific sample suggests the mathematics achievement gender gap in Texas may be smaller than the gender gap at the national level.

Further, the gap between the percentage of male and female students in the top quartile grew wider in higher percentiles. This gap was consistently wider in the 95th percentile-100th percentile score band than in the 75th percentile-89th percentile score band. However, the widening gap in higher percentiles was more prominent in younger grades. This narrowing of the gender gap as high achieving mathematics students matriculate into older grades was also seen in Robinson and Lubienski's (2011) analysis of ECLS-K data. However, other studies examining the gender gap in high achieving mathematics students indicate a widening of this gap as students mature (Cimpian et al., 2016; Penner & Paret, 2008; McGraw et al., 2006).

Implications

This quantitative study revealed a male favoring gender gap at high levels of mathematics achievement in Texas students as measured by STAAR. Such a result has implications for the daily practice of Texas educators, law and policy makers, as well as others who play a role in the development of the next generation such as families, scout leaders, and youth group leaders. While this study did not investigate possible strategies for closing the gender gap in mathematics achievement, we can rely on the findings of other studies to provide insight.

Studies have suggested that male students perform better on multiple choice assessment items while female students respond better to assessment items requiring a written response (Lindberg et al., 2010; Reardon, Kalogrides, Fahle, Podolsky & Zárate, 2018). Currently, the STAAR mathematics assessment is largely multiple choice items (TEA, n.d.-j). A change to the make-up of the mathematics STAAR exam would include law and policy makers. Teachers of mathematics could examine their classroom assessments in an effort to ensure a balance of multiple choice and written response items in response to this study's findings.

A strong mathematics curriculum along with opportunities for hands-on experiences have been suggested as strategies for protecting against the effect of stereotype threat (UNESCO, 2017). Therefore, effective instructional practices such as ". . . activities that promote problem solving coupled with critical thinking opportunities" (Schmidt, 2016, p. 73) are suggested as a means to improve outcomes for female students.

Recommendations for future research

This ex post facto study focused on gender differences in mathematics achievement in Texas. Future research could also investigate the underrepresentation by race and ethnicity in STEM careers and fields of study. For instance, African Americans and Hispanics are currently underrepresented in STEM careers (NSF, 2018). Further investigations into the lack of diversity in STEM fields could bring understanding to the topic and aid in creating a more diverse STEM workforce.

Further investigations into the mathematics performance of Texas students is also needed. This quantitative study focused on gender differences at high levels of mathematics achievement in grades 3-6. Additional studies could add to our knowledge of this topic by analyzing students' mathematics achievement in early childhood, as well as middle and high school. This study suggests a narrowing of the gender gap as students age from grade 3 to grade 6. Future research could determine if such a gap is wider before third grade and if the gap continues to narrow after sixth grade.

Additional analysis of gender differences among high achieving mathematics students could utilize a comparison of male to female scores at particular percentiles. While this study considered the entire data set for a particular grade and year to determine the score at the 75^{th} percentile, 90^{th} percentile, and 95^{th} percentile, a future investigation could consider male scores to determine the score at particular percentiles and female scores to determine the scores at particular percentiles. Then a comparison of the male to female scores at the target percentiles could be conducted.

A future study of gender differences at high levels of mathematics performance in Texas could utilize a different data source. This study analyzed male and female achievement in mathematics as measured by STAAR. Future studies on the topic could look to NAEP. Using NAEP as a data source for student performance would include a sampling of students attending private schools (NCES, 2019c). Thereby, investigating an area eliminated from this study.

Further, qualitative studies could shed some light on the perspectives of male and female high achieving mathematics students. Through interviews, a future study could add to our understanding of the experiences of high achieving mathematics students, potentially identifying affective factors that contribute to such achievement.

Educators may unknowingly contribute to the gendered socialization of boys and girls (Reinking & Martin, 2018). Qualitative or mixed methods studies could delve deeper into the perspectives and behaviors of teachers and other school staff. Such a study may shed light on potential causes of the gender gap in mathematics achievement, as well as possible solutions.

Additional Texas specific studies could add to the literature regarding the influence of family, school, and community characteristics on male and female students' mathematics performance. Studies finding that parents' level of education (Penner & Paret, 2008; Fryer & Levitt, 2010), socioeconomic status (Fryer & Levitt, 2010; Reardon et al., 2019), attending a high performing school (Reardon et al., 2019), and type of community, such as urban versus rural (Fryer & Levitt, 2010) are associated with larger gender gaps in mathematics performance have utilized national samples. A study investigating the influence of such factors in Texas would fill a gap in the current literature.

Concluding remarks

Studies have analyzed the average male and female mathematics achievement in a national sample, suggesting that the male favoring mathematics achievement gap has closed (Hyde et al., 2009; Pope & Sydnor, 2010; Scafidi & Bui, 2010). Yet, other studies have identified a male favoring mathematics achievement gap exists in a national sample at the right tail of the distribution (Cimpian et al., 2016; Pope & Sydnor, 2010). In Texas, the site of this study, Anderson's (2016) study considered the average scores for male and female students in a Texas specific sample. The findings of Anderson's (2016) study indicated a slight female advantage in five of the eight data sets examined. This study sought to fill a gap in the literature by determining if gender differences in mathematics performance at the top quartile exist in Texas as measured by STAAR.

Finding that Texas is experiencing a gap between the mathematics achievement of high performing male and female students can serve as a springboard to a more equitable future. Texas now has evidence that such a gap exists. Further research into the extent of the gap, as well as possible causes and solutions are the next step in closing the gap. The lone star state is home to many STEM employers including industries such as medicine, aerospace, technology, petroleum, and chemical (Communities Foundation of Texas, 2018). Closing this achievement gap has the potential to offer a more diverse workforce contributing to the Texas economy.

REFERENCES

Alkhadrawi, A. A. (2015). *Gender differences in math and science choices and preferences.* ProQuest Dissertations Publishing.

Amelink, C. (2009). *Literature overview: Gender differences in science achievement,* SWE-AWE CASEE Overviews. University Park, PA: Assessing Women and Men in Engineering Project.

Anderson, L. (2007). *Congress and the classroom: From the Cold War to "No Child Left Behind"*. University Park, Pa.: Pennsylvania State University Press.

Anderson, P. B. (2016). *Differences in mathematics and science performance by economic status, gender, and ethnicity/race: A multiyear Texas statewide study* (Doctoral dissertation). Retrieved from https://shsu-ir.tdl.org/handle/20.500.11875/51

Avolio, B. E., Vilchez, C., & Chávez, J. (2019, April). *Underrepresentation of women in science: A literature review*. Paper presented at the annual conference of the Business Association for Latin American Studies, Lima, Perú

Bachman, K. R. O., Nebl, M. R., Martinez, L. R., & Rittmayer, A. D. (2009) *Literature overview: Girls' experiences in the classroom*, SWE-AWE CASEE Overviews. University Park, PA: Assessing Women and Men in Engineering Project.

Casad, B. J., Hale, P., & Wachs, F. L. (2017). Stereotype threat among girls: Differences by gender identity and math education context. *Psychology of Women Quarterly, 41*(4), 513-529. doi:10.1177/0361684317711412

Ceci, S. J., & Williams, W. M. 1. (2010). *The mathematics of sex: How biology and society conspire to limit talented women and girls*. Oxford; New York: Oxford University Press.

Cheema, J. R., & Galluzzo, G. (2013). Analyzing the gender gap in math achievement: Evidence from a large-scale US sample. *Research in Education, 90*(1), 98-112. doi:10.7227/RIE.90.1.7

Cheryan, S., Master, A., & Meltzoff, A. N. (2015). Cultural stereotypes as gatekeepers: Increasing girls' interest in computer science and engineering by diversifying stereotypes. *Frontiers in Psychology, 6*, . doi:10.3389/fpsyg.2015.00049

Cimpian, J. R., Lubienski, S. T., Timmer, J. D., Makowski, M. B., & Miller, E. K., (2016). Have gender gaps in math closed? Achievement, teacher perceptions, and learning behaviors across two ECLS-K cohorts. *AERA Open, 2*(4), 1-19. doi: 10.1177/2332858416673617

College Board. (2015). SAT percentile ranks for males, females, and total group. Retrieved from https://secure-media.collegeboard.org/digitalServices/pdf/sat/sat-percentile-ranks-mathematics-2015.pdf

Communities Foundation of Texas. (2018). Texas science, technology, engineering and mathematics (T-STEM). Retrieved from https://www.edtx.org/our-impact-areas/college-career-readiness/college-and-career-readiness-models/texas-stem

Cunningham, B., Hoyer, K. M., & Sparks, D. (2015). *Gender differences in science, technology, engineering, and mathematics (STEM) interest, credits earned, and NAEP performance in the 12th grade.* Retrieved from National Center for Educational Statistics. Website: https://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2015075

Curran, F. C., & Kellogg, A. T. (2016). Understanding science achievement gaps by race/ethnicity and gender in kindergarten and first grade. *Educational Researcher, 45*(5), 273-282. doi:10.3102/0013189X16656611

Dasgupta, N., & Stout, J. G. (2014). Girls and women in science, technology, engineering, and mathematics: STEMing the tide and broadening participation in STEM careers. *Policy Insights from the Behavioral and Brain Sciences, 1*(1), 21–29. https://doi.org/10.1177/2372732214549471

Dewey, J. (1916).*Democracy and education: An introduction to the philosophy of education*. New York: Macmillan.

DiPrete, T., & Buchmann, C. (2013). The r*ise of women: The growing gender gap in education and what it means for American schools*. Russell Sage Foundation. Retrieved from www.jstor.org/stable/10.7758/9781610448000

Dweck, C. S. (2006). *Mindset: The new psychology of success*. New York: Random House.

Eccles, J. S., & Wang, M. (2016). What motivates females and males to pursue careers in mathematics and science? *International Journal of Behavioral Development, 40*(2), 100-106. doi:10.1177/0165025415616201

Educational Amendments of 1972, Pub. L. No. 92-318, 86 Stat. (1972).

Elementary and Secondary Education Act of 1965 (ESEA), Pub. L. No. 89-10, 79 Stat. (1965).

Ellison, G., & Swanson, A. (2010). The gender gap in secondary school mathematics at high achievement levels: Evidence from the American mathematics competitions. *The Journal of Economic Perspectives*, *24*(2), 109-128. doi:10.1257/jep.24.2.109

Ellison, G. & Swanson, A. (2018). *Dynamics of the gender gap in high school math achievement.* The National Bureau of Economic Research.

Else-Quest, N. M., Hyde, J. S., & Linn, M. C. (2010). Cross-national patterns of gender differences in mathematics: A Meta-Analysis. *Psychological Bulletin*, *136*(1), 103-127. doi:10.1037/a0018053

Else-Quest, N. M., Mineo, C. C., & Higgins, A. (2013). Math and science attitudes and achievement at the intersection of gender and ethnicity. *Psychology of Women Quarterly*, *37*(3), 293-309. doi:10.1177/0361684313480694

Espinoza, P., Arêas da Luz Fontes, A. B., & Arms-Chavez, C. J. (2014). Attributional gender bias: Teachers' ability and effort explanations for students' math performance. *Social Psychology of Education*, *17*(1), 105-126. doi:10.1007/s11218-013-9226-6

Fayer, S., Lacey, A. & Watson, A. (2017). *STEM occupations: Past, present, and future*. Retrieved from U.S. Bureau of Labor Statistics. Website: https://www.bls.gov/spotlight/2017/science-technology-engineering-and-mathematics-stem-occupations-past-present-and-future/home.htm

Fritz, J. H. (2010). Socialization. In R. L. Jackson (Ed.), *Encyclopedia of identity*. Thousand Oaks, CA: Sage Publications. Retrieved from http://steenproxy.sfasu.edu:2048/login?url=https://search.credoreference.com/content/entry/sageidentity/socialization/0?institutionId=4986

Fryer R. & Levitt S. (2010). An empirical analysis of the gender gap in mathematics. *American Economic Journal: Applied Economics. 2* (2).

Geher, G., & Hall, S. (2014). *Straightforward Statistics : Understanding the Tools of Research*. Oxford University Press.

Gendered Innovations (n.d.). Inclusive crash test dummies: *Rethinking standards and reference models*. Retrieved from: http://genderedinnovations.stanford.edu/case-studies/crash.html#tabs-1

Greasley, P. (2008). *Quantitative data analysis using SPSS : An Introduction for Health & Social Science*. McGraw-Hill Education.

Green, S. B. & Salkind, N. J. (2017). *Using SPSS for Windows and Macintosh: Analyzing and understanding the data* (8th ed.). NY: Pearson.

Guiso, L., Monte, F., Sapienza, P., & Zingales, L. (2008). Diversity. Culture, gender, and math. *Science (New York, N.Y.), 320*(5880), 1164-1165. doi:10.1126/science.1154094

Gunderson, E. A., Ramirez, G., Levine, S. C., & Beilock, S. L. (2012). The role of parents and teachers in the development of gender-related math attitudes. *Sex Roles, 66*(3), 153-166. doi:10.1007/s11199-011-9996-2

Haciomeroglu, E. S., Chicken, E., & Dixon, J. K. (2013). Relationships between gender, cognitive ability, preference, and calculus performance. *Mathematical Thinking and Learning, 15*(3), 175-189. doi:10.1080/10986065.2013.794255

Halpern, D. F. (2014). It's complicated-in fact, it's complex: Explaining the gender gap in academic achievement in science and mathematics. *Psychological science in the public interest: a journal of the American Psychological Society, 15*(3), 72.

Halpern, D. F., Benbow, C. P., Geary, D. C., Gur, R. C., Hyde, J. S., & Gernsbacher, M. A. (2007). The science of sex differences in science and mathematics. *Psychological Science in the Public Interest, 8*(1), 1-51. doi:10.1111/j.1529-1006.2007.00032.x

Hendricks, J. (2012). *The effect of gender and implicit theories of math ability on math interest and achievement* (Masters Theses & Specialist Projects) Retrieved from: https://digitalcommons.wku.edu/cgi/viewcontent.cgi?article=2150&context=theses

Hill, C. & Corbett, C. (2015). *Solving the equation: The variables for women's success in engineering and computing, executive summary*. Retrieved from American Association of University Women. Website: https://www.aauw.org/aauw_check/pdf_download/show_pdf.php?file=solving-the-equation-summary-english

Hill, C., Corbett, C., & St. Rose, A. (2010). *Why so few? Women in science, technology, engineering, and mathematics.* Retrieved from American Association of

University Women. Website: https://www.aauw.org/files/2013/02/Why-So-Few-Women-in-Science-Technology-Engineering-and-Mathematics.pdf

Hyde, J. S., Lindberg, S. M., Linn, M. C., Ellis, A. B., & Williams, C. C. (2008). Diversity. Gender similarities characterize math performance. *Science (New York, N.Y.), 321*(5888), 494.

Hyde, J. S., Mertz, J. E., & Schekman, R. (2009). Gender, culture, and mathematics performance. *Proceedings of the National Academy of Sciences of the United States of America*, 106(22), 8801-8807. doi:10.1073/pnas.0901265106

IBM. (n.d.). *IBM SPSS statistics 26 documentation*. Retrieved form: https://www.ibm.com/support/knowledgecenter/SSLVMB_26.0.0/statistics_mainhelp_ddita/spss/base/core_container.html

Illinois State University. (n.d.). *SPSS basic skills tutorials*. Retrieved form: http://my.ilstu.edu/~mshesso/SPSS/tutorial.html

Kent State University Libraries. (2020). *SPSS tutorials.* Retrieved from: https://libguides.library.kent.edu/SPSS/home

Leaper, C. (2014). Parents’ socialization of gender in children. *Encyclopedia on early childhood development*. Retrieved from: http://www.child-encyclopedia.com/sites/default/files/textes-experts/en/2492/parents-socialization-of-gender-in-children.pdf

Legewie, J., & DiPrete, T. (2012). High school environments, STEM orientations, and the gender gap in science and engineering degrees. Retrieved from Social Science

Research Network. Website: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2008733

Legewie, J., & DiPrete, T. (2014). The high school environment and the gender gap in science and engineering. *Sociology of Education, 87*(4), 259-280. Retrieved from http://www.jstor.org.steenproxy.sfasu.edu:2048/stable/43186817

Lin, H. H. (2015). Gender differences in science performance. *Journal of studies in education. 5*(4), 181-190.

Lindberg, S. M., Hyde, J. S., Petersen, J. L., & Linn, M. C. (2010). New trends in gender and mathematics performance: A Meta-Analysis. *Psychological Bulletin, 136*(6), 1123-1135. doi:10.1037/a0021276

Liu, O. L., & Wilson, M. (2009). Gender differences in large-scale math assessments: PISA trend 2000 and 2003. *Applied Measurement in Education, 22*(2), 164-184. doi:10.1080/08957340902754635

Louis, R. A., & Mistele, J. M. (2012). The differences in scores and self-efficacy by student gender in mathematics and science. *International Journal of Science and Mathematics Education, 10*(5), 1163-1190. doi:10.1007/s10763-011-9325-9

Ma, X. (2008). Within-school gender gaps in reading, mathematics, and science literacy. *Comparative Education Review, 52*(3), 437-460. doi:10.1086/588762

Machin, S., & Pekkarinen, T. (2008). Global sex differences in test score variability. *Science, 322*(5906), 1331-1332. doi:10.1126/science.1162573

Maltese, A. V., & Cooper, C. S. (2017). STEM pathways: Do men and women differ in why they enter and exit? *AERA Open*. https://doi.org/10.1177/2332858417727276

Mann, A. & DiPrete, T. (2016). The consequences of the national math and science performance environment for gender differences in STEM aspirations. *Sociological Science 3:* 568-603.

Mann, A., Legewie, J., & DiPrete, T. A. (2015). The role of school performance in narrowing gender gaps in the formation of STEM aspirations: A cross-national study. *Frontiers in psychology, 6,* 171. doi:10.3389/fpsyg.2015.00171

Margolis, J., & Fisher, A. (2002). *Unlocking the clubhouse: Women in computing.* Cambridge: Massachusetts Institute of Technology.

McGraw, R., Lubienski, S. T., & Strutchens, M. E. (2006). A closer look at gender in NAEP mathematics achievement and affect data: Intersections with achievement, race/ethnicity, and socioeconomic status. *Journal for Research in Mathematics Education, 37*(2), 129-150.

Meinck, S., & Brese, F. (2019). Trends in gender gaps: Using 20 years of evidence from TIMSS. *Large-scale Assessments in Education, 7*(1), 1-23. doi:10.1186/s40536-019-0076-3

Microsoft (n.d.). *Closing the STEM gap: Why STEM classes and careers still lack girls and what we can do about it.* Retrieved from: https://query.prod.cms.rt.microsoft.com/cms/api/am/binary/RE1UMWz

Naizer, G., Hawthorne, M. J., & Henley, T. B. (2014). Narrowing the gender gap: Enduring changes in middle school students' attitude toward math, science and technology. *Journal of STEM Education: Innovations and Research, 15*(3), 29.

National Center for Educational Statistics. (2019a). *The nation's report card*. Retrieved from: https://nces.ed.gov/nationsreportcard/subject/publications/stt2019/pdf/2020013TX4.pdf

National Center for Educational Statistics. (2019b). *The nation's report card*. Retrieved from: https://nces.ed.gov/nationsreportcard/subject/publications/stt2019/pdf/2020013TX8.pdf

National Center for Educational Statistics. (2019c). *Representative samples*. Retrieved from: https://nces.ed.gov/nationsreportcard/assessment_process/selection.aspx

National Center for Educational Statistics. (2018). *Digest of educational statistics: 2018*. Retrieved from: https://nces.ed.gov/programs/digest/d18/

National Science Foundation (2018). *Science and engineering indicators 2018.* Retrieved from: https://nsf.gov/statistics/2018/nsb20181/

Neimand, A. (2016). Gender socialization. In C. L. Shehan (Ed.), *Wiley-Blackwell encyclopedias in social science: The Wiley Blackwell encyclopedia of family studies*. Hoboken, NJ: Wiley. Retrieved from http://steenproxy.sfasu.edu:2048/login?url=https://search.credoreference.com/content/entry/wileyfamily/gender_socialization/0?institutionId=4986

Nguyen, H. D., & Ryan, A. M. (2008). Does stereotype threat affect test performance of minorities and women? A meta-analysis of experimental evidence. *Journal of Applied Psychology*, *93*(6), 1314-1334. doi:10.1037/a0012702

Noonan, R. (2017). *Women in STEM: 2017 update*. Retrieved from U.S. Department of Commerce. Website: https://www.spglobal.com/_media/documents/women-in-stem-2017-update.pdf

Nosek, B., Smyth, A., Sriram, N., Lindner, N. M., Devos, T., Ayala, A., Bar-Anan, Y., Bergh, R., Cai, H., Gonsalkorale, K., Kesebir, S., Maliszewsk, N., Neto, F., Olli, E., Park, J., Schnabel, K., Shiomura, K., Tulbure, B., Wiers, R., Somogyi, M., Akrami, N., Ekehammar, B., Vianello, M., Banaj, M., Greenwald, A. G. (2009). National differences in gender–science stereotypes predict national sex differences in science and math achievement. *Proceedings of the National Academy of Sciences, 106*(26), 10593. doi:10.1073/pnas.0809921106

Organisation for Economic Co-operation and Development (2009). *Equally prepared for life? How 15-year-old boys and girls perform in school.* Retrieved from https://www.oecd.org/pisa/pisaproducts/42843625.pdf

Penner, A. M. (2008). Gender differences in extreme mathematical achievement: An international perspective on biological and social factors. *AJS; American journal of sociology, 114 Suppl*(S1), S138-S170. doi:10.1086/589252

Penner, A. M., & Paret, M. (2008). Gender differences in mathematics achievement: Exploring the early grades and the extremes. *Social Science Research, 37*(1), 239-253. doi:10.1016/j.ssresearch.2007.06.012

Perez-Felkner, L., Nix, S., & Thomas, K. (2017). Gendered pathways: How mathematics ability beliefs shape secondary and postsecondary course and degree field choices. *Frontiers in psychology, 8,* 386. doi:10.3389/fpsyg.2017.00386

Pope, D. G., & Sydnor, J. R. (2010). Geographic variation in the gender differences in test scores. *The Journal of Economic Perspectives*, *24*(2), 95-108. doi:10.1257/jep.24.2.95

Powers, A. (2017). The secret to future economic growth and prosperity? More women in STEM. *Forbes*. Retrieved from: https://www.forbes.com/sites/annapowers/2017/08/29/tapping-into-the-untapped-potential-to-drive-economic-growth/#35f12edc63a0

Quinn, D. M., & Cooc, N. (2015). Science achievement gaps by gender and race/ethnicity in elementary and middle school: Trends and Predictors. *Educational Researcher, 44*(6), 336-346. doi:10.3102/0013189X15598539

Rasmussen, K., & Salkind, N. J. (2008). *Encyclopedia of educational psychology*. Thousand Oaks, CA: SAGE Publications, Inc.

Reardon, S. F., Fahle, E. M., Kalogrides, D., Podolsky, A., & Zárate, R. C. (2019, April 25). Gender achievement gaps in U.S. school districts. *American Educational Research Journal*, 283121984382. doi:10.3102/0002831219843824

Reardon, S. F., Kalogrides, D., Fahle, E. M., Podolsky, A., & Zárate, R. C. (2018). The relationship between test item format and gender achievement gaps on math and ELA tests in fourth and eighth grades. *Educational Researcher*, *47*(5), 284–294. https://doi.org/10.3102/0013189X18762105

Reilly, D., Neumann, D. L., & Andrews, G. (2015). Sex differences in mathematics and science achievement: A meta-analysis of national assessment of educational progress assessments. *Journal of Educational Psychology, 107*(3), 645-662. doi:10.1037/edu0000012

Reinking, A., & Martin, B. (2018). The gender gap in STEM fields: Theories, movements, and ideas to engage girls in STEM. *Journal of New Approaches in Educational Research, 7*(2), 148-153. doi:10.7821/naer.2018.7.271

Riegle-Crumb, C., & Moore, C. (2014). The gender gap in high school physics: Considering the context of local communities. *Social Science Quarterly, 95*(1), 253-268. doi:10.1111/ssqu.12022

Riegle-Crumb, C., Morton, K., Nguyen, U., & Dasgupta, N. (2019). Inquiry-based instruction in science and mathematics in middle school classrooms: Examining its association with students’ attitudes by gender and race/ethnicity. *AERA Open*, *5*(3), 233285841986765. doi:10.1177/2332858419867653

Rinn, A. N., McQueen, K. S., Clark, G. L., & Rumsey, J. L. (2008). Gender differences in gifted adolescents' math/verbal self-concepts and math/verbal achievement: Implications for the STEM fields. *Journal for the Education of the Gifted*, *32*(1), 34-53. doi:10.4219/jeg-2008-818

Robinson, J. P., & Lubienski, S. T. (2011). The development of gender achievement gaps in mathematics and reading during elementary and middle school: Examining direct cognitive assessments and teacher ratings. *American Educational Research Journal, 48*(2), 268-302. doi:10.3102/0002831210372249

Rose, D. (2015). Regulating Opportunity: Title IX and the Birth of Gender-Conscious Higher Education Policy. *Journal of Policy History*, *27*(1), 157-183. doi:10.1017/S0898030614000396

Salkind, N. J. (2010). *Encyclopedia of research design*. Thousand Oaks, CA.: Sage.

Scafidi, T., & Bui, K. (2010). Gender similarities in math performance from middle school through high school. *Journal of Instructional Psychology, 37*(3), 252.

Schmidt, N. W. (2016). *Trends in K-12 science, technology, engineering, and mathematics (STEM) education and student achievement: A meta-analysis*. ProQuest Dissertations Publishing.

Skinner, R., & Library of Congress. Congressional Research Service. (2018). *Educational assessment and the Elementary and Secondary Education Act* ([Library of Congress public edition].). [Washington, D.C.]: Congressional Research Service.

Sparks-Wallace, O.J. (2007). *A study of gender differences in academic performance in a rural county in Tennessee* (Master's thesis). Retrieved from https://dc.etsu.edu/etd/2101/

Steegh, A.M., Höffler, T.N., Keller, M.M., & Parchmann, I. (2019). Gender differences in mathematics and science competitions: A systematic review. *Journal of Research in Science Teaching*, 1– 30. https://doi.org/10.1002/tea.21580

Steele, C. M. (1997). A threat in the air: How stereotypes shape intellectual identity and performance. *American Psychologist, 52*(6), 613-629. doi:10.1037/0003-066X.52.6.613

Steele, C. M., & Aronson, J. (1995). Stereotype Threat and the Intellectual Test Performance of African Americans. *Journal of Personality and Social Psychology*, *69*(5), 797-811. doi:10.1037/0022-3514.69.5.797

Stewart, C., Root, M. M., Koriakin, T., Choi, D., Luria, S. R., Bray, M. A., Sassu, K., Maykel, C., O'Rourke, P., & Courville, T. (2017). Biological gender differences in students' errors on mathematics achievement tests. *Journal of Psychoeducational Assessment, 35*(1-2), 47-56. doi:10.1177/0734282916669231

Stoet, G., & Geary, D. C. (2018). The gender-equality paradox in science, technology, engineering, and mathematics education. *Psychological science, 29*(4), 581-593. doi:10.1177/0956797617741719

Su, R., & Rounds, J. (2015). All STEM fields are not created equal: People and things interests explain gender disparities across STEM fields. *Frontiers in psychology, 6*, 189.

Su, R., Rounds, J., & Armstrong, P. I. (2009). Men and things, women and people: A meta-analysis of sex differences in interests. *Psychological Bulletin, 135*(6), 859-884. doi:10.1037/a0017364

Swaby, A., (2019, February 15). Texas' school finance system is unpopular and complex. Here's how it works. *The Texas Tribune*. Retrieved from: https://www.texastribune.org/2019/02/15/texas-school-funding-how-it-works/

Terry, R., Gammon, H., Mullen, E., Dearmon, W., & Alexander, L. (2016). *House bill 5: The new shape of Texas high school education* (Capstone Project). Retrieved from: https://bush.tamu.edu/psaa/capstones/TEGAC%20HB5%20Report_Final.pdf

Texas Classroom Teachers Association. (2018). *2018-2019 survival guide*. Retrieved from: https://tcta.org/node/13847-graduation_requirements

Texas Education Agency. (n.d.-a). *All about the STAAR test*. Retrieved from: https://texasassessment.com/families/all-about-the-staar-test/

Texas Education Agency. (n.d.-b). *Testing*. Retrieved from: https://tea.texas.gov/Student_Testing_and_Accountability/Testing

Texas Education Agency. (n.d.-c). *House Bill 5: Foundation high school program*. Retrieved from: https://tea.texas.gov/graduation-requirements/hb5.aspx

Texas Education Agency. (n.d.-d). *Texas essential knowledge and skills*. Retrieved from: https://tea.texas.gov/curriculum/teks/

Texas Education Agency. (n.d.-e). *Statewide foundation high school program (FHSP) enrollment reports*. Retrieved from: https://rptsvr1.tea.texas.gov/adhocrpt/Standard_Reports/FHSP_Enrollment_Reports/fhsp_enroll_statewide_state_report.html

Texas Education Agency. (n.d.-f). *STAAR Spanish resources*. Retrieved from: https://tea.texas.gov/student-assessment/testing/staar/staar-spanish-resources

Texas Education Agency. (n.d.-g). *STAAR Alternate 2 resources*. Retrieved from: https://tea.texas.gov/student-assessment/testing/staar-alternate/staar-alternate-2-resources

Texas Education Agency. (n.d.-h). *STAAR L resources archive.* Retrieved from: https://tea.texas.gov/student-assessment/testing/staar-l/staar-l-resources-archive

Texas Education Agency. (n.d.-i). *STAAR A resources archive*. Retrieved from: https://tea.texas.gov/student-assessment/testing/staar/staar-a-resources-archive

Texas Education Agency. (n.d.-j). *STAAR mathematics resources*. Retrieved from: https://tea.texas.gov/student-assessment/testing/staar/staar-mathematics-resources

Texas Education Agency. (2014a). *Graduation toolkit: Information for planning your high school years & beyond*. Retrieved from: https://tea.texas.gov/communications/grad_toolkit/booklet.pdf

Texas Education Agency. (2014b). *State and federally required assessments by grade and subject for the 2014-2015 school year*. Retrieved from: https://tea.texas.gov/sites/default/files/ReqAssess2014-2015.pdf

Texas Education Agency. (2017). *Technical digest 2017-2018*. Retrieved from: https://tea.texas.gov/student-testing-and-accountability/testing/student-assessment-overview/technical-digest-2017-2018

Texas Education Agency. (2018). *Texas assessment program frequently asked questions (FAQs).* Retrieved from: https://tea.texas.gov/sites/default/files/Texas%20Assessment%20Program%20FAQs%2004.04.18.pdf

Texas Education Agency. (2019a). State of Texas assessment of academic readiness: Test administrator manual. Retrieved from: https://txassessmentdocs.atlassian.net/wiki/spaces/ODCCM/pages/264896650/STAAR+3+5?preview=/264896650/395116558/2019-20_STAAR_TAM_3-5_tagged.pdf

Texas Education Agency. (2019b). *Texas academic performance report.* Retrieved from: https://rptsvr1.tea.texas.gov/cgi/sas/broker?_service=marykay&year4=2019&year2=19&_debug=0&single=N&batch=N&app=PUBLIC&title=2019+Texas+Academic+Performance+Reports&_program=perfrept.perfmast.sas&ptype=H&paper=N&level=state&search=campname&namenum=&prgopt=2019%2Ftapr%2Fpaper_tapr.sas

Texas Secretary of State. (n.d.). *Texas Administrative Code*. Retrieved from: https://texreg.sos.state.tx.us/public/readtac$ext.viewtac

Tsai, S., Smith, M., & Hauser, R. (2018) Gender gaps in student academic achievement and inequality. In H. Park & G. Kao (Eds.), *Research in the Sociology of Education* (pp. 181-218). Emerald Publishing.

Vilorio, D. (2014). *STEM 101: Intro to tomorrow's jobs*. Retrieved from U.S. Bureau of Labor Statistics. Website: https://www.bls.gov/careeroutlook/2014/spring/art01.pdf

United Nations Educational, Scientific and Cultural Organization (2017). *Cracking the code: Girls' and women's education in science, technology, engineering and* *mathematics (STEM).* Retrieved from: https://unesdoc.unesco.org/ark:/48223/pf0000253479

U.S. Bureau of Labor Statistics (2017). *Women in the labor force: A data book.* Retrieved from: https://www.bls.gov/opub/reports/womens-databook/2017/pdf/home.pdf

Wiswall, M., Stiefel, L., Schwartz, A. E., & Boccardo, J. (2014). Does attending a STEM high school improve student performance? Evidence from New York City. *Economics of Education Review, 40*, 93-105. doi:10.1016/j.econedurev.2014.01.005

Yavorsky, J. E., Buchmann, C., & Miles, A. (2015, May). *High school boys, gender, and academic achievement: Does masculinity negatively impact boys' grade point averages?*. Paper presented at the annual meeting of the Population Association of America, San Diego, California.

Yoon, S. Y., & Strobel, J., (2017). Trends in Texas high school student enrollment in mathematics, science, and CTE – STEM courses. *International Journal of STEM Educators, 4*(1). doi: 10.1186/s40594-017-0063-6

You, S. (2011). Peer influence and adolescents’ school engagement. *Procedia-Social and Behavioral Sciences, 29*, 829-835. doi:10.1016/j.sbspro.2011.11.311

APPENDIX A

STEPHEN F. AUSTIN
STATE UNIVERSITY
NACOGDOCHES, TEXAS

APPLICATION FOR EXEMPT RESEARCH

When finished, please email this form to irb@sfasu.edu and attach consent forms, recruitment, survey and/or other relevant materials (including translations).

SECTION 1. Researcher Information

1. Principal Investigator (PI) Contact Information: (***PI must be SFA faculty or staff***, *and will be the study supervisor at SFA). All correspondence will be directed to the PI and listed CoPIs.*)

Name	Department	Mail Box	Phone	Email
Pauline M. Sampson	ORGS/HSEL		936.468.2807	sampsonp@sfasu.edu

NOTE: Students, post-doctoral researchers, and visiting faculty may not serve as PI given that they are not able to comply with all the guidelines stipulated by University policy and Federal Guidelines.

2. Study Title: Gender differences at the highest levels of mathematics achievement: A Texas based study

3. Type of Study:

☐ Faculty Research ☐ Class Project ☐ Thesis ☒ Dissertation ☐ Capstone Project ☐ Other

4. Will this be cooperative research? List any collaborators and their institution.
No

5. List names of Co-investigators, Coordinators, and Key personnel involved in this research *(Include all persons who will be directly responsible for the study management, data collection, consent process, data analysis, transcription, participant recruitment, or follow up.)*

Name	E-mail	CITI –Completed (Yes/No) OPTIONAL	Role in the research (co-PI, Student Researcher, Research Assistant, Transcriber, etc.)
Susanna Campbell	Susannac35@gmail.com	Y N	Student Researcher/Doctoral Student
Paula Griffin	griffinp@sfasu.edu	Y N	Dissertation Committee Member
Brian Uriegas	uriegasb@sfasu.edu	Y N	Dissertation Committee Member

If additional lines are needed, add lines or submit on a separate page

SECTION 2. Specific Information

1. Estimated Study Start Date: April 27, 2020
   Note: Maximum approval time is one year from approval of the study date.

2. Is this research supported in whole or in part by a grant or contract?
   ☐ Yes ☒ No

   If yes, complete the questions below:
   Funding Agency(s), Foundation, or Business: ☐
   PI on Grant/Contract: ☐
   Grant Title/Contract: ☐

3. Does the research require another IRB's review (US and International)?
   ☐ Yes ☒ No

   If yes, complete below.
   Name of the IRB: ☐
   Number given by the other institution or agency: ☐
   Note: PI is responsible for securing approval and forwarding the documentation of approval to SFASU IRB.

4. Does the PI, Co-PI, or any other person responsible for the design, conduct, or reporting of this research have an economic interest in or act as an officer or director of any outside entity whose financial interest would reasonably appear to be affected by the results of the study?
   ☐ Yes ☒ No

   If yes, complete below:
   Name of the person with potential conflict of interest (COI):
   ☐
   Explain the potential financial conflict of interest:
   ☐
   Explain how the potential conflict of interest will be managed?
   ☐

5. Does the proposed research study requires approval from an outside (non-SFA) facility or entity (e.g., hospitals, clinics, schools, factories, offices, etc..)?
   ☐ Yes ☒ No

   If yes, Name (s) of the facility or entity: ☐
   Note: The researcher has an obligation to ensure that the outside entity is aware of the proposed research study and has no objections (i.e. agrees to participate). Please include an approval letter from site, if applicable.

Section 3. Study Questions

Provide below brief details of the proposed research. Use lay language and avoid technical terms.

1. What is the intent of the research study (hypothesis or research question of the study)? Please provide a brief background (or introduction) indicating why the study is important.
The purpose of this study is to determine if gender differences in mathematics performance in the top quartile of the State of Texas Assessments of Academic Readiness (STAAR) for grades 3-6 are present.

2. Participants: describe your target population/sample and methods of recruiting them. Also describe anything that would cause you to exclude a particular participant, and why:
The design of this study includes the use of archived data. Male and female students' mathematics achievement on the STAAR in grades 3-6 for the years 2016-2019 will be compared.

3. Procedures: describe your data collection methods, such as "Online Survey" or "Public observation," etc.
Upon IRB approval, a records request will be submitted to the Texas Education Agency (TEA). This request will include students' scale scores on the mathematics STAAR in grades 3-6 for the years 2016-2019 by gender. These scores will be used to identify the 75th percentile and higher level of performance. The Statistical Package for the Social Sciences (SPSS) will be used to make comparisons regarding any differences between the percentage of male and female students performing in the top quartile

4. Will you collect participant identities in conjunction with the data? If so, how will you prevent disclosures?
No; records request for archival data will include student gender, student scale score, student grade at time of assessment, assessment type, and year of assessment.

5. Will the participants be recorded (audio/video)? If so, how are you going to prevent a data breach?
No

6. Where and for how long will you store the data after you complete the research (data retention schedule)?
Records will be stored on a restricted computer and destroyed in April of 2026

7. Does your research pose risk of harm to participants (psychological, physical or legal) above and beyond minimal risk[1]?
If no please write: "minimal risk" in the space below;
If yes, please describe any foreseeable risks and your plan to reduce or eliminate them.
No

8. Will the participants be offered an incentive or be compensated for their time? If so, describe.
No

9. Can participants reasonably expect a direct benefit from participation? Describe any foreseeable benefit to the participants, but do not restate the incentive/compensation above (payments or compensation may not be considered a benefit). Research does not always directly benefit the participants.
No

10. How will society benefit from your research?
The literature regarding gender differences in mathematics achievement offers several studies utilizing national samples (Hyde, et al., 2008; Hyde, et al., 2009; Pope & Sydnor, 2010; Scafidi & Bui, 2010) and one study with a Texas sample (Anderson, 2016) in which gender differences at the 50th percentile are examined. The literature also offers several studies examining gender differences amongst the highest performing mathematics students utilizing national samples (Cimpian, et al., 2016; Pope & Sydnor, 2010). This research study proposes to fill a gap in the literature by providing a study in which gender differences in the top quartile of mathematics achievement in a Texas sample are examined.

[1] Minimal risk" means that the probability and magnitude of harm or discomfort anticipated in the research are not greater in and of themselves from those ordinarily encountered in daily life or during the performance of routine physical or psychological examination or tests. 45 CFR 46.102(i)

Section 4. Principal Investigator's Responsibilities and Assurances

Indicate that you have read and will comply with each statement.

1) I certify that the information provided in this application, and in all attachments, is complete and correct.

2) I understand that I have ultimate responsibility for the protection of the rights and welfare of human participants, the conduct of this study, and the ethical performance of this research.

3) I agree to comply with all SFASU policies and procedures, the terms of its Federal Wide Assurance, and all applicable federal, state, and local laws regarding the protection of human participants in research.

4) *I certify that I have followed departmental and college guidelines before sending this application.*

I certify that:

5) the study will be performed by qualified personnel according to the information contained in this application.

6) The equipment, facilities, and procedures to be used in this research meet recognized standards for safety.

7) Unanticipated problems, adverse events, and new information that may affect the risk–benefit assessment for this research will be reported to the SFASU Office of Research and Sponsored Programs (936-468-6606 or irb@sfasu.edu).

8) I am familiar with the latest edition of the *SFASU Policy for Human Research Subjects Protection*, available at http://www.sfasu.edu/researchcompliance/103.asp and I will adhere to the policies and procedures explained therein.

9) I further certify that the proposed research has not yet been done, is not currently underway, and will not begin until exemption has been certified.

PI Name or Signature*: ________________________________Date: ____
* Only required if not submitted from the PI's SFASU or Chair/Dean's email account

Stephen F. Austin State University
Office of Research and Sponsored Programs
Institutional Review Board (IRB)
PO Box 13019 | Human Services and Technology/ Communications Bld.
| Nacogdoches, TX | (936) 468-1153
Email: irb@sfasu.edu

APPENDIX B

STEPHEN F. AUSTIN STATE UNIVERSITY

Institutional Review Board for the Protection of Human Subjects in Research
P.O. Box 13019, SFA Station • Nacogdoches, Texas 75962-3046
Phone (936) 468-1153 • Fax (936) 468-1573

Principal Investigator: Pauline Sampson
ORGS/HSEL
x2807
sampsonp@sfasu.edu

Co-investigators: Susanna Campbell (Susannac35@gmail.com), Paula Griffin, Brian Uriegas

RE: Project Title "Gender differences at the highest levels of mathematics achievement: A Texas based study" Case # AY2020-1187

TYPE OF RESEARCH: Dissertation

FROM: Luis E. Aguerrevere, Chair, IRB-H

DATE: April 30, 2020

I would like to thank you for submitting your project entitled "Gender differences at the highest levels of mathematics achievement: A Texas based study" to the IRB for review. It has been reviewed and has been **Approved** based on the following criteria:

> *104(d)(1): Research involving normal educational practices that are not likely to adversely impact students' opportunity to learn required educational content or the assessment of educators who provide instruction such as: (1) Most research on regular and special education instructional strategies; or (2) Research on the effectiveness of or the comparison among instructional techniques, curricula, or classroom management.*

Your project has approval through **April 30, 2021** should you need additional time to complete the study you will need to apply for an extension prior to that date. The IRB should be notified of any planned changes in the procedures during the approval period, as additional review will be required by the IRB, prior to implementing any changes, except when changes are necessary to eliminate immediate hazards to the research participants. The researcher is also responsible for promptly notifying the IRB of any unanticipated or adverse events involving risk or harm to participants or others as a result of the research.

All future correspondence regarding this project should include the case number **AY2020-1187.**

APPENDIX C

Pending PIR ID: 14800

Title:
First Name: Susanna
Middle Initial:
Last Name: Campbell

Area Code: 713
Phone Number: 2986530
Extension:

Organization:

Email Address: susannac35@gmail.com
Fax Area Code:
Fax Number:
Address 1: 19187 Bailey Lane
Address 2:
Address 3:
City: Forney
State: TX
ZIP: 75126
ZIP extension:

ORR Description: Please provide the STAAR Mathematics scale score, gender, test type administered (i.e., STAAR, STAAR-Spanish), year administered, and student grade at time of assessment for each student for the following years and grades. This request is for STAAR and STAAR-Spanish and does not include STAAR Alternate 2.
Grade 3 Mathematics STAAR in 2016
Grade 3 Mathematics STAAR in 2017
Grade 3 Mathematics STAAR in 2018
Grade 3 Mathematics STAAR in 2019
Grade 4 Mathematics STAAR in 2016
Grade 4 Mathematics STAAR in 2017
Grade 4 Mathematics STAAR in 2018
Grade 4 Mathematics STAAR in 2019
Grade 5 Mathematics STAAR in 2016, first administration
Grade 5 Mathematics STAAR in 2017, first administration
Grade 5 Mathematics STAAR in 2018, first administration
Grade 5 Mathematics STAAR in 2019, first administration
Grade 6 Mathematics STAAR in 2016
Grade 6 Mathematics STAAR in 2017

Grade 6 Mathematics STAAR in 2018
Grade 6 Mathematics STAAR in 2019

Sending Attachments?: No

Consent to Withhold?:

Preferred Delivery Format: E-mail, CD (if too large to e-mail)

Submitted to Website on: 5/2/2020 12:44:00 PM

VITA

An educator for more than 20 years, Susanna Campbell earned a Bachelor of Science in Interdisciplinary Studies from Stephen F. Austin State University in 1996. She began teaching elementary school and returned to Stephen F. Austin State University in pursuit of a Master of Educational Leadership Degree which was conferred in 2004. She began supporting teachers' learning and growth through instructional coaching and professional development. In 2016, Susanna was accepted into the 20^{th} Doctoral Cohort at Stephen F. Austin State University, where she earned a Doctorate of Education in Educational Leadership in 2020. Currently, she is serving as the Director of Instructional Programs at Whitehouse Independent School District.

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Style manual designation:	*Publication Manual of the American Psychological Association, Sixth Edition*
Typist:	Susanna Campbell