A COMPARATIVE ANALYSIS OF THE TRANSITION FROM GRADE 8 MATHEMATICS TO GRADE 9 ALGEBRA FOR STUDENTS WITH AND WITHOUT SPECIFIC LEARNING DISABILITIES

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DEDICATION

Trust in the Lord with all your heart,

And lean not on your own understanding;

In all your ways acknowledge Him,

And He shall direct your paths (Proverbs 3:5-6; NKJV)

Your Grace and Mercy is surely sufficient for me, Amen!

This dissertation is dedicated in memory of Aunt Versie Belle ‘Candy’ Callahan and Papa Roosevelt Smith for your soft-spoken words-of-wisdom and encouragement. This accomplishment is evidence that through trusting God with your guidance, hard work, and dedication, all things are possible.

ACKNOWLEDGMENTS

The journey of working on my doctorate has allowed me to examine and to perceive life in a different way. This journey has helped me to grow professionally, personally, and scholastically. Without the support and encouragement of my family, friends, colleagues, and committee members, this educational accomplishment would not have occurred. I am a extending my heartfelt gratefulness to you all.

ABSTRACT

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A COMPARATIVE ANALYSIS OF THE TRANSITION FROM GRADE 8 MATHEMATICS TO GRADE 9 ALGEBRA FOR STUDENTS WITH AND WITHOUT SPECIFIC LEARNING DISABILITIES

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Because mathematics achievement in Grades 8 and 9 serves as a gateway into STEM programs, a quantitative causal-comparative research design was employed to examine the difference for the Grade 8 mathematics and Grade 9 Algebra I scores between students with specific learning disabilities (SLD) and nondisabled students. The Grade 8 mathematics STAAR scores and Grade 9 Algebra I STAAR end of course (EOC) scores were compared for differences between students with SLDs and nondisabled students. The difference in scores of students who transitioned from Grade 8 mathematics in 2012-2013 to Grade 9 Algebra I in 2013-2014 were compared between students with SLDs and nondisabled students. The sample was a random 10,000 matched pair cases of students who took the 2013 Grade 8 mathematics STAAR and the 2014 Grade 9 Algebra EOC. The diagnosis of SLD was dichotomous. For Grade 8 STAAR Mathematics, four null hypotheses were rejected. Students with SLDs had higher average scores on patterns, relationships, and algebraic relationships as well as on probability and statistics. Nondisabled students had higher average scores for numbers, operations, and quantitative reasoning as well as for geometry and spatial reasoning with trivial effect sizes. For the STAAR Algebra EOC exam, all five null hypotheses were rejected.

Students with SLDs had lower average scores than their non-disabled peers with moderate to large effect sizes. For the within group longitudinal analyses from 2013 Grade 8 to 2014 Grade 9, nondisabled students experienced losses in mathematics achievement in the Grade 8 to Grade 9 transition, but SLD students did not experience any loss in the transition. The results of this study suggest students with SLDs may be coping effectively with the high-stakes state exams. Successful mathematics and algebra instruction to students with SLDs may increase the participation of SLD students in STEM programs. Educational leaders should seek mathematics success increases among Grade 8 and 9 students with SLDs.

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CHAPTER I

INTRODUCTION

The United States' (U.S.) reaction to the workforce crisis, perceived threats to the U.S. national defense, and competition internationally has made science, technology, engineering, and math (STEM) education an issue of national importance. The interest in these fields has risen as evidenced through increased specialized trainings offered to adolescents in STEM fields and increased legislation and funding to support and expand STEM education in our public schools.

President George W. Bush (2009) signed into law the bipartisan America COMPETES Act (2007). This Act was intended to amplify basic research and education in STEM fields. The chair of the House Science and Technology Committee Representative, Bart Gordon of Tennessee said, "I am very concerned that the next generation of Americans can be the first generation to inherit a national standard of living less than their parents if we don't do something. This bill will help turn that corner" (as cited in Subotnik, Tai, Rickoff, & Almarode, 2010, p. 11). In addition to President George W. Bush's (2009) legislative campaign, President Obama's (2011) fiscal year budget for 2012 maintained a commitment to STEM education despite ongoing fiscal difficulties spurred by unprecedented education funding cuts (Berkeihiser & Ray, 2013).

This focus on increasing and improving STEM education has run counter to another issue in the public education system, which includes access by disabled students to the general school curriculum. Nationally, public school students participate in special education programs in the U.S. at a rate of 13%, according to national figures (National Center for Education Statistics [NCES], 2013). In Texas, almost 9% of students fall under special education programs, after efforts to mainstream these students through inclusion programs reduced the number of enrolled students (Texas Education Agency [TEA], 2012a, 2012b). Students in Grades 6 through 12 can participate in career and technical education (CTE) courses. Participation in CTE programs, or courses of study that include coherent sequences of CTE courses, for students in Grades 9 through 12 offers training and instruction designed to help students with and without disabilities gain employment in high-skill, high-wage jobs and potentially advance to postsecondary education.

However, students with specific learning disabilities (SLDs) suffer from a disadvantage in today's inclusion orientation to special education that create barriers to their participation in these classes. For example, students with SLDs take high-level mathematics courses, such as algebra and geometry, in regular education classrooms with their peers and receive little support for overcoming their SLDs. These higher-level math courses are usually gateways to CTE and other STEM related classes. Many students with SLDs need STEM courses to graduate from high school, to obtain the prerequisite skills for college level mathematics, and gain admission to postsecondary education, particularly in the STEM fields (Steele, 2010). Additionally, Texas students diagnosed with SLDs must pass both these rigorous STEM courses and related high-stakes assessments with little support for completing both without difficulty (Steele, 2010).

The Accountability Movement

The U.S. education reform movement has been one of accountability during the 21st century with the passage of the No Child Left Behind Act of 2001 (NCLB, 2002) that was signed into law by President George W. Bush in January of 2002 (as cited in Bush, 2009). One of its most controversial and powerful provisions required state assessments as measurements of accountability (NCLB, 2002). Accountability does not come without controversy. It is hard to argue that schools and teachers should not be accountable for student performance or that students should not be held to high standards of academic performance (Pearson, Vyas, Sensale, & Kim, 2001). Assessment can become a destructive force, and efforts should be made to improve consequences for teachers, administrators, students, parents, and schools (Pearson et al., 2001). The debate has been ongoing about the validity of these tools for accountability. Currently, high-stakes testing is viewed as working against student achievement, particularly for students with SLDs. According to Tanis (2014), these students' performances on the high-stakes testing has negatively affected educational stakeholders.

In accordance with the federal requirements of the Individuals with Disability Education Act of 2004 (IDEA; 2004), students with disabilities must participate in state accountability testing (high-stakes, statewide assessments), as part of the provisions made, to align with NCLB (2002). Under IDEA (2004), states are to establish equal goals for the performance of children with disabilities. This is also in accordance with each state's definitions of AYP used in general education. Children with disabilities must be included in all general state and district-wide assessment programs, including assessments under NCLB (2002) with appropriate accommodations and alternate assessments as necessary based on their respective individualized education plans (IEP). States must report to the federal government all assessment results for students with disabilities including the number of children with disabilities who participated in taking regular assessments, received accommodations, and participated in taking alternate assessments (Scott, 2012).

The common core state standards (CCSS) were developed to address the concerns associated with differences between states and specific accountability tests. For example, an examination of the mathematics course sequence for students transitioning from Grade 8 to Grade 9 yields 27 different names for algebra (Eddy et al., 2015). In addition, about 65% of the students taking the first year of algebra in Grade 8 found themselves reenrolled in the same first year algebra course for Grade 9 (Eddy et al., 2015). Eddy et al. (2015) concluded that despite the common name of algebra, a lack of understanding exists between teachers about the key ideas that constitute algebra.

The standards for learning in classroom instruction and the assessment of student knowledge are established by the Texas Essential Knowledge of Skills (TEKS). In 2010, the Texas Commissioner of Education initiated the revision process for the TEKS. The 2012 revised TEKS represents a total overhaul of the former curricula (Eddy et al., 2015), and require schools to use the Texas College and Career Readiness Standards (TxCCRS). The TxCCRS standards are designed to prepare students for employment success and for passing the state's new and more rigorous assessments (TEA, 2010).

The higher standards set forth by TxCCRS expect students to complete a rigorous course in algebra preferably during Grade 8 or 9. Unfortunately, equity in the rigor of algebra for students from diverse populations, including those with disabilities, has historically been lacking (TEA, 2010). The U.S. is a stronger competitor in the global economy when all of its citizenry has gained a strong algebra foundation and is prepared for postsecondary mathematics and careers (RAND Mathematics Study Panel, 2003). According to the National Council for Teachers of Mathematics (1989, 2016), this foundation in algebra starts in kindergarten and continues through the 12th grade. Therefore, equity in learning algebra remains necessary because students are expected to demonstrate their proficiency in algebra on high-stakes state assessments under NCLB (2002).

Approximately two decades ago, only high school students who planned to attend college would take algebra (Chazan, 2008; RAND Mathematics Study Panel, 2003). Now, the course Algebra I is typically the Grade 9 course in the mathematics high school sequence and provides the foundational knowledge needed for additional high school mathematics courses and for college mathematics readiness (Eddy et al., 2015). Enrolling in the Algebra I course impacts students' future opportunities because students who have not completed algebra and geometry by Grades 11 and 12 have limited their options for postsecondary education (College Board, 2000; Eddy et al., 2015). In fact, taking Algebra I in Grade 8 or 9 leads to increased college enrollment and achievement (Pelavin & Kane, 1990; Spielhagen, 2006). However, Algebra I is a gatekeeper course believed to strongly influence admission into many postsecondary schools and STEM careers.

The National Science Board (2010) released statistics from the U.S. Department of Labor, which predicted that by 2018, 9 of the 10 fastest growing careers would require mathematical, technological, or scientific training. STEM oriented businesses drive U.S. innovation and competitiveness by generating new companies, new industries, and fresh ideas. STEM careers have increased three times faster than non-STEM careers in the 21st century. However, the STEM workforce is aging and increasing in need for replacement professionals even as the number of STEM careers has been increasing across the Nation. President Obama (2011) remarked the following in his State of the Union address to Congress: “Maintaining international leadership in research and technology is crucial to America's success. However, to win in the future and produce innovation and jobs in America, the nation must educate all of its children” (para. 33). The nation is challenged to ensure that today’s school children evolve and grow with enough knowledge to be informed citizens able to participate in their local economies through viable employment. Public school programs need to reflect the needs of their communities and the businesses operating within those communities (Gomez & Albrecht, 2013).

Problem Statement

Student academic achievement in the U.S. is falling farther behind that of other developed nations in the areas of STEM (Peterson, Lastra-Anadon, Hanushek, & Woessmann, 2011) and has spurred efforts to increase participation and success in STEM classes and programs. Nevertheless, that participation and success should also be extended to students with disabilities, particularly those with SLD. Because mathematics achievement in Grades 8 and 9 serves as a gateway into those programs, a need to determine whether a difference in the mathematics achievement of students with mild SLDs and general education students exists. Knowing this would help to assess the need for enacting programs that enable special education students to attain the same level of achievement as their general education peers.

Purpose of the Study

The purpose of this study of this study was to compare the mathematics performance of students with SLDs with that of students without SLDs. The Grade 8 mathematics STAAR scores and Grade 9 Algebra I STAAR end of course (EOC) scores were compared to examine whether there are differences between students with an SLD and students without SLD for the spring of 2013. The difference in scores of students who transitioned from Grade 8 mathematics in 2012-2013 to Grade 9 Algebra I in 2013-2014 were also compared between students with SLDs and students without SLDs. Because these math classes usually service as gateways into STEM classes, it is anticipated that this study will provide understanding about ways to increase the participation of students with SLD in STEM programs.

Research Questions

The research questions that were used to achieve the study's purpose are the following:

1. What are the Grade 8 mathematics STAAR score differences between students with Specific Learning Disabilities and students without for the spring of 2013?

2. What are the Grade 9 Algebra I STAAR EOC score differences between students with Specific Learning Disabilities and students without for the spring of 2014?
3. For students who transitioned from Grade 8 mathematics in 2012-2013 to Grade 9 Algebra I in 2013-2014, what are the STAAR Grade 8 mathematics and Grade 9 Algebra I EOC score transition differences between students with Specific Learning Disabilities and students without?

Significance of the Study

The findings rendered from the study should add to the body of knowledge about the academic performance of students with SLDs who must take the high-stakes state assessments to graduate to Grade 9 and to earn a high school diploma. The study also provided evidence for using performance indicators to inform educators about the inclusion of students receiving Special Education services in Texas' STEM (T-STEM). The results may increase the likelihood of generating an appropriate evidence-based professional response to increase the effectiveness of inclusion and the academic success of all students. Finally, the study will provide policy makers and educators to use evidence in establishing programs for T-STEM programs that ensure college readiness for all students.

Definitions

Academic Excellence Indicator System (AEIS). Provides information on the performance of students at a campus, in a district, within a region, or at the state level.

One of the many useful fields of data provided focuses on the progress of the prior year (Retrieved from www.edtx.org on February 13, 2015; TEA, 2010)

Adequate yearly progress (AYP). Based on the accountability provisions in NCLB (2002), Texas' public schools and districts are evaluated for AYP. Texas school districts and school campuses are required to meet federal AYP criteria on three measures: reading/language arts, mathematics, and one of the following: graduation rate for high schools and districts or attendance rate for elementary and middle/junior high schools (TEA, 2015a).

General education student. The program of instruction delivered to typically developing children based on state standards and evaluated by the annual state educational standards test (About Education, 2015).

Special student populations. A number of populations enrolled in Texas public schools including children needing English language acquisition, bilingual education, or English as a second language. Other programs focus on particular student needs including early childhood education, dyslexia, and Section 504 training, as well as gifted and talented education. Specialized programs are available to meet the needs of populations that include migrant students and children in foster care (TEA, 2015c).

Special education. The practice of educating students with exceptional needs in a way that addresses their individual differences and needs in accordance with federal regulations related to the Section 504 law governing special education (U.S. Department of Education, 2007).

State of Texas Assessments of Academic Readiness (STAAR). In the spring of 2012, the STAAR replaced the Texas Assessment of Knowledge and Skills (TAKS). The STAAR program includes annual assessments for (a) reading and mathematics in Grades 3 through 8, (b) writing at Grades 4 and 7, (c) science in Grades 5 and 8, and (d) social studies in Grade 8. The program of assessments is tied to the Texas Essential Knowledge and Skills (TEKS) curriculum standards (TEA, 2015d).

End-of-course (EOC) assessments. In the spring of 2012, the EOC assessments replaced the TAKS for the high school courses of English I, English II, Algebra I, Biology, and U.S. History (TEA, 2015d).

Texas Growth Indicator. The measure is an estimate of a student's academic growth in the STAAR and EOC, over 2 consecutive years and in 2 consecutive grades. This growth index is used in the state accountability system to calculate Gold Performance Acknowledgements for Comparable Improvement in Reading/English Language Arts (ELA) and Mathematics and to calculate the STAAR and EOC Program Indicator under the Alternative Education Accountability (AEA) procedures (TEA, 2015b).

Organization of the Study

This chapter presented the problem and purpose of the study. Chapter II includes a review of the literature about mathematics achievement and special education student achievement. The study methodology is discussed in Chapter III, including the research design, population, sampling procedures, instrumentation, reliability of the instrument, validity of the instrument, data collection procedures, independent and dependent variables, and statistical analysis. Chapter IV includes the results of the study. Through the context of each of the research questions, descriptive statistics and results of the quantitative analyses are discussed. Information is provided on data analysis, demographic profiles of participants, examination of the hypotheses, and the summary of hypotheses. Chapter V of the study includes a summary of data, findings, conclusions, discussion, and recommendations for future research studies.

CHAPTER II

LITERATURE REVIEW

Introduction

This literature review provides a background to the research problem described in Chapter I. First, the strategy to conduct the literature search to write the literature review is identified. Second, the theoretical framework of the study is discussed. The third section of the literature review includes with the notions of SLDs; inclusion, academic achievement; science, technology, engineering, and math (STEM) education; high-stakes assessments; and transition to high school. Finally, this study includes what previous research on this topic could be identified and what the findings were. The chapter ends with a summary and a conclusion of the literature review.

The following online databases and search engines were used to write the literature review: Google Scholar, Educational Resource Information Center (ERIC), JSTOR, Journal Storage, EBSCOHost Online Research Databases, and Journal Seek. The key search terms that were utilized included *STEM, mathematics, algebra, legislation, SLDs, state assessments, inclusion, discovery learning, inquiry approach,* and *transition*. Different combinations of the search terms were used to yield an optimal number of hits.

Most of the literature reviewed was published between 2012 and 2015 to ensure that the most recent peer reviewed articles, findings and reports were included. To encapsulate the different trends in STEM instruction, legislation, older articles that reported on the initial stages of the STEM pipeline, SLDs and legislation important for this research were included. Older, seminal articles were also consulted in the theoretical framework to include the initial stages of discovery learning and students with SLDs.

STEM Education

The creation of specialized science, technology, engineering, and math (STEM) schools over the past decades has largely been related to economic, political, and educational concerns. The recent America COMPETES Act (2007), for example, intends to strengthen public secondary educational opportunities in STEM by creating additional statewide specialized high schools (Breiner, Harkness, Johnson, & Koehler, 2012; Corlu, Capraro, & Capraro, 2014; Gonzalez & Kuenzi, 2012; Scott, 2012). The decline in the number of students—regular students and those with disabilities—completing undergraduate STEM courses caused alarm and created renewed interest in the promotion of STEM courses in America (Schneider, Broda, Judy, & Burkander, 2013; Scott, 2012).

Many initiatives were instituted by different states over the past thirty years to address this issue and included not only STEM schools, but also summer schools, field trip educational programs, competitions, internships, service-learning programs, and a mobile laboratory for chemistry education, to name a few initiatives (Long et al., 2013). The advantage of attending a STEM school is that there is increased focus on STEM and more time is available to pursue excellence in the projects and learning content (Scott, 2012). STEM schools are the main cultivating grounds for future graduates in STEM subjects (Navruz, Erdogan, Bicer, Capraro, & Capraro, 2014).

Since its early stages in 2006, STEM schools have been growing to 65 T-STEM academies in 2013 where about 35,000 students get STEM instruction (Navruz et al., 2014). Yet, still the U.S. student academic achievement is falling farther behind other developed nations' students in the areas of STEM (Ostler, 2012). Since The Nation at Risk report in 1983 (as cited in Ostler, 2012), the achievements of regular STEM students came under scrutiny (Bruce-Davis et al., 2014). Little has been studied, however, about the achievement of students with SLDs and their participation and success in STEM programs (Temple-Harvey & Vannest, 2012).

Future jobs that today's students prepare may not even exist now (Berkeihiser & Ray, 2013). The U.S., furthermore, aims to develop a STEM-literate society, as STEM competence is required also outside the STEM professions (Saunders, 2012). The Department of Commerce projected that STEM-related jobs will grow 1.7 times quicker than non-STEM jobs, thus emphasizing the need for STEM competence (National Science and Technologies Council, 2013). In the 5-year plan for STEM education, extensive plans and funding allocations were made for regular students and minority groups, including students with disabilities. However, in the lists of funding allocations students with disabilities were not mentioned (Marginson, Tytler, Freeman, & Roberts, 2013). This omission is also evident when studying research on the state of STEM at school level, it is for this reason that the current study aims to examine the achievements of students with SLDs compared to their nondisabled peers.

Each year, the U.S. is sluggishly falling farther-and-farther behind its international competitors. There are 10-plus federal agencies that promote the advancement of STEM activities. The U.S. Department of Education (2007), the National Science Foundation (National Science Board, 2010), and the National Institutes of Health are major contributors to the project. These organizations have a vital role in the future success or the lack thereof in STEM education. U.S. officials must invest and align their efforts in supporting funding initiatives that can fuel successful broad-based STEM programs (Perez, 2013). However, there seems to be a systematic problem in the U.S. with education in mathematics, and this ultimately has a snowball effect that negatively affects the other STEM areas (Perez, 2013).

The aim of STEM instruction is to integrate the different elements namely STEM; whereby, the students have to solve everyday problems similar to the environment where they will ultimately work (Ostler, 2012). In reality, this does not always happen in STEM education and teachers tend to focus on separate subjects (Lederman & Lederman, 2015; Ostler, 2102). Teachers wrongly assume that STEM means more emphasis on the different subjects and not integration thereof in an interdisciplinary fashion. The true STEM character of problem-solving and cooperative learning in small groups may therefore not be achieved in all the STEM courses (Lederman & Lederman, 2015).

The STEM initiative when implemented as it was intended to be is valuable to the 21st century youngster as it focuses on those skills needed for the new millennium. The rigorous development of analytic abilities and problem-solving skills together with the ability to apply theories and follow processes in a creative manner and numeracy skills, prepares the youth for new careers that are not even known at present (West, 2012).

According to West (2012) graduates who were interviewed about the value of STEM education, value the ability to think logically and critically; they remarked on the scientific knowledge and methods they gained, and lastly embraced the research-based learning with its experimentation and problem solving approach. The last word has not been said about the STEM pipeline; however, the basic premise of the STEM approach is sound and relevant for the new millennium.

Accountability and Assessment

Standards based assessments that are well constructed and properly used provide data necessary to assist policy-makers, administrators, teachers, students, and parents with improving teaching, curricula, and student achievement. In the state of Texas, a student must pass exit level mathematics, science, social studies, and English/language arts EOCs to graduate from high school. The state of Texas mandates high-stakes testing in reading, writing, mathematics, social studies, and science.

Using state rules, mandated by the TEA (2014b, 2015b) and published in the Texas Administrators Code (TAC), a student must pass the tests listed as a graduation requirement and the appropriate EOCs to receive a Texas high school diploma. In the Mathematics section of the EOC assessment, students must pass either Algebra I, geometry, or the combined mathematics series (TEA, 2014a, 2014b).

The purpose of NCLB (2002) is “to ensure that all children have a fair, equal, and significant opportunity to obtain a high quality education and reach, at minimum, proficiency on challenging State academic achievement standards and State academic assessments” (Section 1001[1]). Section 1001 of Title I was written to ensure this could be accomplished by “improving and strengthening accountability, teaching, and learning by using State assessment systems to ensure that students are meeting challenging State academic achievement and content standards and increasing achievement overall, but especially for the disadvantaged” (NCLB, 2002, Section 1001[6]).

With NCLB (2002), states must identify a set of academic standards for core subject areas at each grade level. State assessment systems must be set in place to monitor student progress toward meeting these standards as defined by the state. School districts must publish report cards that identify academic achievement of its students. These report cards contain data that were aggregated and disaggregated by ethnicity and other subgroups. States determine an adequate yearly progress (AYP) plan, aiming to ensure 100% of its students reach academic proficiency by 2014-2015. States must come up with a system of accountability that includes rewards and sanctions to schools, educators, and students which are tied to meeting the State goals outlined in an AYP plan (NCLB, 2002, Section 1111 [2B]).

Academic Achievement in Mathematics and Algebra

In England, the idea of making mathematics courses compulsory for students up to 18 years is receiving increasing support (Noyes & Adkins, 2016). Mathematics is increasingly more important in the 21st century with the rise computer-based activities for daily living and technological knowledge (Kaniz, 2015). Unfortunately, in the U.S. mathematical studies are not popular despite several initiatives to change the situation. A wide variety of problems—pedagogical, cultural, social, student attitudes, teacher competence, mathematics instruction—influence the decision to take mathematics courses as well as dropout rates (Kaniz, 2015). In modern times mathematics is recognized for playing a part in the development of reasoning and problem-solving (Kaniz, 2015).

There are negative attitudes about mathematics due to its complexity, and these attitudes discourage students from choosing mathematics courses at the high school level. Although students may have the potential to do better in mathematics, their perception of it being hard and the accompanying anxiety, attitude, and previous negative experiences dissuade them from taking mathematics (Holmes et al., 2015). Gender differences exist that may not necessarily be because of different aptitudes but rather a case of cultural perceptions (Holmes et al., 2015; Kaniz, 2015); the result is that fewer girls enroll in mathematics courses.

Recent results on the Texas assessments are as follows:

- For the 2012- 2013 Grade 8 STAAR mathematics assessment, 284,653 students took the assessment, and 77% met standard on this assessment (TEA, 2013b). The number of special education students who took the Grade 8 STAAR mathematics assessment was 15,205 where 48% met standard rate.
- For the 2012-2013 Grade 9 EOC for Algebra I, 364,613 students took the assessment and 78% passed (TEA, 2013b). The number of special education students who took the Algebra I EOC at the end of Grade 9 was 19,149 with a 43% pass rate.
- For the 2013-2014 Grade 8 STAAR mathematics assessment, 305,174 students took the assessment, and 79% met standard on this assessment (TEA,

2014b). The number of special education students who took the Grade 8 STAAR mathematics assessment was 15,617 and 52% met standard rate.

- For the 2013-2014 Grade 9 EOC for Algebra I, 388,672 students took the assessment and 81% passed (TEA, 2014b). The number of special education students who took the EOC algebra was 21,180 with a 46% pass rate (TEA, 2014b).

Several factors may influence mathematical achievement. Ethnicity (Ackerman & Tazi, 2015; Falk, 2012), socio-economic situation (Aud et al., 2013; Earle, Joshi, Geronimo, & Acevedo-García, 2014), English proficiency (Krogstad, 2014; U.S. Census Bureau, 2012; NCES, 2013), literacy level of parents and children (Baker, 2014; U.S. Census Bureau, 2012), cultural belief systems and child rearing practices (Durand & Perez, 2013; Han, Lee, & Waldfogel, 2012; McWayne, Melzi, Schick, Kennedy, & Mundt, 2013; Reardon, Valentino, & Shores, 2012) level of schooling of parents (NCES, 2014), disabilities (Bell, Tzou, Bricker, & Baines, 2012; Cortiella & Horowitz, 2014), and gender (Holmes et al., 2015) were the most researched.

In short, despite several attempts to make STEM courses and especially mathematics more attractive to high school students, they end up opting for other courses that are traditionally seen as less difficult that would allow them to build a healthier self-esteem (Dutro & Selland, 2012). Apart from cultural and gender bias personal interest play a role in choosing subjects. The American youth does not seem to be influenced by state endeavors to increase the interest in STEM related courses and seem to prefer choosing courses that they are interested in or think they could master on college level.

The Accountability Movement and Students with Disabilities

The U.S. education reform movement has been one of accountability during the 21st century with the passage of NCLB, signed into law by President George W. Bush in January of 2002. A controversial and powerful provision of NCLB is the required state assessments as measurements of accountability (Renaud, 2013). The opinion of many authors, however, is that high-stakes testing works against student achievement (Jennings & Bearak, 2014; Nichols, Glass, & Berliner, 2012; Renaud, 2013), and particularly for students with SLDs (Tanis, 2014). It is therefore necessary to assess the need for enacting programs that enable special education students to attain the same level of achievement as their general education peers.

According to Tanis (2014), students with SLDs' performance on the high-stakes testing has negatively affected educational stakeholders. In accordance with the federal requirements of the Individuals with Disabilities Education Act of 2004 (IDEA-2004), students with disabilities must participate in state accountability testing (high-stakes, statewide assessments), as part of the provisions made, to align with NCLB (2002). Children with disabilities must be included in all general state and district-wide assessment programs, including assessments under NCLB with appropriate accommodations and alternate assessments as necessary based on their respective IEP (Harrison, Bunford, Evans, & Owens, 2013; Renaud, 2013).

Algebra is typically the Grade 9 course in the mathematics high school sequence and provides the foundational knowledge needed for additional high school mathematics courses and for college mathematics readiness (Eddy et al., 2015). To improve their future opportunities, students enroll in algebra because without completed algebra and geometry courses by Grades 11 and 12, limited options for postsecondary education exist (Eddy et al., 2015).

Specific Learning Disabilities

These three issues (e.g., the growing focus on STEM education, the accountability and state-mandated assessment movement, and mathematics as foundational to the first two issues) have proven especially problematic to students with SLDs. SLDs have a pervasive effect on the achievement and self-perception of the students who suffer from it. Due to the nature of this disability, it reaches every sphere of the student's life and continues to do so post schooling. Many students with SLDs dropout of the school system and end up in jobs that do not pay well, placing a further burden on their families and the state. It is imperative to adjust the instructional situation such that this group of students can reach their potential so that they can live productive and fulfilled lives.

Cortiella and Horowitz (2014) quoted the revised definition of specific learning disorders in the 2013 edition of the DSM-5: "Persistent difficulties in reading, writing and arithmetic or mathematical reasoning skills. Symptoms may include inaccurate or slow and effortful reading, poor written expression that lacks clarity, difficulties remembering number facts or inaccurate mathematical reasoning" (p. 2).

The DSM-5 goes further to emphasize that the level of achievement should be significantly below that of appropriate test levels for reading, writing and mathematical skills. A move away from the medical diagnosis towards a more educational description of the challenges SLDs pose to the student has occurred. The above definition encircles the educational nature of the symptoms. In their report on SLDs, Cortiella and Horowitz (2014) stated that learning disabilities are both “real and persistent” (p. 2) and described it as “unexpected significant difficulties in the areas of learning and behavior” (p. 2). Although SLDs may coexist with deficits in attention, behavior and language (communication), the manner in which they influence children’s learning differs with the specific disabilities. Seeing that this study focuses on SLDs in mathematics, only the characteristics associated with dyscalculia will be addressed.

SLDs do not occur in pure forms and may co-occur with any of the other disabilities, presenting a unique set of special needs. In the case of SLDs in mathematics, the child presents with (a) poor number concept, counting, and manipulating numbers; (b) challenges with telling time, measuring or estimating; and (c) difficulties with mental mathematics and problem solving. Some difficulties that are generally found with students with SLDs include information processing disorders—weakness in receiving, processing, remembering, and retrieving information (Cortiella & Horowitz, 2014).

There is a drive towards inclusive education, which takes different forms of support to SLDs, many high school students have to attend classes with their nondisabled peers without any additional assistance. About 80% students with SLDs spend their school days with their nondisabled peers as opposed to 47% ten years ago (Cortiella & Horowitz, 2014). Tanis (2014) wrote passionately about being both a teacher and mother of students with disabilities and described the agony of high stakes testing even with accommodations granted due to the IEP report of children. There is a lack of studies regarding the achievements and progress of students with SLDs in STEM courses and the current study proposes to address some aspects thereof and thus adding to the knowledge of SLDs.

Students with Specific Learning Disabilities in Mathematics

Students with SLDs represent 42% of the learning-disabled children that translates into approximately 2.4 million children. Of the children diagnosed with SLDs, between 3% to 6% have mathematics related SLDs (Cortiella & Horowitz, 2014). The incidence of SLDs has declined with 18% between 2002 and 2011 and a steady rate of decline at 2% per annum. This decline is possibly due to better instructional techniques, early childhood intervention, and changes in the identification of learning disabilities (Cortiella & Horowitz, 2014).

Not all students who have disabilities require specialized instruction. The IDEA organizes the procedural obligations for learners with disabilities who require specialized teaching and support, and this includes an IEP that the teachers develop to suit the needs of the learner. The IDEA route is more complex than the Section 504 of the Rehabilitation Act and necessitates documentation of quantifiable growth. Learners with 504 Plans do not require specialized instruction; however, as in the case of an IEP, annual updates of the 504 Plan ensure that the learner receives accommodations to optimize the learning situation (Cortiella & Horowitz, 2014).

To complete the STAAR or EOC, students needing accommodations due to a disability include:

- Students with an identified disability who receive special education services and meet established eligibility criteria accommodations

- Students with an identified disability who receive Section 504 services and meet established eligibility criteria accommodations
- Students with a disabling condition who do not receive special education or Section 504 services but meet established eligibility criteria accommodations. (TEA, 2013a, para. 1)

Either the admission, review, and dismissal committee (ARD-C) or a Section 504 placement committee (504-C) determines whether students who receive special education or Section 504 services may use accommodations during statewide assessments (TEA, 2013a).

When studying the academic performance of students with SLDs, a bleak picture emerges. Two-thirds of children with SLDs are male, and Blacks and Hispanics are overrepresented compared to the other ethnic groups. In 2011, 12% to 26% SLD students scored average or above average on mathematics and reading state tests, and 7% to 23% scored below average (Cortiella & Horowitz, 2014). Thirty three percent of students with SLD were retained due to lower grades (Cortiella & Horowitz, 2014; Renaud, 2013). This group often presents with disciplinary problems and 33% are recipients of disciplinary action in the form of either expulsion or suspension. Although students with SLDs have the same post high school goals as their nondisabled peers, only 68% earn a regular high school diploma, 12% receive a certificate of completion, and 19% drop out of the system. Blacks and Hispanics have the highest dropout rate and lower graduation rates (Cortiella & Horowitz, 2014).

There is a large amount of research in reading versus mathematics disabilities, which resulted in inadequate understanding of dyscalculia (Price & Ansari, 2013). The low levels of basic numeracy triggered interest in mathematical difficulties (Mclean & Rusconi, 2014). The following is a list of cognitive factors that students, who have a specific learning disability in mathematics, encounter: poor arithmetic retrieval, immature problem-solving strategies, poor short term memory/working memory, insufficient speed of processing due to a lack of automaticity in numerical facts, inaccurate visual-spatial processing, and different levels of anxiety in mathematic performance. About 6% of students of all age groups have an actual SLD in mathematics (dyscalculia; Price & Ansari, 2013; Proctor, 2012).

Learning disabilities are neurobiological disorders that lead to difficulty to learn and remember, to understand, and use information. On the nonacademic side students with LDs exhibit inadequacies in establishing and maintaining social and peer relationships. Psychological problems include setting goals, organizing behavior, inhibition of responses, mental flexibility (e.g., may appear stubborn, attention, and emotional control), and monitoring own progress. These difficulties may co-occur in the same student so that disturbances in more than one process occur (Haydick, Wiener, Badali, Milligan, & Ducharme, 2012).

English language learners (ELL) students with disabilities are the lowest achievers (Liu et al., 2013). Statistics show that ELL is a fast growing group. According to Falk (2012), in 2011, the percentage of non-Hispanic, White births came to 49.6%, while the minority group had a birth rate of 52.4%. The changes in race demographics are also visible in schools where the non-Hispanic White population decreased with around 15% in 2011. Furthermore, the minority populations, especially Hispanics, grow faster (Falk, 2012).

The above two issues have implications for mathematics teaching as language is central to conveying information and currently the largest group of school students are made up of ELL students. Liu et al. (2013) advised that mathematics instruction use cultural attributes and syntax that are not optimally designed for ELL with disabilities. Falk (2012) contended that non-academic issues were important to academic achievement. These include the relationship between proficiency in mathematics and the association with the school. Students who felt proud of their school, performed better. Other factors are communication—access to teachers to discuss difficulties—and feeling safe at school contributed to higher marks in mathematics.

Moreover, the student's perceived self-efficiency in mathematics proved the highest indicator of achievement in mathematics. Teo (2014) provided a view of a gifted Hispanic female with a doctorate in mathematics and it mapped her struggle to fit in at every level of her academic career. Teo (2014) pointed out that students of Hispanic origin felt like border members and that they may eventually leave the STEM field due to the societal issues. Linking the findings of Falk (2012) and Teo (2014), renders a bleak picture of an ELL in the field of mathematics.

Taking this a step further, students with disabilities—and in the case of this study—SLDs are often marginalized due to the disability and their need to receive special attention in an integrated classroom or leave the class for remedial work (Tanis, 2014).

Street et al. (2012) stated that there were systematic barriers that compromise students with disabilities wanting to follow STEM careers. These include instructional barriers as well as language and cultural barriers in the case of ELL (Falk, 2012).

The nature of STEM and mathematics courses is increasingly abstract in the higher grades and this is hard for students with SLDs in mathematics (Israel, Maynard, & Williamson, 2013). The difficult vocabulary and complex descriptions that teachers use when dealing with mathematics further exacerbate the students with SLDs' situations and limit their integration in mathematics classes (Israel et al., 2013). Therefore, it seems that there is not enough support to SLDs in the area of STEM (Gottfried, Bozick, Rose & Moore, 2016). In short, students with disabilities often drop out of the school system and do not attain a post-secondary qualification (Zablocki & Krezmien, 2013). These students are frequently the recipients of disciplinary exclusion and grade retention (Renaud, 2013). Their marks are also lower than average (Cortiella & Horowitz, 2014; Zablocki & Krezmien, 2013).

Algebra Achievement of Students with Specific Learning Disabilities

There is increased interest in Algebra I due to its role as a curricular gatekeeper (Eddy et al., 2015; Liang, Heckman, & Abedi, 2012; Liang & Heckman, 2013). Without successfully passing the Algebra I EOC, students cannot progress to higher mathematics courses. This holds true for students with disabilities as well (Eddy et al., 2015). For this reason, there is a need for effective intervention tools and mathematics assessment for secondary students with SLDs. In particular, there is a critical need for work in areas that address more advanced mathematical topics, such as algebra (Proctor, 2012). The 2011 results from Program for International Student Assessment (PISA; 2012) indicated that the U.S. ranked 27 out of the 34 countries that participated. Moreover, there was no significant change in the results from the previous assessments.

Educational spending per student in the U.S. is significantly higher compared to most other countries, yet student performance does not reflect benefits from this. The U.S. students were adept in tasks that necessitated cognitively less challenging skills in mathematics. There was a noteworthy weakness in items with higher cognitive loads (e.g., to decode real-world problems into mathematical terms and construing mathematical features in real-world problems).

For students with disabilities, reports of mathematics achievement are particularly discouraging. In the report on the state of SLDs by Cortiella and Horowitz (2014), the SLD group results in mathematics compared poorly with their nondisabled peers. Twenty three percent of students with SLDs performed below average on mathematical calculations, compared to 2% of the regular students. Whereas 50% regular students had high average marks in mathematical calculations, only 26% of the students with SLDs achieved high marks. Students with SLDs had similar scores for applied mathematical problems: 8% scored below average, and only 15% were in the high performance group.

Algebra poses challenges to students with or without disabilities (Eddy et al., 2015). In a study that asked students with SLDs what they needed from teachers, the responses included provide more assistance, alter typical teaching styles, incorporate group work, and increase the interest level of the instruction as teacher strategies that would assist them in improving their performance (Proctor, 2010). As schools respond to federal and state mandates for more challenging instructional curricula and more highly qualified teachers, increasing numbers of students with SLDs are receiving their mathematics instruction in general education classrooms from general education teachers or from a co-teaching pair of teachers consisting of a general education teacher and a special education teacher (Proctor, 2010).

Secondary general and special education teachers who taught mathematics to students with disabilities often lack sufficient content preparation relative to the demands of the high school curriculum. General education teachers, on the other hand, were less likely compared to their special education colleagues to implement recommended instructional practices or assessment accommodations for students with disabilities (Proctor, 2010).

NCLB (2002) mandated the nationwide development of state accountability assessment plans for all school districts and students. The act also required that the results of these assessments be made available in terms of individual, school, and statewide reports. Progress for students with special needs is also included in this accountability system (Cortiella & Horowitz, 2014; Renaud, 2013; Street et al., 2012). In the NCLB era, all educational stakeholders musts prove their worthiness whether through the NCLB-oriented regulations of state accountability programs or due to NCLB itself (Liang et al., 2012). Most educational accountability systems evaluate schools based on the percentage of students performing above a score deemed “proficient” (Jennings & Bearak, 2014, p. 381). Focusing on proficiency can potentially influence how teachers instruct their students and use their instructional resources.

Qualitative research and survey studies have found that educators focus more attention on students close to proficiency when they face accountability pressure, this leads to questions about the efficacy of the testing (Everitt, 2012; Jennings & Bearak, 2014; Nichols et al., 2012; Renaud, 2013). Teachers indicated that they allocate instructional resources differently amongst their students when the accountability pressure is higher due to upcoming assessments. Students with disabilities face the challenge that they are often not considered as near proficiency, and teachers do not focus their attention on them; therefore, this leads to a widening of the achievement gap (Renaud, 2013). More students are retained due to NCLB (2002) rules, and students with disabilities are often the recipients of this practice (Renaud, 2013). Sadly, neither social promotion, nor grade retention, nor early dropout rates benefit the students or are closely associated with these practices (Renaud, 2013).

Summary

America still lags behind the other developed nations in terms of enrollment in STEM careers and this causes concern as its place as a world leader is at stake (Gomez & Albrecht, 2013; RAND Mathematics Study Panel, 2003). The new millennium will place increasingly more emphasis on the ability to think critically and creatively as the society becomes more complex and people need to be more flexible and adaptable (Schneider et al., 2013). Not only does this call for increased STEM graduates, it also emphasizes the need for all citizens to be more STEM focused as society becomes more technological with a definite need of mathematical skills and insights (Schneider et al., 2013). The nation is challenged to ensure that today’s school children evolve and grow with enough knowledge to be informed citizens able to participate in their local economies through viable employment. Public school programs need to reflect the needs of their communities and the businesses operating within those communities (Gomez & Albrecht, 2013). This means that all students, including those with SLDs, should have the opportunity to access those classes and programs that will prepare them for the future.

CHAPTER III

METHODOLOGY

Purpose of the Study

The purpose of this study of this study was to compare the mathematics performance of students with SLDs with that of students without SLDs. The Grade 8 mathematics STAAR scores and Grade 9 Algebra I STAAR EOC scores were compared to examine whether there are differences between students with SLDs and students without for the spring of 2013. The difference in scores of students who transitioned from Grade 8 mathematics in 2012-2013 to Grade 9 Algebra I in 2013-2014 were also compared between students with SLDs and students without SLDs. Because these math classes usually serve as gateways into STEM classes, this researcher anticipated that this study would provide an understanding about ways to increase the participation of students with SLD in STEM programs. Specifically, this study focused on addressing the following research questions:

1. What are the Grade 8 mathematics STAAR score differences between students with SLD and students without SLD for the spring of 2013?
2. What are the Grade 9 Algebra I STAAR EOC score differences between students with SLD and students without SLD for the spring of 2014?
3. For students who transitioned from Grade 8 mathematics in 2012-2013 to Grade 9 Algebra I in 2013-2014, what are the STAAR Grade 8 mathematics

and Grade 9 Algebra I EOC score transition differences between students with SLD and students without SLD?

This chapter includes a discussion of the method and design utilized for this study. The chapter also includes a discussion of the target population, samples, and sampling procedures used in the study. This chapter also provides a discussion on the instrumentation, specific data collection procedures, and data analyses. This chapter ends with the discussion of ethical procedures and a summary of the key points of this study.

Research Design

A quantitative causal-comparative research design was employed in this study to examine the difference between the Grade 8 mathematics and Grade 9 Algebra I STAAR scores of students with SLD and students without SLD. A quantitative method was deemed appropriate for the study because the variables considered in the study are numerical. Academic performance of general education students and students with SLD is measured using their STAAR scores. The use of the standardized test to measure academic performance allows an objective measure of the construct considered in the study.

Specifically, a non-experimental study was used because the assignment of students to the two groups (e.g., general education students and students with SLDs) was not random. Students are assigned to the two groups based on whether they have SLDs or not. Thus, the researcher cannot control or manipulate the samples in the study. The design of the study was causal-comparative because the data will be extant and provided by the state. Causal-comparative designs are used when attempting to identify relationships or differences between quantitative variables in existing data (Gall, Gall, & Borg, 2006). The causal-comparative design is non-experimental; therefore, no definitive statements about cause and effect can be made (Gall et al., 2006).

Population and Sample

For the 2012- 2013 Grade 8 STAAR mathematics assessment, 284,653 students took the assessment, and 77% met standard on this assessment (TEA, 2013b). The number of special education students who took the Grade 8 STAAR mathematics assessment was 15,205 with a 48% met standard rate. For the 2012-2013 Grade 9 EOC for Algebra I, 364,613 students took the assessment and 78% passed (TEA, 2013b). The number of special education students who took the Algebra I EOC at the end of Grade 9 was 19,149 with a 43% pass rate.

For the 2013-2014 Grade 8 STAAR mathematics assessment, 305,174 students took the assessment, and 79% met standard on this assessment (TEA, 2014b). The number of special education students who took the Grade 8 STAAR mathematics assessment was 15,617 with a 52% met standard rate. For the 2013-2014 Grade 9 EOC for Algebra I, 388,672 students took the assessment and 81% passed (TEA, 2014b). The number of special education students who took the EOC algebra was 21,180 with a 46% pass rate.

The random sample of 10,000 cases of matched pairs of students who took the Grade 8 mathematics STAAR and the Grade 9 algebra EOC was used for the analysis. The data will be 50%, or 5,000 general education students and 50%, or 5,000 special education students. The demographic variables that were described for the sample include gender, race, and diagnosis of an SLD. Gender was dichotomous, and were classified according to the state's labeling system of White, African American, Hispanic, Asian/Pacific Islander, and Native American, and the diagnosis of SLD was considered as a dichotomous variable.

For the purpose of this study, a total of 311,381 students were classified in the non-learning disability group and 14,381 students were classified in the learning disability group. Due to the large number of samples considered for the study, it was assumed that the analyses have a power of greater than the standard of 80%. Thus, the samples were deemed sufficient for the analyses performed in the study.

Instruments

The state of Texas has employed statewide testing programs for several decades. The Texas Assessment of Academic Skills (TAAS) test was used from 1990 to 2002. TAAS was replaced by the TAKS in 2003. In the 2011-2012 academic school year, the TAKS was replaced by the STAAR and high school EOC examinations. The EOCs are considered part of the STAAR program of assessments and are commonly referred to as the STAAR EOC tests. The STAAR assessments and EOC examinations were designed to measure students' understanding and knowledge of the TEKS that form the state's curricula guidelines.

The Grade 8 STAAR mathematics test measures students' mathematical knowledge within four categories and includes 56 items purported to measure the mathematics TEKS requirements (TEA, 2015d). The Grade 9 Algebra I EOC measures five categories encompassing algebraic functions and includes 54 items aligned with the

TEKS (TEA, 2015d). All STAAR mathematics assessments, including the Algebra I EOC administered at the high school level, require students to complete them within a 4-hour time limit. Most students are expected to complete the assessments in less than the maximum time of 4 hours. However, the time limit was established to ensure students would not spend an entire school day focused on a single subject. Accommodations for extra time or an extra day are available for students who meet eligibility criteria for their use. For example, the STAAR and EOCs are provided as "STAAR Spanish, STAAR L (a linguistically accommodated version), and STAAR A (a special education accommodated version)" (TEA, 2010, para. 1).

To complete the STAAR or EOC, students needing accommodations due to a disability include:

- Students with an identified disability who receive special education services and meet established eligibility criteria for certain accommodations;
- Students with an identified disability who receive Section 504 services and meet established eligibility criteria for certain accommodations;
- Students with a disabling condition who do not receive special education or Section 504 services but meet established eligibility criteria accommodations. (TEA, 2013a, para. 1)

Either the ARD-C or a Section 504 placement committee (504-C) determines whether students who receive special education or Section 504 services may use accommodations during statewide assessments (TEA, 2013a).

For the purposes of the current study, the spring 2013 and spring 2014 objective scores for the Grade 8 STAAR mathematics examinations and the Grade 9 EOCs for Algebra I will be analyzed. The writers and reviewers for STAAR tests reported that all Grade 8 mathematics test questions related to each TEKS category and measured the appropriate content (TEA, 2012a). Construct validity for STAAR test content was shown by the relationship between the tested content and the subject matter they were designed to measure (TEA, 2012b). For the STAAR tests utilizing multiple-choice items, the Kuder-Richardson Formula-20 (KR20) was used to calculate the reliability estimates. The TEA (2012a) reported the STAAR's reliability indices ranged from .87 to .90.

Data Collection Procedures

The data were requested from the TEA (2010, 2012a, 2012b, 2013a, 2013b, 2014a, 2014b, 2015a, 2015b, 2015c, 2015d). The request involved asking for a random sample of 10,000 cases of matched pairs for students who took both the Grade 8 mathematics STAAR and the Grade 9 EOC for Algebra I. Non-stratified random sampling for the general education versus the special education students ensured both groups' sizes were equal in the analysis (Gall et al., 2006). Once the data were received, data management procedures were used to determine if any outliers or cases with missing data must be removed from the sample prior to performing the analysis.

Even though no identity related information was included in the sample of data, the data were kept confidential and maintained in a secure environment, namely, the researcher's home. The researcher's computer is password and firewall protected also. All data collected in the study were only accessible to the researcher.

Data Analysis

Data collected for the study were inputted to SPSS v22.0 for data analyses. Descriptive and inferential data analysis was used to answer the three research questions. Descriptive statistics were used to present the demographic characteristics of students considered in the study. Measures of central tendencies such as mean, standard deviation, and range values were used to describe the study variables considered in the study. Frequencies and percentages were used to describe the profile of the students involved in the study. Inferential statistics such as independent samples *t*-test and *z*-scores were used to compare the study variables. Specifically, the first and second research questions were answered using independent samples *t*-tests. The independent samples *t*-test allows for a comparison of STAAR scores between the non-learning disability group and the learning disability group.

The third research question was answered using mixed between-within analysis of variance (ANOVA) to detect performance differences between general and special education students' Grade 8 math STAAR and Grade 9 Algebra I EOC scores. *Z*-scores were used to determine whether there is a significant difference in the change in STAAR scores from Grade 8 Mathematics to Grade 9 Algebra I between the non-learning disability and the learning disability groups. A significance level of .05 was used for all analyses.

Ethical Considerations

Human participants were involved in the study; therefore, it was important to ensure that ethical standards were met throughout the study. The researcher had no physical interaction with the students considered in the study. All data collected in the study were based on existing test results. Thus, it was not necessary to use informed consent forms. A formal permission letter was sent to the school districts involved in the study. The permission letter included the details on how data would be handled in the study. No identifiable information such as name, address, and ID number was collected in the study. Only data relevant to the study such as gender, race, group classification, and test scores were collected. All data collected in the study were stored in a password and firewall protected computer of the researcher. All data were only accessible to the researcher. Three years after the completion of the study, all data used for the study will be destroyed and deleted.

Summary

A quantitative causal-comparative study was used to compare the academic performance of general education students and students receiving special education in mathematics. Data were obtained from the TEA (2010, 2012a, 2012b, 2013a, 2013b, 2014a, 2014b, 2015a, 2015b, 2015c, 2015d) Public Education Information Management System. A total of 311,381 students were classified in the non-learning disability group and 14,381 students were classified in the learning disability group. The STAAR and high school EOC examinations in mathematics and algebra were collected for the study. Independent samples *t*-test and *z*-scores were used to analyze whether there were significant differences in the STAAR scores of students with learning disabilities and students without learning disabilities. A significance level of .05 was used for all analyses.

CHAPTER IV

RESULTS

Data were obtained from the TEA (2010, 2012a, 2012b, 2013a, 2013b, 2014a, 2014b, 2015a, 2015b, 2015c, 2015d) Public Education Information Management System on all Grade 8 students in Texas for the 2012-2013 school year. The data were obtained in three Excel files, which were then converted into a format suitable for analysis in the Statistical Package for the Social Sciences (SPSS) Version 22.0. Once the data were in SPSS, relevant variables were recoded so that the research questions previously delineated could be addressed.

Results of the Statistical Analyses for Research Question 1

With respect to RQ1 (What are the Grade 8 STAAR Mathematics score differences between students with SLDs and their nondisabled peers for the spring of 2013?), an independent samples *t*-test was calculated for each of the five category scores on the STAAR Mathematics exam, as well as for the scale score. As such, six separate independent samples *t*-tests were calculated to answer the first research question.

For the STAAR Mathematics Category 1 (i.e., numbers, operations, and quantitative reasoning), the independent samples *t*-test revealed the presence of a statistically significant difference between students with SLDs from their nondisabled peers, $t(18247.41) = 4.46$, $p < .001$. As such, the null hypothesis was rejected. Students with SLDs had an average score on the STAAR Mathematics Category 1 (i.e., numbers, operations, and quantitative reasoning) that was 0.08 points lower compared to their nondisabled peers. Readers are directed to Table 1 for the descriptive statistics for this analysis. To determine the practical importance or meaningfulness of this difference, the effect size was calculated, using Cohen's (1988) *d*. With 0.2 being the beginning of a small effect size, the effect size that was calculated for this difference was 0.04. As such, this difference constituted a trivial effect size, indicative that the difference was not meaningful and might be attributable to the extremely large sample size that was present.

Table 1

Descriptive Statistics for the STAAR Mathematics Category 1 (i.e., Numbers, Operations, and Quantitative Reasoning) by Group Membership

Group	*n*	*M*	*SD*
Non-Disability	311,383	4.53	3.42
Learning Disability	14,381	4.45	2.06

Concerning the STAAR Mathematics Category 2 (i.e., patterns, relationships, and algebraic relationships), the independent samples *t*-test yielded a near-statistically significant difference between students with SLDs from their nondisabled peers, $t(18246.64) = 1.89$, $p = .058$. For this analysis, the null hypothesis was not rejected. Students with SLDs had an average score on the STAAR Mathematics Category 2 (i.e., patterns, relationships, and algebraic relationships) that was 0.04 points higher compared to their nondisabled peers. The descriptive statistics for the STAAR Mathematics Category 2 (i.e., patterns, relationships, and algebraic relationships) are delineated in Table 2.

Table 2

Descriptive Statistics for the STAAR Mathematics Category 2 (i.e., Patterns, Relationships, and Algebraic Relationships) by Group Membership.

Group	*n*	*M*	*SD*
Non-Disability	311,383	5.72	4.24
Learning Disability	14,381	5.76	2.50

Regarding the STAAR Mathematics Category 3 (i.e., Geometry and Spatial Reasoning), the independent samples *t*-test yielded a statistically significant difference between students with SLDs from their nondisabled peers, $t(17848.84) = 5.09$, $p < .001$. For this analysis, the null hypothesis was rejected. Students with SLDs had an average score on the STAAR Mathematics Category 3 (i.e., geometry and spatial reasoning) that was 0.069 points lower compared to their nondisabled peers. The descriptive statistics for the STAAR Mathematics Category 3 (i.e., geometry and spatial reasoning) are revealed in Table 3. The practical importance, or Cohen's (1988) *d*, for this difference was 0.04, another trivial effect size. This difference may again be attributed to the extremely large sample size of students whose data were analyzed.

Table 3

Descriptive Statistics for the STAAR Mathematics Category 3 (i.e., Geometry and Spatial Reasoning) by Group Membership.

Group	*n*	*M*	*SD*
Non-Disability	311,383	3.02	2.42
Learning Disability	14,381	2.95	1.54

With respect to the STAAR Mathematics Category 4 (i.e., measurement), the independent samples *t*-test did not reveal a statistically significant difference between students with SLDs from their nondisabled peers, *t* (18009.73) = 1.05, *p* = .292. The null hypothesis for this analysis was not rejected. No difference was present in the average STAAR Mathematics Category 4 (i.e., measurement) scores between students with SLDs and their nondisabled peers. Presented in Table 4 are the descriptive statistics for the STAAR Mathematics Category 4 (i.e., measurement).

Table 4

Descriptive Statistics for the STAAR Mathematics Category 4 (i.e., Measurement) by Group Membership.

Group	*n*	*M*	*SD*
Non-Disability	311,383	4.67	3.727
Learning Disability	14,381	4.65	2.317

For the STAAR Mathematics Category 5 (i.e., probability and statistics), the independent samples *t*-test did reveal a statistically significant difference between students with SLDs from their nondisabled peers, *t*(17729.98) = 11.82, *p* < .001. The null hypothesis was rejected. Students with SLDs had an average score on the STAAR Mathematics Category 5 (i.e., probability and statistics) that was 0.19 points higher compared to their nondisabled peers. Presented in Table 5 are the descriptive statistics for the STAAR Mathematics Category 5 (i.e., probability and statistics). The practical importance, or Cohen's (1988) *d*, for this difference was 0.08, another trivial effect size. Again, this difference may due to the extremely large sample size of students whose data were analyzed.

Table 5

Descriptive Statistics for the STAAR Mathematics Category 5 (i.e., Probability and Statistics) by Group Membership.

Group	*n*	*M*	*SD*
Non-Disability	311,383	3.52	2.87
Learning Disability	14,381	3.71	1.85

Next, the STAAR Mathematics raw score, which reflects student performance across all five of the Mathematics categories, was analyzed. The independent samples *t*-test did not yield a statistically significant difference between students with SLDs from their nondisabled peers, $t(20400.59) = 0.90$, $p = .365$. For this analysis, the null hypothesis was not rejected. Students with SLDs had a similar average raw score on the STAAR Mathematics test to their nondisabled peers. Presented in Table 6 are the descriptive statistics for the STAAR Mathematics raw scores.

Table 6

Descriptive Statistics for the STAAR Mathematics Raw Score by Group Membership.

Group Membership	*n*	*M*	*SD*
Non-Disability Group	311,383	21.45	15.471
Learning Disability Group	14,381	21.51	7.586

Results of the Statistical Analyses for Research Question 2

With respect to the second research question (RQ2: What are the Grade 9 Algebra I STAAR EOC score differences between students with SLDs and their nondisabled peers for the spring of 2014?), an independent samples *t*-test was calculated for each of the five reporting category scores on the STAAR Algebra EOC exam, as well as for the scale score. As such, six separate independent samples *t*-tests were calculated to answer this second research question.

For the STAAR Algebra EOC Reporting Category 1 (i.e., number and algebraic methods), the independent samples *t*-test revealed the presence of a statistically significant difference between students with SLDs from their nondisabled peers, t (15726.82) = 81.04, $p < .001$. The null hypothesis for this analysis was rejected. Students with SLDs had an average score on the STAAR Algebra EOC Reporting Category 1 (i.e., number and algebraic methods) that was 1.14 points lower compared to their nondisabled peers. Readers are directed to Table 7 for the descriptive statistics for this analysis. The practical importance, or Cohen's (1988) *d*, for this difference was 0.67, a moderate effect size. As such, a moderate degree of relevance or importance might be attributed to this difference in performance between the two groups of students.

Table 7

Descriptive Statistics for the STAAR Algebra End of Course Exam Reporting Category 1 (i.e., Number and Algebraic Methods) by Group Membership.

Group p	*n*	*M*	*SD*
Non-Disability	221,358	4.18	1.82
Learning Disability	13,441	3.04	1.56

Regarding the STAAR Algebra EOC Reporting Category 2 (i.e., describing and graphing linear functions, equations, and inequalities), the independent samples *t*-test yielded a statistically significant difference between students with SLDs from their nondisabled peers, t(16072.69) = 100.39, $p < .001$. For this analysis, the null hypothesis was rejected. Students with SLDs had an average score on the STAAR Algebra EOC

Reporting Category 2 (i.e., describing and graphing linear functions, equations, and inequalities) that was 1.83 points lower than their nondisabled peers (see Table 8). The practical importance, or Cohen's (1988) *d*, for this difference was 0.80, a large effect size. Accordingly, a large degree of relevance or importance may be attributed to this difference in performance between the two groups of students.

Table 8

Descriptive Statistics for the STAAR Algebra End of Course Exam Reporting Category 2 (i.e., Describing and Graphing Linear Functions, Equations, and Inequalities) by Group Membership

Group	*n*	*M*	*SD*
Non-Disability	221,358	6.24	2.52
Learning Disability	13,441	4.41	2.02

Concerning the STAAR Algebra EOC Reporting Category 3 (i.e., writing and solving linear functions, equations, and inequalities), the independent samples *t*-test revealed the presence of a statistically significant difference between students with SLDs from their nondisabled peers, $t(16310.37) = 120.16$, $p < .001$. The null hypothesis for this analysis was rejected. Students with SLDs had an average score on the STAAR Algebra EOC Reporting Category 3 (i.e., writing and solving linear functions, equations, and inequalities) that was 2.50 points lower compared to their nondisabled peers. Readers are directed to Table 9 for the descriptive statistics for this analysis. The practical importance, or Cohen's (1988) *d*, for this difference was 0.94, a large effect size. Accordingly, a large degree of relevance or importance may be attributed to this difference in performance between the two groups of students.

Table 9

Descriptive Statistics for the STAAR Algebra End of Course Exam Reporting Category 3 (i.e., Writing and Solving Linear Functions, Equations, and Inequalities) by Group Membership

Group	*n*	*M*	*SD*
Non-Disability	221,358	8.12	2.98
Learning Disability	13,441	5.62	2.30

For the STAAR Algebra EOC Reporting Category 4 (i.e., quadratic functions and equations), the independent samples *t*-test yielded a statistically significant difference between students with SLDs from their nondisabled peers, $t(16313.69) = 102.94$, $p < .001$. The null hypothesis for this analysis was rejected. Students with SLDs had an average score on the STAAR Algebra EOC Reporting Category 4 (i.e., quadratic functions and equations) that was 1.63 points lower compared to their nondisabled peers. Readers are directed to Table 10 for the descriptive statistics for this analysis. The practical importance, or Cohen's (1988) *d*, for this difference was 0.80, a large effect size. As such, a large degree of relevance or importance may be attributed to this difference in performance between the two groups of students.

Table 10

Descriptive Statistics for the STAAR Algebra End of Course Exam Reporting Category 4 (i.e., Quadratic Functions and Equations) by Group Membership

Group	*n*	*M*	*SD*
Non-Disability	221,358	5.07	2.27
Learning Disability	13,441	3.44	1.75

Regarding the STAAR Algebra EOC Reporting Category 5 (i.e., exponential functions and equations), a statistically significant difference was present between students with SLDs from their nondisabled peers, $t(15910.44) = 81.09$, $p < .001$. For this analysis, the null hypothesis was rejected. Students with SLDs had an average score on the STAAR Algebra EOC Reporting Category 5 (i.e., exponential functions and equations) that was 1.17 points lower compared to their nondisabled peers. Readers are directed to Table 11 for the descriptive statistics for this analysis. The practical importance, or Cohen's (1988) *d*, for this difference was 0.66, a moderate effect size. As such, a moderate degree of relevance or importance may be attributed to this difference in performance between the two groups of students.

Table 11

Descriptive Statistics for the STAAR Algebra End of Course Exam Reporting Category 5 (i.e., Exponential Functions and Equations) by Group Membership

Group	*n*	*M*	*SD*
Non-Disability	221,358	4.47	1.94
Learning Disability	13,441	3.30	1.61

Next, the STAAR Algebra EOC exam scale score, which reflects student performance across all five of the Algebra EOC exam Reporting categories, was analyzed. The independent samples *t*-test revealed the presence of a statistically significant difference between students with SLDs from their nondisabled peers, $t(15063.31) = 136.19$, $p < .001$. The null hypothesis for this analysis was rejected. Students with SLDs had a lower average scale score on the Algebra EOC exam scale score that was 580.84 points lower than the average scale score of their nondisabled peers. Presented in Table 12 are the descriptive statistics for the STAAR Algebra EOC exam scale scores. The practical importance, or Cohen's (1988) *d*, for this difference was 1.22, a large effect size. The scale score difference between these two groups of students was reflective of a large degree of practical importance.

Table 12

Descriptive Statistics for the STAAR Algebra End of Course Exam Scale Score by Group Membership

Group	*n*	*M*	*SD*
Non-Disability	221,358	3756.58	472.78
Learning Disability Group	13,441	3175.74	480.52

Results of the Statistical Analyses for Research Question 3

With respect to RQ3 (For students who transitioned from Grade 8 mathematics in 2012-2013 to Grade 9 Algebra I in 2013-2014, what are the STAAR Grade 8 mathematics and Grade 9 Algebra I EOC score transition differences between students with SLD and their nondisabled peers?), the 2013 and 2014 data files were merged. This merging permitted an analysis of student scores across the two school years. Because scores on the STAAR Mathematics exam and on the Algebra EOCs were not reported in the same format, scores were converted to *z*-scores. This conversion permitted the two scoring formats to be compared for the students with SLDs and for the non-disabled group of students.

Two different sets of analyses were conducted, one for the raw scores for each exam and a second analysis for the scale scores. The emphasis in this research question was on determining whether differences were present in the transition from the Grade 8 exam to the Grade 9 exam for these two groups of students. With respect to the non-disabled group of students, a statistically significant difference was not present between their *z*-scores on the Grade 8 STAAR Mathematics exam and their *z*-scores on the Grade 9 Algebra EOC exam raw scores, $t(223710) = 1.78$, $p = .076$. Students in this group had similar *z*-score averages when their raw scores on both exams were converted to *z*-scores. Regarding students with SLDs, a statistically significant difference was not revealed between their *z*-scores on the Grade 8 STAAR Mathematics exam and their *z*-scores on the Grade 9 Algebra EOC exam raw scores, $t(10799) = -0.18$, $p = .859$.

For this analysis, the null hypothesis was not rejected. This group of students had similar average *z*-scores on both exams when their raw scores were converted to *z*-scores. Because the descriptive statistics for the Grade 8 STAAR Mathematics exam and for the Grade 9 Algebra EOC exam have already been provided and because z-scores in and of themselves do not provide additional information, descriptive statistics were not provided for these analyses.

Concerning the non-disabled group of students, a statistically significant difference was present between their *z*-scores on the Grade 8 STAAR Mathematics exam and their *z*-scores on the Grade 9 Algebra EOC exam scale scores, $t(223710) = 3.19$, $p = .001$. The null hypothesis was rejected for this analysis. These students had higher average *z*-scores on the Grade 8 STAAR Mathematics scale scores than they did on the Grade 9 Algebra EOCs. The effect size for this difference was 0.01, or trivial in nature.

With respect to the students with SLDs, a statistically significant difference was not yielded between their *z*-scores on the Grade 8 STAAR Mathematics exam and their *z*-scores on the Grade 9 Algebra EOC exam scale scores, $t(10799) = -0.26$, $p = .795$. The null hypothesis for this analysis was not rejected. These students had similar average *z*-scores on the Grade 8 STAAR Mathematics scale scores than they did on the Grade 9 Algebra EOCs.

Summary

Summary of Results for Research Question One

With respect to the five STAAR Mathematics Categories, the null hypothesis was rejected in four of the five categories. No difference was revealed for the STAAR Mathematics Category 4. Students with SLDs had higher average scores on the Mathematics Categories 2 and 5, whereas their nondisabled peers had higher average scores on the Mathematics Categories 1 and 3. These differences, however, constituted effect sizes that were trivial and might be due to the extremely large sample size of students whose data were analyzed herein. On the STAAR Mathematics raw score, these two groups of students had similar average raw scores.

Summary of Results for Research Question Two

With respect to the five STAAR Algebra EOC exam Reporting Categories, the null hypothesis was rejected for all five reporting categories. In all five categories, students with SLDs had lower average scores than their non-disabled peers. On the Algebra EOC exam scale score, students with SLDs had a lower average score as well. Effect sizes, or the degree of practical importance, ranged from being moderate to large.

Summary of Results for Research Question Three

To address this third research question, student data for the 2013 and 2014 school years were merged into single dataset so that scores could be compared across the two school years. Analyses were conducted separately for the two groups of students to determine their transitions from the Grade 8 STAAR Mathematics exam to the Grade 9 Algebra EOC exam. With respect to the raw score analyses, students in both groups had similar *z*-score averages on both exams. Thus, the transition for both sets of students was similar in nature from Grade 8 to Grade 9. Regarding the scale score analyses, the non-disabled group of students had higher average *z*-scores on the Grade 8 STAAR Mathematics scale scores than they did on the Grade 9 Algebra EOCs. Students with SLDs, however, had similar *z*-score averages on the two exams. These results may be interpreted as meaning that the non-disabled student group experienced a slight loss in their mathematics achievement in this transition, whereas the students with SLDs did not experience a loss in their transition.

The following section includes a summary of the results, the limitations of the study, and recommendations for future study. In addition, Chapter V includes a reiteration of the problem statement and key findings. Then, Chapter V ends with the conclusion for this study.

CHAPTER V

SUMMARY AND CONCLUSIONS

In reaction to the workforce crisis, perceived threats to the U.S. national defense, and competition internationally, the U.S. has focused on enhancing STEM education (Executive Office of the President, 2014). STEM schools came because of President Bush's America COMPETES Act (2007), which took 2 years of advocacy before it was passed in 2012. The primary advocacy groups came from scientific, business, and academic communities as well as key members of Congress (Thomas & Williams, 2010). The increased attention to specialized education in STEM fields led to increased interest in STEM related careers for adolescents. Sustainment of these specialized state-of-the-art schools faces funding and policy challenges and financial commitments from federal, state, and local governments is therefore a necessity (Thomas & Williams, 2010).

The STEM workforce is aging and increasing in need for replacement professionals even as the number of STEM careers has been increasing across the nation. President Obama (2011) remarked in his State of the Union address to Congress that maintaining leadership in research and technology is vital to America's success and to achieve that "the nation must educate all of its children" (para. 33). The nation has to ensure that its children become informed citizens able to participate in the economy through employment. Public school programs need to reflect the needs of their communities and the businesses operating within those communities (Gomez & Albrecht, 2013).

This focus on increasing participation in STEM classes and programs is one that should be extended to all students, including those with SLDs. Students participate in specialized education in the U.S. at a rate of 13% whereas in Texas, almost 9% participate in specialized programs (NCES, 2013). Texas public schools offer special education and other instructional programs designed to meet the needs of students who qualify for special education programs. Some students are enrolled in more than one of these programs and some are not enrolled in any of these programs.

Students with SLDs suffer from a disadvantage in today's inclusion orientation to special education. For example, students with SLDs take high-level mathematics courses, such as algebra and geometry, which are gateways into STEM programs, in regular education classrooms with their nondisabled peers and receive little support in accommodating for their SLDs. Because many students with SLDs need STEM courses to graduate from high school, to obtain the prerequisite skills for college level mathematics, and to gain admission to postsecondary STEM education, their problems in gateway mathematics classes create barriers for them in their STEM classes (Steele, 2010). Additionally, Texas students diagnosed with SLDs must pass both these rigorous STEM courses and related high-stakes assessments with little support (Steele, 2010).

Problem Statement

What constitutes adequate mathematics achievement is controversial at local, state, national, and international levels. The U.S. student academic achievement is falling farther behind other developed nations' students in the areas of STEM (Peterson et al., 2011). Because mathematics achievement for general education students is under scrutiny, there is a need to determine the mathematics achievement of students with SLDs to assess the need for enacting programs that enable special education students to attain the same level of achievement as their general education peers.

Purpose of the Study

The purpose of this study was to compare the mathematics performance of students with SLDs to that of students without SLDs by comparing Grade 8 students' scores on the mathematics STAAR with Grade 9 students' scores on the EOC for Algebra I. It was anticipated that the results would provide guidance in improving the mathematics achievement of students with SLD in gateway mathematics programs, thus increasing their participation in STEM programs.

Key Findings

In general, the findings did not reveal significant score differences between the students with SLDs and their nondisabled peers in the STAAR Grade 8 mathematics in 2012-2013. The comparison of the Grade 9 Algebra I STAAR EOC scores brought to light a statistically significant difference between the students with SLDs and their nondisabled peers. For students who transitioned from Grade 8 mathematics in 2012-2013 to Grade 9 Algebra I in 2013-2014, the comparison between the STAAR scores indicated that the nondisabled group experienced a slight loss in their mathematics achievement whereas the students with SLDs did not.

Research Question One: Grade 8 Mathematics STAAR Score Differences between Students with SLDS and their Nondisabled Peers in 2013

STAAR mathematics includes five categories, each addressing different aspects of mathematics. STAAR mathematics Category 1 focuses on numbers, operations, and quantitative reasoning; Category 2 includes patterns, relationships, and algebraic relationships; Category 3 addresses geometry and spatial reasoning; Category 4 contains only measurement; and Category 5 has probability and statistics in its focus. STAAR mathematics raw score reflects student performance across all five of the mathematics categories.

With respect to the five STAAR mathematics categories, the null hypothesis was rejected in four of the five categories. No difference was revealed for the STAAR mathematics Category 4. Students with SLDs had higher average scores on the mathematics categories two and five, whereas their nondisabled peers had higher average scores on the mathematics Categories 1 and 3. These differences, however, constituted effect sizes that were trivial and might be due to the extremely large sample size of students whose data were analyzed. On the STAAR mathematics raw score, these two groups of students had similar average raw scores.

These results did not support those of Wagner, Newman, Cameto, Levine, and Garza's (2006) national longitudinal report, which found that more than half of high school students with disabilities demonstrated mathematics computation and problem solving levels below the 25th percentile on an individually administered achievement test. Although the trivial differences of the current study might be attributed to the extremely large sample size, the national study of Wagner et al. (2006) had comparable a number of subjects. The differences may be attributable to other factors that warrant further research.

Research Question Two: Differences in the Grade 9 Algebra I STAAR EOC Scores between Students with SLDs and their Nondisabled Peers for the Spring of 2014

The STAAR Grade 9 Algebra I assessment batch constituted the following categories, namely:

1. Category 1 includes number and algebraic methods;
2. Category 2 consists of describing and graphing linear functions, equations, and inequalities;
3. Category 3 contains writing and solving linear functions, equations, and inequalities;
4. Category 4 is made up of quadratic functions and equations; and
5. Category 5 comprises exponential functions and equations.

Students with or without disabilities face challenges when it comes to algebra (Prevatt, Welles, Li, & Proctor, 2010). As expected, with respect to the five STAAR algebra EOC exam-reporting categories, the null hypothesis was rejected for all five reporting categories. In all five categories, students with SLDs had lower average scores than their nondisabled peers. On the Algebra EOCs scale score, students with SLDs had a lower average score as well. The effect sizes or the degree of practical importance (Cohen, 1988) ranged from being moderate to large. This degree range of relevance or importance may be attributed to a difference in performance between the two groups of students.

Algebra entails abstract symbolic representation, which proves to be challenging to most students, including those with SLDs in the field of mathematics. Students who have difficulties in mathematics present with impaired working memory capacity, inhibitory ability, and speed of processing (Passolunghi & Siegel, 2004). The study of Proctor (2012) indicated that working memory capacity is linked with mathematical reasoning. The categories included in Algebra I STAAR EOC assessments are indicative of mathematical reasoning and the results of this study confirm those of Proctor (2012).

Research Question Three: Score Transition Differences in the 2013-2014 STAAR Grade 8 Mathematics and Grade 9 Algebra I EOC between Students with SLDs and their Nondisabled Peers

The emphasis in this research question was on determining whether differences were present in the transition from the Grade 8 mathematics assessments to the Grade 9 algebra 1 EOC exam for these two groups of students. Student data for the 2013 and 2014 school years were merged into a single dataset so that scores could be compared across the two school years. Analyses were conducted separately for the two groups of students to determine their transitions from the Grade 8 STAAR mathematics exam to the Grade 9 Algebra I EOC exam. The raw score analyses indicated that students in both groups had similar *z*-score averages on both exams. Thus, the transition for both sets of students was similar in nature from Grade 8 to Grade 9. Regarding the scale score analyses, the nondisabled group of students had higher average *z*-scores on the Grade 8 STAAR mathematics scale scores than they did on the Grade 9 algebra EOC exams. Students with SLDs, however, had similar *z*-score averages on the two exams. These results may be interpreted as meaning that the nondisabled student group experienced a slight loss in their mathematics achievement in this transition, whereas the students with SLDs did not experience a loss.

Interpretation of the Findings

The results of Research Question 1 indicated that the students with SLDs performed better than expected as the null hypotheses were rejected in some categories. For Categories 2 and 5 the students with SLDs performed better compared to their nondisabled peers. In both cases, the practical and or meaningfulness of the size difference was trivial (Cohen, 1988), and it could be attributed to the large sample size. Nonetheless, it represented an interesting finding that could be explored further in future research. The results of the STAAR mathematics assessments for the Texas school year 2012-2013 indicated that the students with SLDs performed better compared to those in the longitudinal study of Wagner et al. (2006). On the other hand, Wagner et al.'s (2006) also performed a large-scale study that was—in addition—a national, longitudinal study and therefore included students from all states. However, Wagner et al. (2006) found that more than half of the students with SLDs performed below the 25th percentile for mathematics computation and problem solving. The results of Research Question 2 confirmed the expectation that students with SLDs would experience more difficulty with Algebra I compared to their nondisabled peers (Prevatt et al., 2010; Tzur, Xin, Si, Kenney, & Guebert, 2010).

The results of Research Question 3, dealing with differences in mathematics, were surprising as research indicate that students with SLDs often experience challenges with more advanced work (Letrello & Miles, 2003). Nondisabled students' performance in subjects (e.g., English I, Algebra I, Biology I, and physical science) were significantly better than their disabled peers in a study by Zhang, Katsiyannis, and Kortering (2007). Transition periods are challenging to anyone and the emotional stress experienced during these periods may lead to developmental difficulties. Students with SLDs' level of anxiety is expected to rise during the transition resulting in lower EOC scores (Cauley & Jovanovich, 2006; Letrello & Miles, 2003).

The differences in results of this study may be due to the sources of achievement data utilized as well as the participation size. Recently, there was increased interest in providing transition programs to vulnerable students due to the high dropout rate after grade 9 and this might have resulted in improved scores for students with SLDs (Cauley & Jovanovich, 2006). These findings warrant further research.

Implications of the Findings

The results of this study add to the body of knowledge regarding the academic achievement of students with SLDs and bring with it the realization that these students may be coping better with the high-stakes state exams than initially thought. In both Research Questions 1 and 3, the Texas students with SLDs performed better than expected on the Grade 8 STAAR mathematics and the transition from Grade 8 mathematics STAAR versus Grade 9 Algebra I EOC.

When considering the different findings between this study and the longitudinal study of Wagner et al. (2006), policy makers could benefit by the results of this study. In the nationwide study of Wagner et al. (2006), students with SLDs did rather dismally in the mathematics assessment administered while the current study revealed similar and even better scores on the state test (STAAR). This may be indicative of differences in instruction practices or emotional support to students with SLDs in the state of Texas. Should this be the case, policy makers should be cognizance of the fact and identify the key differences for application in the other states of the U.S.

The current study made use of a methodological approach, namely the causal-comparative design of Gall et al. (2006). As this approach compares two sets of existing data, it is not an empirical study and cause-effect statements cannot be made. Whereas the data collected by means of existing data is convenient and therefore a great time saver, the question arises whether similar exam results could be obtained by means of an empirical study. The application of the causal-comparative design may not be appropriate for this kind of study to deal with data. To compare the study of Wagner et al. (2006) with the results of this study, an experimental design should be followed where a specific test is drafted and administered to a selected group of students with SLDs. This would yield comparable test results obtained from a high school. Policy makers nationally could utilize the findings of this study to inform future policies and regulations regarding mathematics instruction. Teachers of students with SLDs may be interested in this study to inform the teaching of mathematics to students with SLDs. School administrators and resource teachers could use the results of this study to inform students with SLDs of the results of past students to motivate these students to pass their exams.

Limitations of the Study

One of the limitations of this study is that it only focused on Texas and results may not be the same for other states. The question here is whether the students in other states have similar results and if the mathematics instruction is the same for all the states. In other words, do all students with SLDs in the U.S. do better in mathematics than some years ago or is it only in Texas? To what can one ascribe the improved scores and whether it derived from better classroom instruction? This aspect needs to be explored further.

Although the participants were matched in terms of gender and race, the possible influence of socio-economic status (SES) and family situation on performance in mathematics and algebra was not considered in this study. Students living in poverty face different hardships and may lack parental and societal support to do well at school and this could negatively influence their assessment scores (White, 1982). Although a random sample was selected, matching of students with SLDs and their nondisabled peers could result in nonconformance with the actual demographics of the population. The different subgroups may therefore be differently represented in the sample and the results could be influenced as a result.

As mentioned earlier, 9% of students in the state of Texas have been identified as having SLDs, whereas 13% students are registered as students with SLDs nationwide. This raises the question about the diagnosis of students with SLDs in Texas versus the rest of the country. The fact that 4% fewer students with SLDs in Texas schools existed might indicate that the inclusion criteria are different and that admission to special education may be dissimilar compared to the rest of the country. This study might have findings different to what was expected (e.g., in the STAAR mathematic scores and the transition scores) because of this. This matter warrants further research.

The purpose of this study was to determine relationships between existing scores on the Grade 8 STAAR mathematics and Grade 9 Algebra I EOC exams and a causal-comparative design was chosen to satisfy this goal. Due to the nonexperimental nature of the causal-comparative design, definite conclusions regarding cause and effect cannot be made. This also limits the generalizability of the results to other populations.

By using extant data derived from the TEA (2010, 2012a, 2012b, 2013a, 2013b, 2014a, 2014b, 2015a, 2015b, 2015c, 2015d) Public Information Management System, it was assumed that the assessments were administered uniformly and in keeping with the instructions set out by the education department. It was further assumed that the students with SLDs received the appropriate accommodations they qualified for and were not disadvantaged in any manner. Should schools not administer the assessments uniformly, or not grant accommodations to students with SLDs on similar grounds, the scores may be different as a result. Findings based on the scores may therefore be not correct.

Recommendations for Future Research

Regarding the results of Research Questions 1 and 2, the nature of this study was not longitudinal and comparison with the national study of Wagner et al. (2006) is not possible. Data that stretched over a longer period could be requested from the Agency to determine trends over time. Furthermore, the STAAR and EOC assessments are administered nationwide and this valuable data source can be utilized to draw conclusions over a longer time and larger sample. The results of such research would be more useful as parallels could be drawn across states, which may highlight different approaches in instruction that may prove successful when teaching mathematics and algebra to students with SLDs.

Pertaining to Research Question 3, focusing on the transition between Grade 8 mathematics and Grade 9 Algebra I, the differences in results of this study might have occurred due to the sources of achievement data utilized as well as the participation size. Recently, there was increased interest in providing transition programs to vulnerable students due to the high dropout rate after Grade 9 and this might have resulted in improved scores for students with SLDs (Cauley & Jovanovich, 2006). Research to determine the effectiveness of the transition programs in supporting students to maintain their mathematics scores will highlight best practices in this regard.

The influence of SES has been widely researched and White (1982) has found that although this is an easily identifiable variable, it does not exhibit a strong relationship with academic achievement. These findings were echoed by Barton's (2003) study of a large body of research regarding factors that influence academic achievement and pointed out that familial support as well as societal elements together with school, all rooted in SES, were closely associated with academic results.

White (1982) indicated that family characteristics, sometimes erroneously counted as SES, revealed a stronger relationship with academic performance. Prevatt et al. (2010) reported on the negative influence of anxiety on mathematic performance; adverse family circumstances may contribute to feelings of anxiety and thus negatively influence algebra achievement of students with SLDs. Research in this field supported a view that these students and their families might lead to better achievement and reduced school dropout rates.

Research regarding the differences between different race groups and mathematic achievement of students with SLDs should provide insights that could lead to practical ways to support such students and their families. Barton (2003) studied 14 areas of possible influence to academic achievement and their relationship to race amongst others. Barton (2003) pointed out that minority and poor schoolchildren face higher incidences of conditions that prevent them from achieving at school and that these conditions lead to a gap in cognitive development. In an endeavor to remove such gaps in the lives of students with SLDs belonging to minority groups, research should be undertaken to determine those factors that further impact on their academic achievement in the field of mathematics. In addressing these factors academic achievement, and ultimate profitable placement in the workforce, could be achieved.

Summary and Conclusions

This study set out to assess the academic performance of general education and students receiving special education services by comparing Grade 8 students' scores on the mathematics STAAR with Grade 9 students' scores on the EOC for mathematics. A causal-comparison design was utilized to identify the relationships between quantitative variables in existing date (Gall et al., 2006). For this non-experimental study extant assessment scores were obtained from the TEA (2010, 2012a, 2012b, 2013a, 2013b, 2014a, 2014b, 2015a, 2015b, 2015c, 2015d) Public Information Management System.

The literature review indicated that students with SLDs exhibit deficiencies in working memory capacity, inhibitory ability, and speed of processing (Passolunghi & Siegel, 2004). These areas are linked with achievement in mathematics and other school subjects. In a nationwide longitudinal study, Wagner et al. (2006) found that students with learning disabilities lag behind their nondisabled peers in mathematics, computation, and problem solving, placing them below the 25th percentile. The lack of academic achievement in mathematics and the Algebra I course in the case of students with SLDs was prevalent in several other studies (Prevatt et al., 2010; Tzur et al., 2010).

Based on the findings in literature, this study expected students with SLDs to perform poorer than their nondisabled peers in the high-stakes assessments. These assumptions were disproved in some instances, as the results from the Grade 8 STAAR mathematics exam for 2013-2014 did not reveal any statistically significant differences between the students with SLDs and their nondisabled peers. In terms of achievement in Algebra I, the assumptions were confirmed, as the Grade 9 Algebra I EOC scores yielded statistically significant differences between the two groups of students. Regular education students achieved better scores on all six categories assessed in the Algebra I EOC in the 2013-2014 assessment periods.

The research findings for Research Question 3, explored the assessment scores of students who transitioned from Grad 8 mathematics in 2012-2013 to Grade 9 Algebra I in 2013-2014. The expectation was that the students with SLDs would experience either the same or more difficulties as their nondisabled peers. The results revealed that the students with SLDs scores remained constant during the transition period whereas the general education students' 2013-2014 scores for the Grade 9 Algebra I EOC were lower compared to their mathematics STAAR scores for the previous year. Investigation of the staff interaction with the students with SLDs during the transition year might indicate which interventions could also benefit the general education students during this transition period.

The U.S. student academic achievement is falling farther behind other developed nations' students in the areas of STEM or STEM subjects (Peterson et al., 2011). Because mathematics achievement for general education students is under scrutiny, there is a need to determine the mathematics achievement of students with SLDs to assess the need for enacting programs that enable special education students to attain the same level of achievement as their general education peers.

Successful mathematics and algebra instruction to students with SLDs may prove to be of cardinal importance in the efforts to increase the participation of students with SLD in STEM programs. The results of this study suggest that policy makers and school employees should address factors that increase the success of students with SLD in Grade 8 math and Grade 9 algebra to determine which practices may lead to improve math performance for all students, including those with SLDs.

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