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The Effects of Socioeconomic Status on Mathematical Achievement

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by

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Declaration of Originality

I do hereby declare and attest to the fact that this is an original study based solely upon my own scholarly work at Lindenwood University and that I have not submitted it for any other college or university course or degree.

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Abstract

Socioeconomic background is one of the strongest, best-established predictors of a student's academic achievement (Claro, Paunesku, & Dweck, 2016). The purpose of this study was to conclude the difference in mathematics achievement levels based on socioeconomic status determined by the concentration of free and reduced price meal rates in elementary schools grades K-4. Identification of specific mathematics achievement gaps could lead to a more individualized program of instruction and increased awareness of professional learning needs at instructional sites. To recognize if there was a difference in mathematical achievement levels based on socioeconomic concentration, three quantitative research questions were asked as part of this study. Data were used to apply a *t*-test to document significance. The *t*-test results exposed a statistical significance between mathematics achievement levels of students attending elementary schools with a free and reduced price meal population above 70% compared to K-4 elementary schools with a free and reduced price meal population below 30% on beginning-of-the-year and end-of-the-year diagnostic assessment. The *t*-test results did not result in a statistical difference in growth rate students attending elementary schools with a free and reduced price meal population above 70% compared to K-4 elementary schools with a free and reduced price meal population below 30%.

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Chapter One: Introduction

A major responsibility of the United States government is to offer adequate services and opportunities to its people in an attempt to support their health, social, and economic aspirations (Quinn, 2015). The achievement of the objective results in a nation wherein every citizen is entitled to equal opportunities, rights, freedoms, justice, and success (Quinn, 2015). Unfortunately, many global societies have not been able to achieve this goal due to a number of socioeconomic gaps (Iammartino, Bischoff, Willy, & Shapiro, 2016). Tosto, Asbury, Mazzocco, Petrill, and Kovas (2016) cited, "International surveys predict an increase of almost 1% in annual GDP [gross domestic product] growth per capita with half a standard deviation's increase in individual math and science performance" (p. 1). Benner, Boyle, and Sadler (2016) asserted the socioeconomic status (SES) of a given cultural group dictates the experiences and wellbeing of its people. Gaps in SES in many countries have led to segregation, inequality, and the inability to achieve personal goals (Iammartino et al., 2016).

Socioeconomic background is one of the strongest, best-established predictors of academic achievement (Claro, Paunesku, & Dweck, 2016). The achievement gap in socioeconomic backgrounds remains a significant issue that has led to the implementation of many educational reforms and policies in nations around the world (Bohrnstedt, Kitmitto, Ogut, Sherman, & Chan, 2015). For example, the No Child Left Behind (NCLB) Act was implemented in the United States in 2001 to ensure more children were empowered through quality education (GreatSchool, 2015). Proposed changes in the U.S. education system were intended to support the needs of all children by addressing key areas such as reading, science, and mathematics (Spring, 2017). In the new policy, the Every Student Succeeds Act (ESSA), an accountability system was eliminated that punished states if too few students were proficient in reading and math—a pillar of the NCLB Act that was largely blamed for creating a culture of over-testing (U.S. Department of Education, 2018). Instead, states are required to create student performance accountability and teacher evaluation systems and can decide how to fix failing schools and close achievement gaps (U.S. Department of Education, 2018). Similarly, many countries have been on the frontline to promote adequate skills in subjects such as mathematics to meet the needs of more students and to make it easier to achieve their potential as adults (U.S. Department of Education, 2018).

Rector and Sheffield (2014) found the total amount spent in the U.S. to combat poverty in the last 50 years exceeded $22 trillion (p. 8). Rector and Sheffield (2014) also noted the U.S. had 1.6 million children living in poverty in 1964, and the number of children has tripled to 4.8 million today (p. 9). Jensen (2016) showed the percentage of students living in households of poverty in 2005 was about 16% (p. 7). By 2015, 51% of students attending public schools in the U.S. were from homes that met federal standards for poverty (Jensen, 2016, p. 7).

The discipline of mathematics has become one of the fastest growing disciplines needed for careers today (Tosto et al., 2016). The knowledge and skills required to be productive and gainfully employed in the 21st-century world are drastically different than those needed a generation ago (Tosto et al., 2016). The current job market requires employees who are prepared to learn, analyze, and use mathematical ideas they may not have previously encountered (Tosto et al., 2016). Students today must have a higher mathematical proficiency to achieve adequate employment in the current and future workplace (Autor, Dorn, Hanson, & Song, 2014). In 1900, 41% of the U.S. workforce was employed in agriculture; by 2000, that share had fallen to 2% (Autor et al., 2014, p. 1799). Because of the shift in employment opportunities, the skillset students need is ever-changing (Autor et al., 2014).

Unfortunately, there is a wide gap in mathematics attainment, which makes it impossible for low-performing children to achieve their economic goals and potential as adults (Wagner, 2014). In addition, Larson (2017) asserted the teaching gap affects the success of students while in school and after completing school. In past studies, mathematics scores on standardized tests have been linked to socioeconomic status and future economic outcomes of students (Petrilli & Wright, 2016). Arnett-Hartwick and Walters (2016) stated:

> Two things must occur to break the cycle of generational poverty: (1) obtaining an education (e.g., diploma) and (2) having individuals intervene and encourage children at every point of need (Jensen, 2009). These two factors will lead to the best route to eradicating poverty: employment. (p. 1)

Cochran-Smith and Villegas (2016) believed good-quality teaching remains one of the best practices for promoting academic performance. Learners who received quality instruction and who were supported throughout the mathematics skills development period found it easier to achieve their potential (Payne & Tucker, 2017). Hattie's (2015) synthesis of evidence-based research regarding instructional strategies yielding the greatest effect size on student achievement provided data around strategies and influences on educational attainment. Hattie (2015) determined:

> An effect size is a useful method for comparing results on different measures (such as standardized, teacher-made tests, student work), or over time, or between groups, on a scale that allows multiple comparisons independent of the original test scoring (for example, marked out of 10, or 100), across content, and over time. This independent scale is one of the major attractions for using effect sizes, because it allows relative comparisons about various influences on student achievement. (p. 3)

While teacher efficacy has the most significant positive effect size on student achievement of 1.57, Hattie (2015) identified socioeconomic status as having an effect size much lower at 0.54 (p. 251).

Hattie (2015) and Payne and Tucker (2017) identified students in poverty as under-resourced and at high risk for an achievement gap. Meeting today's mathematical standards requires students to complete abstract tasks that harness problem-solving ability, intuition, creativity, and precision, which are cognitive tasks required of skilled students and workers alike (Autor et al., 2014). Scholars and researchers have not focused on the nature of the cognitive mathematics skill attainment gap (Gurses, Cetinkaya, Dogar, & Sahin, 2015; Jensen, 2017; Wagner, 2014). Past studies have focused on child developmental attributes, social sciences, and language development, thereby ignoring the implications of mathematics skills throughout the learning process (Bohrnstedt et al., 2015).

The background of this study regarding how socioeconomic indicators may affect mathematics achievement in elementary grades, including a detailed analysis of the background and nature of the problem, was included in this chapter. Emerging issues and concerns that revolve around gaps in mathematics attainment and achievement of personal, social, and economic goals were addressed (Rabiner, Godwin, & Dodge, 2016). Mathematics education is examined as a critical factor for positive wage attainment in a student's future (Tosto et al., 2016). The statement of the problem, purpose of the study, and research questions were also described. The significance of the study was then offered, along with the definition of key terms and an explanation of study limitations and assumptions.

Background of the Study

Jensen (2017) reflected, "Gone are the many good-paying jobs that required a high school diploma and hard work (manufacturing, mining, automobiles, oil and gas, and more). …Technology (robots, automated websites, and smartphones) has replaced people for many of these jobs" (p. 5). The shift in U.S. educational policies, such as NCLB and the ESSA, has led to critical research about poverty and has informed the country's education sector (Cohen, Spillane, and Peurach, 2018). The increased accountability of schools entering the NCLB era led to a critical focus on various competencies and skills being taught and measured to ensure college and career readiness (Cohen et al., 2018). To maintain its economic position and performance, the U.S. government put great emphasis on K-12 mathematics education (Popkewitz, Diaz, & Kirchgasler, 2017). The goal of the United States to compete globally in mathematical sectors has been taken seriously in an attempt to ensure the country's global position and hegemony are retained (Popkewitz et al., 2017).

The increased focus on mathematics has led to the implementation of robust policies such as NCLB and the Common Core State Standards (CCSS), which were designed to increase educational rigor and accountability to meet the changing needs of the U.S. economy (Kelley & Knowles, 2016). Unfortunately, the nation continued to grapple with a wide range of challenges and obstacles that affect student academic success outlined in legislative policies (Payne, 2018). For instance, Hart, Ganley, and Purpura (2016) indicated the alarming state of U.S. mathematics education was most evident when standardized test scores of American students were compared to scores of international peers.

The Program for International Student Assessment (PISA) of 2018 documented the average math score of a 15-year-old in the United States ranked 37th in mathematics among the 78 nations reporting, with math scores statistically significantly below the National Education Statistics average (Balingit & Van Dam, 2019, p. 1). This low ranking in mathematics and other subject areas raised concerns that high school graduates in the United States were not prepared to succeed in the global economy (Balingit & Van Dam, 2019). President Obama, in his 2009 remarks at Cairo University, indicated, "Education and innovation will be the currency of the 21st century" (The White House, 2009, para. 62). Additionally, the U.S. Bureau of Labor Statistics projected the need for some type of postsecondary education for an entry-level job would grow the fastest during the 2010-2020 decade, compared with growth for non-degreed entry-level jobs (Dubina, Morisi, Rieley, & Wagoner, 2019).

According to the National Council of Teachers of Mathematics (NCTM) (2019), the importance of solid mathematics understanding is critical now more than ever in the United States. In today's ever-changing landscape, the need for knowledge, tools, and ways of communicating mathematics are at an all-time high (Kelley & Knowles, 2016).

Individuals who manage to develop adequate skills and competencies in mathematics are empowered to pursue a wide range of personal goals and objectives (Abraham, Slate, Saxon, & Barnes, 2014). High school and college graduates in the United States should be prepared to compete globally for employment (Abraham et al., 2014). Students who achieve mathematical proficiency tend to have greater problem-solving and critical thinking skills, which are needed in the global marketplace (Ballentine, Hammack, & Stuber, 2017). With this in mind, the need to use mathematics will continue to grow, both in the classroom and in the workplace (Abraham et al., 2014). Over the years, teachers and parents have been encouraged to combine efforts and focus on initiatives to ensure the right mathematical content was available to students (Abraham et al., 2014).

Larson (2017) indicated that students must have an understanding of how to use mathematics in an ever-changing environment. The acquisition or possession of mathematics skills has made it possible for students to achieve their potential career success (Harmon & Wilborn, 2016). According to the NCTM, everyone needs to have a working knowledge of mathematics, and all students from all backgrounds should have the opportunity and support to increase their depth and understanding of mathematics (Roth, 2017). The provision of adequate competencies has empowered and made it easier for more learners to address higher-level mathematics competencies and emerge successful (Harmon & Wilborn, 2016). Harmon and Wilborn (2016) found a lack of mastery of the depth of elementary and middle school level competencies hinders the success of graduates in training for science, technology, engineering, and mathematics fields of work.

Despite these expectations in terms of U.S. math achievement, an achievement gap still existed for students who came from economically disadvantaged homes (Hart, Ganley, & Purpura, 2016; Payne & Krabill, 2016; Wagner, 2014). According to Jensen (2016), the brains of children from poverty differed in three primary ways: (1) chronic stress, (2) weaker cognitive skills, and (3) impaired socioemotional relationships. As a result, teachers often observed lower cognitive skills (deficient vocabulary, poor reading skills, and weak working memory) and impaired socioeconomic skills (poor manners, misbehaviors, or emotional overreactions) in students from poverty (Payne & Krabill, 2016). About half of all children born in 2015 will be on food stamps at some point in their lives (Rank & Hirschl, 2015). With such a large population of children living in poverty, teachers must help students catch up from starting school one to three years behind their classmates (Jensen, 2017).

The Missouri Assessment Program (MAP) measures student achievement in the areas of English Language Arts and Mathematics for students in the third and fourth grades in Missouri (Missouri Department of Elementary and Secondary Education [MODESE], 2018). The MAP assessment data revealed there was a strong correlation between schools with more students who qualified for free and reduced price meals and low student achievement in all academic areas (MODESE, 2017). School districts with a high number of low-socioeconomic students have expressed meeting state and federal requirements on standardized tests were unrealistic (Lee & Bierman, 2015). Other educators challenged this theory and implied other variables outside the socioeconomic status of a student are determining factors of academic performance (Marzano, 2017).

It is, therefore, evident there were numerous causes of achievement gaps in the area of mathematics (Lee & Bierman, 2015). For instance, many children find it hard to achieve better grades due to their socioeconomic status, cultural environment, and family background (Rank & Hirschl, 2015). Additionally, the nature of instruction and teaching models applied in different schools have been critical factors that dictate the level of educational attainment (Marzano, 2017).

Broer, Bai, and Fonseca (2019) established a relationship between the issue of socioeconomic status and educational performance. The level and nature of the learning process were observed to influence academic performance significantly (Broer et al., 2019). With academic gaps in place, theorists have acknowledged that educational performance was a function based on the ability to use skills gained in the classroom to pursue career skills (Jensen, 2016; Smith, 2015). To achieve positive outcomes, researchers have focused on some of the best approaches to improve student achievement (Jensen, 2016). When this goal was achieved, it became easier for U.S. educators to deal with the major issues affecting their students (Wagner, 2014).

In the recent past, U.S. schools have been keen to hire and recruit educators to meet the needs of many children (Harris, 2015). Educators have been encouraged to focus on existing models and instruction to maximize skills attained by learners in different schools (Wingard & Lapointe, 2016). The focus on mathematics has continued to gain attention because mathematics dictates or influences a wide range of attributes in a person’s life (Wingard & Lapointe, 2016). Additionally, the American population and student enrollment have been on the rise (U.S. Department of Education, 2018). There was a need to implement powerful initiatives to support the educational needs of the increasing population and make it easier for students to achieve their goals in life (Wingard & Lapointe, 2016.)

As learning needs have shifted, so has preparation for teachers (Harris, 2015). Teachers have been supported with adequate resources and competencies in the past (Harris, 2015). The main objective was to ensure teachers were aware of educational gaps and issues affecting many learners from poverty (Harris, 2015; Wingard & Lapointe, 2016). Students whose teachers were skilled and certified have increased chances of positive educational outcomes (Hall & Simeral, 2015; Harris, 2015). Achievement was, therefore, related to better outcomes in life (Peters et al., 2017; Rossiter, 2015).

Despite the implementation of powerful policies and incentives, the problem of socioeconomic outcomes has continued to plague American society for many years (Hall & Simeral, 2015). The unique gap in education and mathematics attainment levels made it impossible for many individuals to achieve their goals in life (Harris, 2015). The current position held by the government and educational policymakers was that all students deserve adequate and quality instruction regardless of socioeconomic status (Petrilli & Wright, 2016).

New policies have been implemented to ensure powerful educational models focused on the needs of all children from minority and majority cultural backgrounds who deserve equal educational opportunities (Hall & Simeral, 2015; Harris, 2015; Petrilli & Wright, 2016; Albrecht & Brunner, 2019). While the United States has managed to implement highly structured frameworks to ensure children have access to education, the issue of quality appeared to have escaped the attention of many individuals (Hall &

Simeral, 2015; Harris, 2015; Petrilli & Wright, 2016). There was a need to conduct research and deliver evidence-based approaches to support the changing needs of individuals in the country and to promote economic development (Harris, 2015).

Theoretical Framework

Jensen (2016) stated, "Poverty is a chronic experience resulting from an aggregate of adverse social and economic risk factors" (p. 6). Upwards of 5.3 million Americans live in extreme poverty and have less than $2 per day of spendable cash (Deaton, 2018, p. 1). Living in poverty affected students in three major ways: increased stress, cognitive gaps, and less emotional support (Jensen, 2016). These effects have a dramatic effect on the brain and the functions necessary for successful learning outcomes in educational settings (Jensen, 2016).

There was a significant body of researchers who have categorized the importance of understanding how the brain learns in order to educate students and how to best apply that knowledge to research-based instructional strategies (Jensen, 2017; Sousa & Tomlinson, 2018). Teachers could employ brain-based learning theory to guide their instruction in the classroom based on student brain development and mindset (Caine, Caine, McClintic, & Klimek, 2009; Jensen, 2017, Sousa & Tomlinson, 2018). Maynard (2016) stated, "research in the field of brain-based learning is a combined pool of research that encompasses neuroscience, biology, psychology and the field of education" (p. 1).

The frameworks of brain-based learning from theorist Eric Jensen were used to frame this study. Jensen (2005, 2009, 2013, 2016, 2017) has researched and published multiple works about the effects of trauma on the brain. To untangle the complexities between socioeconomic status and academic achievement, as examined in this current study, a brain-based learning theory will be adopted. Jensen (2017) has researched the brain-based learning theory for over 20 years and has published more than 35 books related to brain-based learning. Jensen (2017) documented the effects of living in poverty on the student brain and strategies for teaching to positively impact the learning of students affected by poverty. Armstrong (2016) reminded educators that brain-based learning strategies were helpful but not if used in isolation. The learning in the brain occurred when multiple regions of the brain synchronized, so ignoring one region could also act as a barrier for long-term memory (Armstrong, 2016).

Caine et al. (2009) illustrated how to apply brain-based learning strategies to the process of teaching and learning to positively address some of the negative impact poverty has had on the brain. Caine et al. (2009) stated that more focus should be placed on learning in a meaningful way rather than a more traditional approach that relied on memorization. The focus on the function of each part of the brain allowed students to connect to their learning to the way they received, perceived, and acted on learning (Jensen, 2017). Specifically, Jensen (2016) outlined negative effects on the brains of students that may relate to the trauma endured by living below the poverty line. The theory contained evidence that the effects of stressors, due to low SES, on the hippocampus of the brain were not fixed and may be changed for positive outcomes (Benner et al., 2016).

According to brain-based learning theory, chronic adverse social and economic hardships changed the development of the brain and may have dictated the level of educational attainment in society (Crosnoe & Ansari, 2016; Jensen, 2016). In many communities, the SES of different groups has led to a situation whereby inequality and segregation affect the life experiences and outcomes of many people (Suitts, 2015). For instance, the experience of a minor or underage child has been observed to reflect his or her neighborhood's demographics (Benner et al., 2016). Therefore, children who study in learning institutions with high concentrations of poverty tend to have reduced educational attainment (Rank & Hirschl, 2015). Additionally, such persons tend to be unable to perform positively in the social setting of a school and future work settings and have double the rate of violent victimization compared to persons in high-income households (National Academies of Sciences, Engineering, and Medicine, 2017).

Albrecht & Brunner (2019) asserted that children from poor neighborhoods or marginalized communities attended high-poverty schools that tend to have fewer competent or experienced educators. These aspects of high-poverty challenges inhibited learning and made it impossible for targeted students to record positive results (Albrecht & Brunner, 2019). Schools in less-concentrated low-poverty environments displayed increased disparities in the level of educational attainment than did schools with higher concentrations of high-poverty environments (MODESE, 2017). Educational attainment was also difficult for learners from poverty who were focused on mathematics skills and competencies (MODESE, 2017). Generational poverty persisted, even though the United States has been focusing on the best approaches to maximize socioeconomic positions (Harris, 2015). Arnett-Hartwick and Walters (2016) reported:

> Policies and initiatives have been launched to address the educational challenges of economically disadvantaged students. These include the Carl D. Perkins Acts

> of 2006 and 2012, the No Child Left Behind Act of 2002, the 21st Century Skill Sets, and, most recently, the passage of the Every Student Succeeds Act. (p. 1)

The gap in academic achievement demonstrated why there should be powerful approaches to deal with this challenge and empower more people to achieve their potential (Jensen, 2016).

This theoretical argument was considered to inform the research questions, and problem statement presented. The theoretical framework included meaningful insights that described the existing gaps in socioeconomic status and educational attainment in the area of mathematics (Jensen, 2016). The brain and cognitive development were imperative to educational achievement at all levels; therefore, the work of Jensen regarding teaching students in poverty (2009, 2013, 2016, 2017) served to frame the understanding of possible differences found in the data collected. Jensen's (2009, 2013, 2016, 2017) work continued to include more instructional strategies for use in the classroom as he gathered more research about the differences in brain and cognitive development of students growing up in poverty. Students, teachers, and policymakers dealt with a wide range of challenges, including poverty, lack of opportunities, and the inability to assist students in achieving their potential (Petrilli & Wright, 2016). Through the use of the brain-based learning framework, it was possible to present meaningful insights and ideas that could be implemented in different school settings to provide strategies for overcoming mathematical achievement differences if any were discovered (Payne, 2018).

Statement of the Problem

The focus on education attainment and SES have been the central focus of many studies in the past (Gurses et al., 2015; Jensen, 2017; Payne, 2018; Wagner, 2014). However, very little attention has been given to individual subjects such as mathematics to understand or predict how socioeconomic status impacts performance in an individual subject (Harris, 2015). Consequently, it was difficult to determine whether student performance in mathematics was related to teacher quality, life goals, socioeconomic status, or school characteristics (Darling-Hammond, Flook, Cook-Harvey, Barron, & Osher, 2019). Additionally, little was known regarding the implications of mathematics skills and socioeconomic achievement (Boaler, 2016).

In May of 2017, the administration of a Midwestern school district began reviewing student achievement data because of a discrepancy in student math achievement compared to English language arts achievement on the state accountability tests (D. Whitham, personal communication, March 29, 2019). The Analytics Department in the school district was commissioned to examine local diagnostic data in the form of i-Ready Diagnostic Assessment data (D. Whitham, personal communication, March 29, 2019). The i-Ready Assessment suite is a research-based testing and instructional platform that provides teachers and school leaders with data on student performance gaps and accompanying personalized resources to support academic growth (Curriculum Associates, LLC. 2017a). The i-Ready Diagnostic Assessment results for reading and math in grade levels K-8 were analyzed by the Analytics Department team members (D. Whitham, personal communication. March 29, 2019).

The data were presented to the curriculum department and department leaders to create a plan of action to increase math achievement (C. Castillo, personal communication, March 28, 2019). A mathematics workshop model instructional configuration was created and implemented in the Midwest school district (C. Castillo, personal communication, March 28, 2019). One component of the instructional configuration is providing instruction in the zone of proximal development during small group instruction (C. Castillo, personal communication, March 28, 2019). This instruction should be specific to the student group being taught (C. Castillo, March 28, 2019). The problem to be addressed was if, and to what extent, a difference in mathematical achievement gap was evident in elementary sites with greater than 70% free and reduced price meal rates compared to elementary sites with less than 30% free and reduced price meal rates as assessed using the i-Ready Diagnostic Assessment.

Purpose of the Study

The purpose of this study was to conclude the difference in mathematics achievement levels based on socioeconomic status determined by the concentration of free and reduced price meal rates in elementary schools. In addition, data were analyzed to determine the difference in one school year's increase in mathematics achievement of students on the i-Ready Diagnostic Assessment based on socioeconomic status. Math achievement was measured using the average scale scores from both the beginning-of-year (BOY) and end-of-year (EOY) i-Ready Diagnostic Assessment. Growth was measured by analyzing data of students in the sampled schools with paired data from the BOY and EOY i-Ready Diagnostic Assessment. The targeted location of this study was an urban school district in the Midwest. By reviewing the outcome of the study, educators could build or design instruction specific to the socioeconomic status of students they support and increase math achievement levels on standardized assessments.

Research questions and hypotheses. The following research questions and hypotheses guided the study:

1. What difference exists in the scale scores of students testing on the beginning-of-the-year (BOY) mathematics i-Ready Diagnostic Assessment in K-4 elementary schools with a free and reduced price meal population above 70% compared to K-4 elementary schools with a free and reduced price meal population below 30%?

   $H1_0$: There is no difference in the scale scores of students on the beginning-of-the-year (BOY) mathematics i-Ready Diagnostic Assessment in K-4 elementary schools with a free and reduced price meal population above 70% compared to K-4 elementary schools with a free and reduced price meal population below 30%.

   $H1_a$: There is a difference in the scale scores of students on the beginning-of-the-year (BOY) mathematics i-Ready Diagnostic Assessment in K-4 elementary schools with a free and reduced price meal population above 70% compared to K-4 elementary schools with a free and reduced price meal population below 30%.

2. What difference exists in the scale scores of students testing on the end-of-the-year (EOY) mathematics i-Ready Diagnostic Assessment in K-4 elementary schools with a free and reduced price meal population above 70% compared

to K-4 elementary schools with a free and reduced price meal population below 30%?

$H2_0$: There is no difference in the scale scores of students testing on the end-of-the-year (EOY) mathematics i-Ready Diagnostic Assessment in K-4 elementary schools with a free and reduced price meal population above 70% compared to K-4 elementary schools with a free and reduced price meal population below 30%.

$H2_a$: There is a difference in the scale scores of students testing on the end-of-the-year (EOY) mathematics i-Ready Diagnostic Assessment in K-4 elementary schools with a free and reduced price meal population above 70% compared to K-4 elementary schools with a free and reduced price meal population below 30%.

3. What difference exists in student scale score growth on the mathematics i-Ready Diagnostic Assessment in K-4 elementary schools with a free and reduced price meal population above 70% and K-4 elementary schools with a free and reduced price meal population below 30%?

   $H3_0$: There is no difference between the student scale score growth on the mathematics i-Ready Diagnostic Assessment in K-4 elementary schools with a free and reduced price meal population above 70% and K-4 elementary schools with a free and reduced price meal population below 30%.

   $H3_a$: There is a difference between the student scale score growth on the mathematics i-Ready Diagnostic Assessment in K-4 elementary schools with

a free and reduced price meal population above 70% and K-4 elementary schools with a free and reduced price meal population below 30%.

Significance of the Study

Despite the initiatives implemented in the United States to reduce SES inequalities, a major challenge still affected the educational performance of many students (Jensen, 2017; Payne & Tucker, 2017). While schools are required to meet specific annual targets in several academic areas such as mathematics, the sad news was that not many students have been able to realize their academic goals (Petrilli & Wright, 2016). In this study, student mathematics assessment data were analyzed to determine whether a difference in achievement existed based on the concentration of students of low SES in the learning setting. The results of the study could inform educators and policymakers in efforts to support the needs of students and may improve the quality of mathematics instruction available in different learning environments (Jensen, 2005, 2009; Sousa & Tomlinson, 2018; Wagner, 2014).

Consequently, educators and policymakers could become aware of the nature of the SES achievement gap and could be on the frontline to implement evidence-based practices and policies to improve student academic success in mathematics. The information could add to the body of knowledge regarding poor mathematics skill attainment as a major risk factor for poor economic gains or outcomes (Jensen, 2016). This ideology could pave the way for the implementation of better policies and models driven by evidence-based theories to reduce the existing SES-based academic achievement gap (Broer et al., 2019). The findings gained from the study could also represent ideas to empower parents, teachers, and stakeholders to focus on the best attributes to empower learners to realize economic goals (Banerjee, 2016).

The ESSA allowed states to create their own accountability systems as well as their own teacher evaluation systems (U.S. Department of Education, 2018). This research may yield meaningful insights to inform educators and administrators at the state and local levels about existing differences between the two groups of scores when compared. This knowledge could be used to promote powerful models for increasing access to quality education and an opportunity to access quality math instruction (Allsopp, Lovin, van Ingen, 2017). The study outcomes could be beneficial to students living in poverty-stricken regions and may also apply to children from minority groups or marginalized societies. Research involving mathematical achievement could be used to decide how to structure instruction to close achievement gaps (U.S. Department of Education, 2018).

Definition of Key Terms

Academic success. York, Gibson, and Ranking (2015) provided a "…theoretically grounded definition of academic success that is made up of six components: academic achievement, satisfaction, acquisition of skills and competencies, persistence, attainment of learning objectives, and career success" (p. 9).

Achievement gap. An achievement gap is when a student group continually outperforms another student group on achievement tests (Kotok, 2017).

High-poverty school. For the purpose of this study, high-poverty schools enroll 70-100% of students who qualify for free or reduced price meals. The U.S. Department of Agriculture (2018) defined high-poverty schools as schools with enrollments of 75-100% of students who qualify for free or reduced price meals.

Low-poverty school. For the purpose of this study, low-poverty schools enroll 0-30% of students who qualify for free or reduced price meals. The U.S. Department of Agriculture (2018) defined low-poverty schools as schools with enrollments of 0-25% of students who qualify for free or reduced price meals.

Socioeconomic status (SES). According to the American Psychological Association (2018), "Socioeconomic status is the social standing or class of an individual or group. It is often measured as a combination of education, income and occupation" (p. 1).

Limitations and Assumptions

The following limitations were identified in this study:

Sample demographics. Secondary archival data were gathered for students enrolled in Kindergarten, first, second, third, and fourth grades from the i-Ready Diagnostic Assessment BOY and EOY assessments. All data were collected from an urban Midwest school district. Assessment data were only collected from schools with an average free and reduced price meal rate greater than 70% or less than 30%.

Instrument. The only instrument for this research was a computer-delivered, adaptive assessment developed by Curriculum Associates to assess reading and mathematics knowledge for students in Kindergarten through high school (Curriculum Associates, LLC, 2017b).

The following assumption was accepted:

1. The secondary data were accurately reported.

Summary

In the 21st-century world, mathematics is the fastest-growing discipline in careers (Tosto et al., 2016). With the increased need for more cognitive skills and technical thinking to perform today's careers compared to the more labor-intensive careers in the past, families in poverty are even less likely to break the generational poverty cycle (Arnett-Hartwick & Walters, 2016). Employees in global economies will need high-level academic skills rather than manual labor skills to sustain long-term employment (Rank & Hirschl, 2015). As poverty rates increase and academic achievement gaps grow, students from poverty certainly face an uphill climb to gain employment in a more highly skilled and technical workplace (Rank & Hirschl, 2015). Mathematics education is crucial to the next generation of students in job attainment and career earnings (Boaler, 2016).

The achievement gap has also been linked to social aspects such as culture, gender, and economic background (Petrilli & Wright, 2016). The purpose of this study, therefore, was to focus on the function of education and to examine the nature of the relationship between mathematics achievement and the socioeconomic gap. The findings from the study may be used to develop future concepts for dealing with this issue and for empowering students.

In Chapter Two, a summary of related literature is presented. Additional factors critical to improving academic achievement and impactful on low-SES students' ability to achieve are reviewed**.** The review of literature includes U.S. legislation enacted to close the achievement gap between low and high-socioeconomic status schools (Hess & Eden, 2017).

Chapter Two: Review of Literature

In this study, the level of mathematics scores on standardized tests compared to socioeconomic status were analyzed. The proposed study will add to information about the mathematical achievement of students entering Kindergarten through fifth grades. By gathering evidence of beginning-of-year (BOY) mathematics achievement and end-of-year (EOY) mathematics achievement scores, as well as mathematics achievement growth throughout the school year, educational practitioners may be able to make informed decisions about mathematical achievement gaps and instructional practice to meet students' needs (Roth, 2017). The presented insights may also be a resource for teachers, administrators, and educational policymakers promoting or implementing new policies and models to ensure the educational needs of more students are met.

The purpose of this project was to examine if a difference existed between student assessment scores in mathematics and socioeconomic status. To provide a foundation for the study, a review of related literature is provided in this chapter. Topics included in the literature review are the effects of poverty, brain-based learning related to trauma, history of the Every Student Succeeds Act (ESSA), history and purpose of Title I educational services, and mathematics.

Theoretical Framework

The study allowed for examination of the difference between socioeconomic status and achievement data to determine if poverty created a discrepancy in mathematics competency in elementary schools in a Midwest school district. Diagnostic math achievement data were examined to determine if there was a difference in mathematical achievement between student groups in high and low-poverty schools in one large

Midwest school district. The framework of Jensen's (2005, 2009) brain-based learning theory was used to understand how poverty affected brain development. The following topics were discussed to comprehend the impact of poverty: effects of poverty, brain-based learning and trauma, mathematics, Title I policies, and current educational legislative policies.

Effects of poverty. Payne (2018) stated, "Poverty is defined as the extent to which an individual does without resources" (p. 7). Resources were defined as stability, community, functionality, abstract reality, formal written language, option seeking, abundance, wealth, work/career/larger cause, and more education (Payne, 2018). Members of society have often seen poverty through the lens of financial resources; however, this did not explain fully why some individuals stay in poverty (Payne, 2018). Rothwell and McEwen (2017) explained, "Poverty is generally regarded as the condition of having too few resources to participate fully in society" (p. 1). Poverty was more about other resources an individual had access to, rather than the amount of money he or she could access (Payne, 2018). Rothwell and McEwen (2017) stated, "When compared with non-poor peers, children in poverty are likely to experience lifelong economic, social, and psychological hardship" (p. 1).

Philip DeVol (as cited in Payne, 2018) asserted, "Poverty traps people in the tyranny of the moment, making it…difficult to attend to abstract information or plan for the future – the very things needed to build [toward the attainment of a college degree]" (p. 163). Sadly, many individuals have not been able to step out of poverty due to poor relationships and low educational attainment (Payne, 2018). According to Payne (2018):

> [When] teachers understand how to teach, build relationships, foster relational learning, and direct-teach skills for educational success, awareness is created, cognitive ability is built, and language acquisition is accelerated; all of which make up for lags caused by growing up in a low-resource environment. (p. 162)

Educators should be mindful that "what may seem to be very workable suggestions from a middle-class point of view may be virtually impossible given the resources available to people in poverty" (Payne, 2018, p. 30). Lack of resources not only created challenges for students in schools but was experienced by students in day-to-day life events (Jensen, 2009). Factors that led to poverty were not always within the control of educators (Raun, 2018). When poverty was not alleviated, families were at risk of emotional and social challenges, acute and chronic stressors, cognitive lags, and health and safety issues (Brown, Bynum, & Beziat, 2017; Jensen, 2009). Those factors made everyday living a challenge (Brown et al., 2017; Jensen, 2009).

Family income was associated with academic success, especially during the primary years (Egalite, 2016). Jensen (2009) advised the association was due to problems with transportation, health care, family care, high tardy rates, and absenteeism. Jensen (2009) stated, "Many children raised in poverty enter school a step behind their well-off peers" (p. 38). Child poverty often had an impact that carries throughout a lifetime, particularly if the child lived in poverty at an early age (Farrigan, 2014). In addition, Jensen (2009) explained, "Standardized intelligence tests show a correlation between poverty and lower cognitive achievement, and low-SES kids often earn below-average scores in reading, math, and science and demonstrate poor writing skills" (p. 38).

The middle class was shrinking (Kochhar, 2016). Jensen (2017) claimed, "Poverty is here to stay, and it is getting worse" (p. 7). As a result, educators were faced with challenges due to the effects of poverty (Jensen, 2017). These challenges must be kept in mind in order to advocate, influence, and improve the educational advancement of students living in poverty (Jensen, 2017). Strides have been made in the United States regarding educational opportunities for every student since Brown v. Board of Education 1954 federal ruling (Raun, 2018). Educators needed to continue to work on addressing inequalities seen in academic outcomes of different socioeconomic and race classes (Raun, 2018).

Brain-based learning and poverty. Larsen (2017) stated, "Children are like sponges, absorbing the world as they grow" (p. 1). Experiences in childhood often influenced cognitive processes even into adulthood (Perry & Szalavitz, 2017). Most children's development was impacted by either warm and loving experiences or negative experiences (Craig, Piquero, Farrington, & Ttofi, 2017). As reported in the 1900s Adverse Childhood Experiences (ACE) Study, "the more adversity or trauma you face as a child, the more likely you are to engage in risky behaviors or have poor health as an adult" (Larsen, 2017, p. 1). Assuring the healthy development of all children is essential for societies seeking to achieve children's full health, social, and economic potential (Metzler, Merrick, Klevens, Ports, & Ford, 2017). Preventing early adversity, including child abuse and neglect, is critical if these goals are to be met, and understanding adverse childhood experiences is vital to this prevention (Metzler et al., 2017).

Sorrels (2017) shared, "Betsy Groves, author of *Children Who See Too Much,* defines trauma as, 'any event that undermines a child's sense of physical or emotional safety or poses a threat to the safety of the child's parents or caregivers'" (p. 13). Trauma has two forms: acute or complex (Substance Abuse and Mental Health Services Administration, 2014). Acute trauma is when an individual is exposed to an overwhelming event one time, which is often referred to as post-traumatic stress (Substance Abuse and Mental Health Services Administration, 2014). Pressley & Spinazzola (2015) stated:

> Trauma refers to a dual problem of exposure and adaptation. Complex trauma exposure is the experience of multiple or chronic and prolonged, developmentally adverse traumatic events, most often of an interpersonal nature and early-life onset. These exposures often occur within the child's caregiving system and include physical, emotional and educational neglect, and child maltreatment beginning in early childhood. (p. 2)

Both types of trauma often occurred at the hands of the caretakers of young children, and the trauma could affect children into adulthood (Wilkinson, 2017).

Sorrels (2017) reported, "Children who experience abuse in the early years of life are often diagnosed with ADD/ADHD [Attention Deficit Disorder/Attention Deficit Hyperactivity Disorder] because they live in a chronic state of alarm, hyper vigilant to any possibility of threat" (p. 14). Record-Lemon and Buchanan (2017) stated, "[T]he biopsychosocial impacts of trauma vary greatly from person to person and can undoubtedly permeate a child's educational experiences" (p. 2). Creating lasting relationships is difficult because individuals who have experienced trauma are unable to trust others and often solve conflict through aggression (Sorrels, 2017). Bailey and Pransky (2014) stated:

> Children's home and community environments play an important role in shaping their memory systems. This is particularly true of semantic memory. Semantic memory stores the system of symbols and meanings that comprise much of culture, while culture helps select and shape much of the information stored in semantic memory. (p. 128)

Substance abuse is a coping mechanism used by those who have experienced trauma to manage their emotional pain (Record-Lemon & Buchannan, 2017). Resilience is the ability to cope with and succeed through challenging times a person faces (Gallagher, 2016). Children learned resilience from trusted and caring adults who protect them from extreme adversity (Gallagher, 2016). Individuals who have experienced trauma "often carry within themselves a deep sense of worthlessness and the false belief that they somehow deserve the abuse, which often leads to risky behaviors" (Sorrels, 2017, p. 14).

According to prior researchers, children who experienced neglect often experience learning deficits, anxiety, mental health issues, difficulty forming lasting relationships, significant language delays, and difficulty coping with stress (Payne, 2018; Siegel-Hawley, 2016). Researchers have added knowledge about how a child's brain develops and the needs and environments a child requires to be healthy and to demonstrate age-appropriate growth and development (Perrin, Lu, Geller, & DeVoe, 2019). Perry and Szalavitz (2017) shared knowledge on the importance of the first years in a child's life and the impact these had on future mental health.

Relational trauma occurred in all socioeconomic classes, races, and ethnicities (Wilkinson, 2017). Neglect and abuse did not just occur in poor, uneducated homes, but occurred in affluent, educated homes as well (Bernard, 2018). Sorrels (2017) stated, “The true rates at which young children are subject to trauma is difficult to assess because the private nature of many forms of trauma can fly under the radar and not come to the attention of the community” (p. 19).

Trauma is seen in many areas of a child’s life: behavioral, developmental, social, physiological, and academic (Brunzell, Stokes, & Waters, 2016). Trauma causes the body’s biological stress response systems to activate (Brunzell et al., 2016). This ongoing stress at an early age could harm both a child’s brain development and other body systems that may lead to disease in adulthood (Tanner, 2017). Children may not be able to recall the traumatic event; however, trauma is “encoded in the psyche and in the cells of the body, and its effects are felt throughout the biological system” (Sorrels, 2017, p. 19). University City Schools Superintendent Shaonica Hardin stated, “You can’t just teach a child when they have experienced things that most of the people in this room can’t imagine and yet, schools have historically been forced to navigate these issues with no support” (as cited in Cambria, 2016, p. 1). Caregivers and educators often did not recognize that traumatized children communicate discomfort through negative behaviors; educators were limited in helping children effectively if they did not recognize the signs of trauma (Chamberlain et al., 2019). Raising awareness of triggers was an important step to support pathways for children and adults in educational settings (Chamberlain et al., 2019).

The primary job of the brain is to help individuals survive (Raver & Blair, 2016). When an individual interprets data as posing a threat to survival, a rush of adrenaline is sent throughout the brain (Perry & Szalavitz, 2017). This automatic response shuts down all unnecessary activity in order to direct the brain's attention to the threat (Sousa & Tomlinson, 2018). Sousa and Tomlinson (2018) concluded, "Students must feel physically safe and emotionally secure before they can focus on the curriculum" (p. 23). Tanner (2017) stated:

> The ongoing stress during early childhood—from grinding poverty, neglect, parents' substance abuse and other adversity—can smolder beneath the skin, harming kids' brains and other body systems. And research suggests that can lead to some of the major causes of death and disease in adulthood, including heart attacks and diabetes. Community leaders are increasingly adopting what is called 'trauma-informed' care. The approach starts with the premise that extreme stress or trauma can cause brain changes that may interfere with learning, explain troubling behavior, and endanger health. The goal is to identify affected children and families and provide services to treat or prevent continued stress. (p. 2)

These findings suggest that socioeconomic context is a powerful force shaping children's brain development and impacting educational opportunities and success (Reardon, 2016). However, poverty is not destiny; inequality is not inevitable (Rotberg & Glazer, 2018). There were schools where students from lower socioeconomic status performed much better on tests than children in other places with the same background (Rotberg & Glazer, 2018). It is essential that educational leaders and policymakers study schools with high concentrations of low socioeconomic students who are outperforming similar schools to identify practices that will improve educational opportunities for children who do not have the opportunity to grow up in an affluent community (Jensen, 2017). Persinger (2016) expressed that to break the cycle of poverty, it is best to invest in children and education.

21st Century Educational Reform and Initiatives

The turn of the century brought about a new educational reform movement (Lee & Wu, 2017). This reform movement culminated in the signing of the No Child Left Behind Act (NCLB) January of 2002, which was active until 2016 as a nationwide mandate in the United States (Shanahan, 2014). No Child Left Behind created testing that ensured all states were meeting the standards' rigor and expectancy with an aim for "100 percent reading and math proficiency for all students across all states by 2014" (Lee & Wu, 2017, p. 2). With the implementation of NCLB, funding for Title I programs was expanded with the mandates for testing, reporting, and accountability requirements at the forefront (Shanahan, 2014). Liebtag (2013) argued that teachers focused instruction with students on an assurance that they would have the content needed for mandated tests. This teacher behavior led to students becoming solely obsessed with the pass or fail result of the test (Liebtag, 2013). Liebtag (2013) lamented, "The NCLB Act of 2001 was an attempt to use recommendations from the report to reform education practices, but it brought questionable success in student learning" (p. 56).

Lee and Wu (2017) explained student learning was brought into decline when "threats of NCLB high-stakes state testing" caused the "rigor of proficiency standards on assessments, relative to NAEP, to decline" (p. 3). This decline was defined as the phenomenon called *race to the bottom* among states (Lee & Wu, 2017). When the NCLB came up for reauthorization, problems with "its academic and performance standards became increasingly clear" (Griffith, Kornhaber, & Tyler, 2014, p. 3). The NCLB required schools to meet state standards, which should have included investing in professional development, instructional materials, and instruction to remediate shortfalls (Shanahan, 2014). However, instead, many state policymakers just lowered their standards (Shanahan, 2014).

The Common Core State Standards (CCSS) were developed by the National Governors Association (Durand, Lawson, Wilcox, & Schiller, 2016). President Obama endorsed federal money in the way of Race to the Top grants for state educational agencies that conformed to federal guidelines (Korte, 2015). As Race to the Top grants became available during President Obama's Administration in 2009, states were incentivized with federal grant money to adopt the CCSS (Korte, 2015). McLaughlin & Overturf (2012) stated:

> The Common Core State Standards (CCSS) were developed due to several factors: the desire for one set of common standards to enable students to compete on a global scale, the efforts of the CCSSO and the NGA to coordinate a state-led effort to create a set of English Language Arts (ELA) and Mathematics Standards that would ensure that all United States students were prepared for college and the workplace, and the Gates Foundation's ambitious goal to have all students graduate college-ready. (p. 153)

Mathematical standards were radically changed with the writing and adoption of the CCSS (Griffith et al., 2014). In response to the criticism that American mathematics was a mile wide and an inch deep, mathematical process standards and practices were written into the CCSS (NCTM, 2014). The CCSS were among the most influential initiatives of creating mathematics standards to achieve a greater focus and coherence in the math curriculum (Hartnett, 2016). Understanding the background of and need for CCSS was critical to the U.S. competing in mathematics globally (Hartnett, 2016).

Liebtag (2013) explained that the Common Core State Standards and the standards-based education reform, which reshaped curriculum was a result of the 1983 report, *A Nation at Risk.* This report gave heed to the public that something needed to be done in an effort to fix schools that were failing (Liebtag, 2013). The report "revealed that U.S. students were lagging behind their international counterparts and that this gap had economic consequences" (Shanahan, 2014, p. 8). As the economy shifted from a focus on industry to information-based, a need grew for a workforce that was educated (Shanahan, 2014). Once the attention was shifted to instructional reform, efforts were made to establish learning goals that were of higher thought and ambition (Shanahan, 2014). These events led to research that was investigative of what these processes and outcomes might be (Coburn, Hill, & Spillane, 2016). Processes and learning outcomes were a focus before developing standards with higher rigor for alignment across the nation (Coburn et al., 2016.) These standards had previously been voluntarily determined by the states in the 1990s (Shanahan, 2014). Among the recommendations for improvements from the *A Nation at Risk* report, was a focus on standards-based reform, "which emphasized clear expectations for what students should know and be able to do in each subject and grade" (Brown, Boser, Sargrad & Marchitello, 2016, p. 15). The federal policies that resulted in education directed toward a greater emphasis on testing (Shanahan, 2014).

The actions taken toward improvement led to the Common Core State Standards (CCSS) initiative, which took shape between 2006 and 2010 (Griffith et al., 2014). The promotion of the CCSS initiative was done by groups that promoted the need for a common set of standards that met the rigor required to develop equitable opportunities and prepare students for a changing economy (Griffith et al., 2014). The goals within the CCSS asked students to "engage in disciplinary reasoning, develop the ability to build arguments and make inferences, and understand structure, similarities, and contrasts" (Coburn, Hill, & Spillane, 2016, p. 243).

The writers of the CCSS narrowed the view of the focus with slogans like, "What every student should know" and '" College and Career readiness"' (Wexler, 2014, p. 52). This narrowed vision provided parents and teachers a clear understanding of what students should be learning, not dependent on where the student lived nor the cognitive ability of the student. (Griffith et al., 2014). The standards released for the CCSS were described as fewer, clearer, and higher than those that were developed as state standards previously under NCLB (NCTM, 2014). This theory of action articulated that the standards students should be able to do should be built on a foundation "upon which to align curriculum materials, instruction, assessment and professional development" (Griffith et al., 2014, p. 3). Not only that, but teachers would have the flexibility to adjust learning as necessary (Liebtag, 2013). Liebtag (2013) stated this was an adjustment from when teachers had to "follow mandates to teach certain content on an exact date" with previous learning initiatives (p. 59).

From 2010 to 2012, 46 states and the District of Columbia adopted the Common Core State Standards (Rothman, 2014, p. 2). Vecellio (2013) stated, "With some 45 states presently seeking to implement these content standards across their K-12 school systems, we are for the first time seeing what is in effect a national curriculum" (p. 222). States were motivated to support the CCSS for two reasons (McLaughlin & Overturf, 2012). The first being, the adoption of CCSS was a requirement to apply for federal funds from the Race to the Top initiative (McLaughlin & Overturf, 2012). The second reason was that states had the ability to modify their standards by adding up to 15% of new content (McLaughlin & Overturf, 2012). This curriculum included standards for Kindergarten through twelfth grade, which were divided into two individual categories: English Language Arts and Mathematics (McLaughlin & Overturf, 2012). Whereas previous state standards had varying levels of rigor, the CCSS provided students across the nation "a common knowledge that they can build upon and mobility" (Liebtag, 2013, p. 59).

Where previous standards may have been thorough to include everything that students had to accomplish, the CCSS shifted the focus on instructional decisions back to the classroom teachers (Shanahan, 2014). Shifting this focus of standards represented a "substantial departure from many extant standards documents in their degree of specificity, and their focus on depth of content over breadth" (Massell & Perrault, 2014, p. 197). The writers intentionally clustered elements that created coherence among the standards (Massell & Perrault, 2014). Standards were designed intentionally to be "robust and relevant to the real world, reflecting the knowledge and skills that our young people need for success in college and careers" (Wexler, 2014, p. 55).

Students who were college and career ready could be defined as "demonstrating independence, building strong content knowledge, responding to the varying demands of audience, task, purpose, and discipline, comprehending as well as critiquing, valuing evidence, using technology and digital media strategically and capably, and understanding other perspectives and cultures" (McLaughlin & Overturf, 2012, p. 154). These indicators of college and career readiness became the anchor standards for the CCSS (McLaughlin & Overturf, 2012). The indicators offered a specification of what students should know and be able to do by graduation in order to be successful in a college placement and the workplace (Massell & Perrault, 2014).

Recognizable high school challenges, including boredom, passivity and apathy, along with pressure to know the material simply to apply it to assessment, were interrelated (Massell & Perrault, 2014). McTighe & Wiggins (2008) stated that these problems could be traced to underlying factors. These factors included "lack of clarity about the goals of high school education and how these goals should inform instruction, assessment, and curriculum design" (McTighe & Wiggins, 2008, p 36).

Thus, the CCSS purpose was anchored in standard development around creating students who have a clear direction regarding college and career readiness (McLaughlin & Overturf, 2012). Vecellio (2013) urged educators to be vigilant with the phrase "college and career," so it did not become a slogan for CCSS (p. 232). Rather the "pedagogue is intentional about the educational goals… and designs instruction that moves students towards attainment of the goals set for them" (Vecellio, 2013, p. 232).

Writers of the CCSS reform promised an opportunity for accountability where no child would be overlooked, and CCSS policy entrepreneurs stated that educational equity was a role for the formation and goals of the CCSS reform (Griffith et al., 2014). While similar to the mission of No Child Left Behind (NCLB), the partnership between states gave hope to this truth of both accountability and equality being a reality (Wexler, 2014). Given the aim to "provide all students with the same high standards and graduate them without need for remediation," the CCSS set goals on equity (Griffith et al., 2014, p. 4). Not only including equitable standards and instruction, but also the resources that were provided in school systems. Griffith et al. (2014) stated that "diverse students and schools needed more equal educational resources" (p. 13). In sum, equity was important and the CCSS fostered this equity in material, resources, curriculum, and teachers (Griffith et al., 2014). The curriculum should be of equal focus, rigor, and coherence which leads to educational equity and provides all students the opportunity to learn (Griffith et al., 2014). The opportunity to learn should not be limited when a student was from a lower performing state, in poverty, urban or rural environment, of minority background, lower track, transient situation, or an English Language Learner (ELL) (Griffith et al., 2014).

As these new standards were adopted, states were able to begin cross-state partnerships within planning that was not previously possible while states had their own set of standards (Rothman, 2014). States that implemented the CCSS had the opportunity to boost professional development opportunities due to the possibility of educators being able to exchange ideas across districts and states (Griffith et al., 2014). McLaughlin and Overturf (2012) identified the role of professional development for the CCSS initiative as both in-depth and ongoing (p. 161). Private groups began the process of developing materials to provide professional development (Rothman, 2014).

A study conducted by McDonnell and Weatherford (2016), showed results that challenged the implementation of CCSS. The results included lack of state autonomy due to the federal guidelines of standards, missing credibility of positive educational outcomes, lack of pilot initiative prior to full implementation, and a disproportionate emphasis on standardized testing (McDonnell & Weatherford, 2016). The CCSS had transformed education into "merely test preparation that puts students at risk," and the greatest at risk were the poor and the disabled (Wexler, 2014, p. 60).

The ability of educators to implement curricular standards was often a determination of whether educational policies were successful or failed (Polikoff, 2017). Wexler (2014) stated the "lack of dialogue involved in the conception and implementation of CCSS" left teachers feeling irrelevant (p. 59). A national teacher survey found that a "sizable amount of the U.S. teachers" who were in a state that was implementing CCSS felt unprepared to teach the new standards (Smith & Teasley, 2014, p. 68). Another survey that was used to gauge the implementation of CCSS included questions that probed on practices and standards that an educator may not know if they were unfamiliar with the standards (Polikoff, 2017). This survey revealed that "large proportions of teachers… have misconceptions about what the Common Core standards are calling for (in terms of content and practices), suggesting that their instruction is likely to be questionably aligned at best" (Polikoff, 2017, p. 5).

Fulfilling the work of the Common Core State Standards required educators to understand and focus alignment around the implementation of curriculum, assessment, and the professional learning opportunities provided (Massell & Perrault, 2014). Even with all the tools and professional development in place, the CCSS would "require significant leaps into unfamiliar, and to some extent, uncharted territory" (Massell & Perrault, 2014, p. 199). With the mission of school in mind, educators could focus not only on uncovering content for students but on preparing their students for the world beyond graduation, “to enable them to apply what they have learned to issues and problems they will face in the future” (McTighe & Wiggins, 2008, p. 36).

Learning for understanding required that the standards and instruction by the educator addressed goals that assisted students in acquiring information, making meaning of this learned content, and finally transferring the knowledge into meaningful experiences both in school and beyond (McTighe & Wiggins, 2008). Given the importance of these three goals, policymakers of the CCSS contemplated how not to separate focus “on either the dynamics of learning or relations of power, but have a more robust understanding of the process and outcomes of implementation” requiring educators to understand the instruction and the collaboration with students to improve classroom experiences (Coburn et al., 2016, p. 248). Liebtag (2013) said that the CCSS “holds possibilities for all students regardless of class, race, gender, and location to be provided the same high standards for learning” (p. 59). A major component for educational policy to succeed was the improvement of both standards alignment and testing accountability, as well as if the policy worked for both teaching and learning (Lee & Wu, 2017).

President Barack Obama signed the Every Student Succeeds Act (ESSA) into law on December 10, 2015 (Ferguson, 2016). The ESSA is the newest reauthorization of the Elementary and Secondary Educational Act (ESEA) passed in 1965 by Lyndon B. Johnson (Fisher, 2019). The 2001 reauthorization of the ESEA was the No Child Left Behind Act (NCLB) (Hinga, 2016). The NCLB Act required states “…to test students in grades 3-8 and disaggregate results based on student characteristics to make achievement gaps visible” (Hess & Eden, 2017, p. 2). Schools had to show adequate yearly progress at mandated proficiency levels, or school interventions would be implemented (Jacob, Decker & Lugg, 2016). Hess and Eden (2017) explained, "Under the Obama administration, the federal government used carrots and sticks to encourage states to adopt new academic standards and test-based teacher evaluation systems" (pp. 2-3).

The ESSA retained the main framework of NCLB, but now states have more flexibility with implementation (Ali & Buenavista, 2018). The ESSA testing requirements remained the same as NCLB, with the addition of a state's ability to respond to the concern of over-testing of students (Gilbert, 2017). The ESSA has removed NCLB's school accountability system, permitting states the flexibility and autonomy to identify and remedy low-performing schools (Gilbert, 2017).

The ESSA "has ten 'Titles' dealing with matters ranging from teacher quality to Native American education" (Hess & Eden, 2017, p. 2). The original intent of the ESEA was that school systems would use the money to reform and reach out to underperforming students (Social Welfare History Project, 2016). Title I annual allocations were roughly $16 billion to schools with high concentrations of low-income students (Hess & Eden, 2017, p. 59).

Under ESSA, states must adopt academic standards in at least mathematics, English language arts (ELA), and science (DuFour, Reeves, & DuFour, 2018). These three standards must have at least three levels of achievement (DuFour et al., 2018). Hess and Eden (2017) specified:

> ESSA requires that the standards be 'challenging' and that each state demonstrates that the standards are 'aligned with entrance requirements for credit-bearing

> coursework in the system of public higher education in the state and relevant state career and technical education standards. (p. 61)

The primary requirement of these standards was to challenge all students in all public schools (McKenzie & Kress, 2015).

Under NCLB, schools were considered focus schools if the students were underperforming, but the ESSA required states to identify "'targeted support schools', in which any subgroup of students is consistently underperforming, as determined by the state" (Hess & Eden, 2017, p. 70). The schools then had the autonomy to create intervention plans to improve outcomes for lagging students (Raun, 2018). The ESSA afforded new opportunities to utilize and comprehend student data (Ali & Buenavista, 2018). In addition, allowing site-based autonomy provided districts the opportunity to utilize student data to positively impact classroom interventions (Ali & Buenavista, 2018).

Title I

The centerpiece of the ESEA is Title I (Jacob et al., 2016). The focus of Title I is the education of the disadvantaged (Hess & Eden, 2017). According to Hess and Eden (2017), "Title I is funded at about $16 billion in Fiscal Year 2016, roughly 70 percent of ESSA's total funding" (p. 59). The Improving America's Schools Act (IASA) of 1994 resulted in changes to Title I, which were carried over to NCLB and now to the ESSA (Aldeman, 2015; McKenzie & Kress, 2015). The IASA required all states to have aligned statewide assessments, academic standards, performance goals, and interventions in schools not meeting performance targets (Aldeman, 2015). Hess and Eden (2017) shared, "NCLB added to and tightened requirements in each of these areas, and the

Obama administration's waivers loosened them somewhat, though not quite back to the level of flexibility in IASA" (p. 61).

In 2017, Jiang, Granja, and Koball found that 43% of children were living in low-income families during the 2015 calendar year (p. 1). Wilson (2018) determined children from low-income families were at an increased chance to attend poorly funded schools with fewer resources, increased class size, and less-experienced teachers. The goal of Title I is to provide resources to schools with a high percentage of poverty (Aldeman, 2015). The U.S. Department of Education Title I purpose statement is the guiding document (see Appendix A).

The largest program for elementary and secondary schools is the Title I Act of the ESEA with the purpose of leveling the educational field for economically disadvantaged students (Gordon, 2016). Critics agreed that at times, the program design and implementation inhibited the effectiveness of Title I's objectives (Aldeman, 2015). School districts were often left with unclear and conflicting guidance on how to allocate Title I funds from their State Education Agencies (Gordon, 2016).

Mathematics

Past generations of rural America favored hard work and blue-collar labor jobs (Harmon & Wilborn, 2016). For future success, learning and mastering mathematics is increasingly important for careers (Jitendra et al., 2018). According to Change the Equation (2011), "Almost all of the 30 fastest-growing occupations in the next decade will require some background in STEM (Science, Technology, Engineering, and Mathematics)" (as cited in Harmon & Wilborn, 2016, p. 2).

Professionals with STEM knowledge are increasingly needed to meet the demands of the global economy (Dejarnette, 2016; Niu, 2017; Smith, Bill, & Raith, 2018). Dejarnette (2016) stated:

> Results on the Programme for International Student Assessment and the Trends in International Mathematics and Science Study international studies of math and science exams revealed American youth fall behind other developed countries in their abilities in science and math. (p. 182)

Darling-Hammond, emeritus professor at Stanford University's Graduate School of Education, shared poverty is a top factor in determining children's performance on the PISA, which is used to assess science and math (as cited in Lubell, 2015). According to Lubell (2015), "On the 2012 PISA test, U.S. students ranked 35th in math and 27th in science, but corrected for poverty, they ranked near the top" (p. 3).

Compared to all other advanced nations, the United States was the most pervasive in poverty among children (Lubell, 2015). To compete in a global economy, with a STEM workforce, the United States must create systems for economically disadvantaged students to receive the support they need to succeed in future job markets (Lubell, 2015). Students were not born knowing math, nor were they born lacking the ability to learn math (Leslie, Cimpian, Meyer & Freeland, 2015). Brock and Hundley (2016) found that students with a fixed mindset tended to give up more easily, compared to students with a growth mindset who worked hard and were persistent. Fixed mindset thinking could be detrimental because students believed they were smart or not (Sun, 2015). Students with a fixed mindset were afraid to take on challenging work due to the fear they might not be able to accomplish the work (Leslie et al., 2015).

Students with a growth mindset were not afraid to take on challenging work; these students viewed mistakes as a challenge (Brock & Hundley, 2016). Rose and Betts (2004) stated, "Research studies have established that the more math classes students take, the higher their earnings ten years later, with advanced math courses predicting an increase in salary as high as 19.5% ten years after high school" (p. xi). According to Boaler (2016):

> The new evidence from brain research tells us that everyone, with the right teaching and messages, can be successful in math, and everyone can achieve at the highest levels in school. (p. 4)

Helping students develop the mindsets and practices that will serve them well on their path to achievement could be especially helpful in mathematics education (Dweck, 2016).

Conceptual Knowledge

An emphasis was placed on students' conceptual understanding of mathematics through the implementation of the Common Core standards (Smith et al., 2018). The CCSS provided specific standards that were "focused on conceptual understanding" and incorporated practices for students to develop their understanding (Chandler et al., 2016, p. 1). Providing for student conceptual understanding required an educator to provide a wide range of "examples and nonexamples, a task analysis identifying prior knowledge necessary for learning, authentic word/story problems solved at Bruner's three levels, a script or visual representation of the necessary steps to solve the problem, and adequate practice" (Geller & Smith, 2004, p. 26).

Focusing on the concepts within mathematics and not just the procedures would allow students to develop mathematical understanding (Williams, 2017). Based on research done by John Dewey, Williams (2017) stated that schools and classrooms should be "representative of real-life situations" to support the learner (p. 92). Boaler and Zoido (2016) believed that children needed to see math as conceptual in order for them to make sense of new learning. Not only did children need to see math as conceptual, but mathematics itself was also a conceptual domain and not a list of facts to be remembered (Boaler, 2016).

A mathematical mindset was acquired when "students see mathematics as a set of ideas and relationships, and their role as one of thinking about the ideas and making sense of them" (Boaler, 2016, p. 29). Traditionally, math instruction was focused on teaching students to be doers not thinkers and attention was placed on students' ability to follow the procedures as well as growth mindset (Boaler, Dieckmann, Perez-Nunez, Sun, & Williams, 2018). Huang and Normandia (2009) found that though a student was able to follow steps in a procedure and arrive at the correct answer, there wasn't always a correlation with the student understanding the concept. Students who approached mathematics with a focus on memorization were lower-achieving than students who approached mathematics with conceptual understanding (Smith et al., 2018).

Math Anxiety

Math anxiety is an emotion that leads to "persistent fear, tension and apprehension related to situations that require math" (Ramirez, Hooper, Kersting, Ferguson & Yeager, 2018, p. 1). Mutlu (2019) defined math anxiety as "the feelings of tension and anxiety that interfere with the manipulation of numbers and the solving mathematical problems in a wide variety of ordinary life and academic situations" (p. 471). The cause of math anxiety could include the mathematical background a student had, applicability to real-life of mathematical problems, difficult and time restrained exams, lack of concrete materials, varying levels of difficulty within mathematical subjects, individual personality type, confidence level of an individual, and feelings about math by those around the individual, such as parents or educators (Mutlu, 2019). Furner (2017) narrowed the cause to "include social, cognitive, and academic factors" (p. 2).

Studies revealed that when students had a moderate level of procedural knowledge and a lower level of conceptual knowledge, the power of mathematics was diminished and anxiety increased (Ramirez et al., 2018). Boaler (2015) suggested anxiety may be a greater block to math learning than deficiencies in our school curriculum or teacher preparation programs. Mathematic anxiety was more than an individual's dislike of mathematics (Sun, 2015). Rather mathematics anxiety included an uneasiness to perform mathematics, avoidance of math, negative physical impact, inability to perform on assessments, and possible use of a tutor with little to no success (Ramirez et al., 2018).

According to recent studies, Jensen (2005) stated that 30-50% of students had moderate to elevated levels of anxiety each day and for students in poverty, this number was higher (p. 87). Gunderson, Park, Maloney, Beilock, and Levine (2018) defined math anxiety as the tension felt during, as well as the apprehension and fear of, mathematical situations. In a questionnaire given to students regarding non-cognitive factors towards mathematical success, results showed that "grit is positively and significantly" correlated to academic achievement in math and “attitudes toward math” were also positively correlated to academic achievement (Al-Mutawah & Fateel, 2018, p. 97)

The effect of math anxiety on student learning has been studied, and research has led to a good understanding of the impact, but math anxiety also existed among teachers (Foley, Herts, Borgonovi, Guerriero, Levine, & Beilock, 2017). Ferguson, Hooper, Kersting, Ramirez, and Yeager (2018) stated that elementary teachers had higher math anxiety than individuals in other undergraduate fields of study. Educators with math anxiety unintentionally, “through their teaching comments, behaviors, and teaching practices, may create an environment that devalues sense-making and effort in lieu of an emphasis on memorization and innate ability” (Ferguson et al., 2018, p. 2). Sun (2015) found that there was a relationship between mathematics anxiety from educators to students. In a study conducted by Scholfield (1981), there was a direct link between the teacher attitude and student performance as well as the student’s attitude towards math. Furner (2017) stated that math anxiety, when transmitted teacher to student, caused the student to “become exasperated and give up rather than continue” and that “math is something to be afraid of” due to seeing this behavior from their teacher (p. 4). However, teachers who were high-achieving in mathematical ability produced high-achieving students (Furner, 2017).

After gaining a foundational knowledge of what math anxiety is, and where it might stem from, educators should ensure fundamental skills for students, focus on teacher training, eliminate timed tests, offer students time to write about their emotion, and think about what might be said when working with a student who struggles with math anxiety (Gunderson et al., 2018). Boaler et al. (2018) found that about one-third of students who suffered math anxiety had the onset due to timed-tests (p. 31). When a student found he or she could not be successful on the timed test, his or her confidence eroded (Boaler et al., 2018). This phenomenon did not affect a particular achievement group nor economic background (Boaler et al., 2018). Math anxiety was a learned behavior for any individual and could, in turn, be unlearned through positive self-talk (Foley et al., 2017). Dweck and Molden (2017) stated, "children build up mindsets about themselves and the world as they develop," and these mindsets play a critical role in their behavior and abilities (p. 145).

21st Century Math Classrooms

The NCTM (2019) called for a focus on the process of math instruction rather than the testing outcomes. Contrary to students in traditional settings working to solve problems in the classroom, the NCTM adjusted the focus to creating students who were problem solvers in their everyday lives (Althauser, 2018). Students could be everyday problem solvers through learning in action which included games, simulations, problem-solving activities, discoveries, and challenges (Foley et al., 2017). Learning in action aligns with the eight effective teaching practices that were endorsed by the NCTM: math goals to focus learning, tasks that promote reasoning and problem solving, use and connect mathematical representations, mathematical discourse, purposeful questioning, build procedural fluency from conceptual understanding, use student thinking, and support productive struggle (NCTM, 2019).

Althauser (2018) affirmed the responsibility of teachers to not only be experts within their classroom but also to have a "repertoire of useful strategies" available to provide "useful complex information to diverse learners" (p. 53). An effective teacher has strong pedagogy and develops classroom practice that integrates mathematical content, pedagogy, child development and student thinking (Althauser, 2018; Mo, Yu, & Wei, 2018). Standards-based mathematics teaching and learning is not a one size fits all approach (Dowker, Sarker, & Looi, 2016). Rather standards-based teaching and learning is a "multi-faceted approach with many strategies to guide students in acquiring mathematical knowledge through problem solving with the use of manipulatives" (Althauser, 2018, p. 55).

Mathematical Discourse

The implementation of the Common Core State Standards introduced new practices in math instruction (Althauser, 2018). One of these new practices included increasing a student's ability to problem solve and communicate about their thinking through mathematical discourse (Althauser, 2018). Ensuring that a classroom of students understood a lesson was a daunting task, but understanding could be measured through conversations about conceptual thinking (Tofel-Grehl, Callahan, & Nadelson, 2017). Utilizing mathematical language, an educator could lead a math discussion that allowed students to demonstrate their understanding through a variety of strategies and concepts (Tofel-Grehl et al., 2017). Alnizami (2017) asserted, "[D]ialogical mathematical discourse allows for multi-directional communication between the teacher and students, among students, or a mix of both in order for the intended meaning to be delivered" (p. 12).

When a learner understood the content, the demonstration of having learned the content was put to the test when the student could develop a sense of questions and reasoning (Dweck & Molden, 2017). Robertson, Scherr and Hammer (2015) explained there were three components of mathematical practice: the content, the discourse, and the community in which content and discourse were intertwined. In a study conducted by Huang and Normandia (2009), it was concluded that among the 22 students who were interviewed, all stated that there was a positive effect on math discourse for the acquisition and comprehension of content. Kaplan and Dance (2018) found that in a classroom with mathematical discourse, students were justifying their thinking and explaining their ideas, whether their answer was right or wrong. However, this level of discourse did not come naturally and "it requires both time and effort from the teacher and the students" (Huang & Normandia, 2009, p. 7).

Certainly, educators need both professional learning and exposure to this type of discourse (Kaplan & Dance, 2018). If an educator's self-efficacy was low, this was then connected to the performance and commitment of their work (Althauser, 2018). Henderson-Pinter, Merritt, Berry, and Rimm-Kaufmann (2018) found that uses of cognitive strategies during mathematical instruction provided a technique for students to tackle difficult problems. Self-questioning, the ability for a student to talk with themselves through the task in a series of small steps to discuss the answer, was one of these strategies (Henderson-Pinter et al., 2018).

Differentiated Instruction

Differentiated instruction allowed for students in the same classroom to have various formats to learn the same instructional material (Lang, 2019). Teachers who differentiated instruction were providing educational alternatives for student learning, without an assumption that any individual student was going to need the same instruction identical to anyone else (Lang, 2019). In a differentiated classroom, a teacher will "accept, embrace, and plan for the fact that learners bring to school both many commonalities and the essential differences that make them individuals" (Tomlinson, 2014, p. 4). The challenge for educators included how to meet students' needs on the spectrum of learning readiness, students' personal interests, and the biases that students have formed about the world around them (Tomlinson, 2014). Althauser (2018) shared that teachers needed to possess a high self-efficacy in teaching mathematics using the variety of instructional resources required to differentiate instruction. Furthermore, educators would need to "have deep insights about mathematics, about students as learners of mathematics, and about pedagogy that will support students' learning. After all, the future is only as good as what we put out there" (Althauser, 2018, p. 66).

Summary

Students living in poverty had a higher chance of traumatic experiences that may affect the development and cognition of the brain (Jensen, 2009, 2013, 2016, 2017; Payne, 2018). School district administrators and teachers who educate students must not overlook the impact of poverty on students (Jensen, 2016). The trauma incurred due to the stress of poverty made it of the utmost importance for educators to be well-versed in brain-based learning theory (Jensen, 2009, 2013, 2016, 2017). Developing an understanding of educational legislative policies from the past and present was important to understand the school environment students and teachers were experiencing (Harris, 2015). It was also vital to understand how mathematics varied from literacy and the importance of requiring a specific mathematical mindset shift for success (Boaler, 2016).

In Chapter Three, the research methodology for this study is explained. The problem and purpose, research questions with hypotheses, research design, population and sample, instrumentation, data collection and analysis, and ethical considerations are described in detail. Chapter Three contains the details of the methodology utilized in this study. The data analysis process is revealed in Chapter Four, while findings are shared in Chapter Five.

Chapter Three: Methodology

The procedures and methods used in this study were outlined in this chapter to illustrate how the findings were useful for educational decision makers who serve student populations in poverty. The problem and purpose, research questions with hypotheses, research design, population and sample, instrumentation, data collection and analysis, and ethical considerations were described in detail.

Problem and Purpose Overview

Schools facing high concentrations of poverty were not frequently high-achieving schools (Becares & Priest, 2015). Students in poverty were suffering from a gap in achievement as measured by various indicators, including graduation rates from high school and college and on standardized tests (Becares & Priest, 2015). The purpose of NCLB was to ensure all students would be on grade level regardless of SES by 2014 (New America Foundation, 2015). The NCLB goal of having all students on grade level was not met by that date (GreatSchool, 2015).

Very little attention had been given to how SES impacted or predicted performance in individual subjects such as mathematics (Harris, 2015). Consequently, it was difficult to determine whether student performance in mathematics was related to teacher quality, life goals, socioeconomic status, or school characteristics (Darling-Hammond et al., 2019). Additionally, little was known regarding the implications of mathematics skills and socioeconomic achievement (Boaler, 2016). The problem to be addressed was if, and to what extent, a mathematical achievement gap was evident in sites with a greater than 70% free and reduced price meal rate compared to elementary sites with a less than 30% free and reduced price meal rate.

For this study, the difference between average mathematical test scores on BOY, EOY, and academic growth in elementary sites with greater than a 70% free and reduced price meal rate compared to elementary sites with less than a 30% free and reduced price meal rate was investigated. The targeted location of this study was an urban school district in the Midwest. This research was conducted to yield meaningful insights to inform educators and administrators about existing differences between the two groups when compared. Because statistical differences were discovered, the evidence for a shift in teacher mindset and practices when working with students in poverty via brain-based learning strategies was supported (Jensen, 2016, 2017). The Midwest school district assessment practices required each elementary school to provide an i-Ready Diagnostic Assessment at the BOY and EOY to gather achievement data and growth at the student, building, and district levels (D. Whitham, personal communication, March 29, 2019).

Research questions and hypotheses. The following research questions and hypotheses guided the study:

1. What difference exists in the scale scores of students testing on the beginning-of-the-year (BOY) mathematics i-Ready Diagnostic Assessment in K-4 elementary schools with a free and reduced price meal population above 70% compared to K-4 elementary schools with a free and reduced price meal population below 30%?

   $H1_0$: There is no difference in the scale scores of students on the beginning-of-the-year (BOY) mathematics i-Ready Diagnostic Assessment in K-4 elementary schools with a free and reduced price meal population above 70%

compared to K-4 elementary schools with a free and reduced price meal population below 30%.

$H1_a$: There is a difference in the scale scores of students on the beginning-of-the-year (BOY) mathematics i-Ready Diagnostic Assessment in K-4 elementary schools with a free and reduced price meal population above 70% compared to K-4 elementary schools with a free and reduced price meal population below 30%.

2. What difference exists in the scale scores of students testing on the end-of-the-year (EOY) mathematics i-Ready Diagnostic Assessment in K-4 elementary schools with a free and reduced price meal population above 70% compared to K-4 elementary schools with a free and reduced price meal population below 30%?

   $H2_0$: There is no difference in the scale scores of students testing on the end-of-the-year (EOY) mathematics i-Ready Diagnostic Assessment in K-4 elementary schools with a free and reduced price meal population above 70% compared to K-4 elementary schools with a free and reduced price meal population below 30%.

   $H2_a$: There is a difference in the scale scores of students testing on the end-of-the-year (EOY) mathematics i-Ready Diagnostic Assessment in K-4 elementary schools with a free and reduced price meal population above 70% compared to K-4 elementary schools with a free and reduced price meal population below 30%.

3. What difference exists in student scale score growth on the mathematics i-Ready Diagnostic Assessment in K-4 elementary schools with a free and reduced price meal population above 70% and K-4 elementary schools with a free and reduced price meal population below 30%?

   $H3_0$: There is no difference between the student scale score growth on the mathematics i-Ready Diagnostic Assessment in K-4 elementary schools with a free and reduced price meal population above 70% and K-4 elementary schools with a free and reduced price meal population below 30%.

   $H3_a$: There is a difference between the student scale score growth on the mathematics i-Ready Diagnostic Assessment in K-4 elementary schools with a free and reduced price meal population above 70% and K-4 elementary schools with a free and reduced price meal population below 30%.

Research Design

Due to the push to provide data-driven instruction, data desegregation, and evidence-based practices (Bluman, 2019), this study was strictly quantitative in design. The Institutional Review Board (IRB) at Lindenwood University approved the research project (see Appendix B). Permission was then secured from the school district's central administration office to secure data. The i-Ready Diagnostic Assessment math data were collected from schools in one Midwest district with a free and reduced price meal population above 70% and schools with a free and reduced price meal population below 30% for grades Kindergarten, first, second, third, and fourth during the 2016-2017 and 2017-2018 school years. To answer research questions one, two, and three in the study, a two-sample *t*-test was used. According to Bluman (2019), "The *t*-test is a statistical test for the mean of a population and is used when the population is normally or approximately normally distributed" (p. 425).

Population and Sample

The population for the study was taken from one urban Missouri public school district which had been an organized school district since 1867 and was the largest fully accredited district in the state (Local School Directory, 2018). Within this school system were 33 elementary schools and one fifth- and sixth-grade center (Local School Directory, 2018). Historically, the city, which had a population of over 150,000, had two distinct socioeconomic areas: the north and south sides (City Information, 2018). The north side of the city was the older of the two areas, where property values had dropped, and many of the old houses had been removed and replaced by less-expensive multi-family dwellings (City Information, 2018). The south side of the city had less industry and more new home construction (City Information, 2018).

In the district, 52.6% of the students qualified for a free and reduced price meal (Local School Directory, 2018). The wide range of socioeconomic status was exemplified by two elementary schools: Non-Title School 1 (NTS-1), the furthest south in the district with a free and reduced price meal rate of 20%, and Title School 1 (TS-1), located in the northern region of the district with a free and reduced price meal rate of 98% (MODESE, 2018). The sample consisted of students in grades K-4 who attended elementary schools with an average free and reduced price meal population above 70% and elementary schools with a free and reduced price meal population below 30%. The purposive sampling was used to find the difference between schools meeting the free and reduced price meal population above 70% and elementary schools with a free and reduced price meal population below 30%. The minimum number of schools in the sample was 28 elementary schools (Grade s K-4) to a maximum of 35 elementary schools (Grades K-4). Academic growth scores were collected for three research questions. Only students who tested at the beginning-of-the-year on the i-Ready Diagnostic and the end-of-the-year i-Ready diagnostic were included for question three, which was a measure of scale score growth.

Instrumentation

Secondary data were used to address the research questions in this study. The data collection instrument used in the study was the i-Ready Diagnostic Assessment designed and produced by Curriculum Associates (Curriculum Associates, LLC, 2017a). The Midwest school district administered the i-Ready Diagnostic Assessment to students in grades Kindergarten through eight at beginning-of-the-year, middle-of-the-year, and end-of-the-year for mathematics (School Data, 2019).

Validity. A study of validity was completed by the Educational Research Institute of America (2017) to measure the validity of i-Ready Diagnostic Assessments for Curriculum Associates. According to the Educational Research Institute of America (2017):

> Curriculum Associates contracted with the Educational Research Institute of America to conduct a study to evaluate the validity of i-Ready Diagnostic for both reading and mathematics. The study utilized i-Ready Diagnostics administered to students in grades 3 through 8 during the 2015-2016 academic year and the 2016 New York State (NYS) ELA and Mathematics scores for the same students from participating schools. (p. 3)

The focus of the study was to determine the validity and reliability of the i-Ready Diagnostic Assessment to accurately predict student proficiency on the New York State (NYS) assessments (Educational Research Institute of America, 2017). The NYS assessments were aligned to the CCSS (Educational Research Institute of America, 2017). The i-Ready Diagnostic Assessment could positively factor into district, teacher, and parent decision making if statistically significant correlations were present (Educational Research Institute of America, 2017). The Educational Research Institute of America (2017) results were explained:

> The correlations for students at each grade level and the average correlations across all grade levels were very high. The 2016 spring correlations for ELA ranged from a low of .78 to a high of .84. The 2016 spring correlations for Mathematics ranged from a low of .79 to a high of .86. In addition, the correlations were high across all i-Ready testing periods and were all statistically significant ($p \leq .0001$) and exceed the Center on Response to Intervention's recommended .70 minimum threshold for correlations. These strong correlations indicate that i-Ready Diagnostic and the NYS assessments were assessing similar constructs, providing strong evidence of the validity of the i-Ready Diagnostic assessments as a measure of students' progress toward meeting the New York State P-12 Common Core Learning Standards. (p. 15)

The Educational Research Institute of America (2017) supported the validity of the i-Ready Diagnostic Assessments in reading and mathematics as predictors of state assessment proficiency levels and on-grade level measures based upon the CCSS.

Reliability. A study of the reliability of the i-Ready Diagnostic Assessment was completed by the American Institutes for Research (2019). The type of reliability measured was a Test-retest model and included students in grades K-12 (American Institutes for Research, 2019). The American Institutes for Research (2019) method and results were explained:

> Evidence of test-retest stability was assessed based on a subsample of students who, during the 2014–2015 school year, took *i-Ready Diagnostic* twice within the recommended 12-18 week testing window. The average testing interval was 106 days (15 weeks). Correlations between the two tests were calculated. In lower grades where growth and variability were expected to be higher, test-retest correlations were expected to be relatively lower. Test-retest correlations for grades K-12 mathematics were 0.63, 0.72, 0.77, 0.78, 0.81, 0.82, 0.83, 0.83, 0.83, 0.88, 0.87, 0.89, and 0.87, respectively. (p. 3)

The Test-retest reliability correlation coefficient median was 0.83 (American Institutes of Research, 2019, p. 3).

In this study, secondary data in the form of the i-Ready Adaptive Diagnostic scale scores in mathematics were used. Patten and Newhart (2017) suggested selecting an instrument with research based validity measures to reduce threats to validity of a quantitative study. The Educational Research Institute of America (2017) supported the validity of the i-Ready Diagnostic Assessments in reading and mathematics as predictors of state assessment proficiency levels and on-grade level measures based upon the CCSS. In addition, the validity of the i-Ready instrument was based on the defensibility of the implications a researcher could make from the data collected (Fraenkel et al., 2019).

Scale scores were a metric that provided a common language across grades, as they were measured on a single continuum representing skill mastery up to the point of assessment (Schweitzer, 2019). The i-Ready Diagnostic Assessment provided scale scores with standard errors reported at the overall subject level, which allowed for across grade comparison (Ezzelle, 2017). For the purpose of this study, scale scores representing skill mastery in math up to the point of assessment (on an 800-point scale), for selected grades (K-4), were used.

Data Collection

The participating school district required a request to conduct research. Once the request to conduct research was approved, the i-Ready Diagnostic Assessment data were compiled by a staff member in the accountability, analytics, and assessment office of the district. Data were collected, grouped by building, de-identified, coded, and emailed via secure email to the researcher.

Data Analysis

A quantitative methodology was used as the research technique to analyze student math achievement data to determine if a difference was present in higher-SES schools when compared to lower-SES schools (Fraenkel et al., 2019). For research questions one and two, a two-tailed *t*-test was performed to determine if the difference between means was within the parameters to reject, or fail to reject, the null hypothesis (Bluman, 2019). For research question three, a two-tailed *t*-test was performed to determine if the difference between means of the paired BOY and EOY scale score growth was within parameters to reject, or fail to reject the null hypothesis (Bluman, 2019). The *p*-value was a numerical value obtained from the *t*-test (Bluman, 2019). The level of significance was the maximum probability of committing a Type I error, which occurs when the null hypothesis was rejected and was found to be true (Fraenkel et al., 2019). The level of significance for this study was set at $\alpha = .05$. The data for questions one, two, and three were entered in Microsoft Excel, and the Data Analysis Tool-Pak was used to perform the statistical tests.

Ethical Considerations

Secondary data was used to answer research questions one, two, and three. There were no primary participants in this study, and the Midwest school district's assessment, accountability, and analytics staff deidentified and provided the data. Thus, the chance of coercion was eliminated (Creswell, 2018; Crossman, 2015). All students and schools in this study have been and will remain anonymous. The paper records printed for this research, along with all electronic records, would be securely stored for three years and then destroyed. The paper records were kept in a locked file cabinet, and the electronic records were kept on a password-protected computer.

Summary

The methods and procedures followed were provided in this chapter to illustrate how data were collected to answer the research questions. Essential steps in writing a research report outlined in Bluman's (2019) work were reviewed. The purpose and problem, research questions with hypotheses, research design, population and sample, instrumentation, data collection and analysis, and ethical considerations of this study were presented. This study was focused on determining if there was a difference in mathematical achievement levels, deemed valid using the i-Ready Diagnostic Assessment, when comparing two independent student populations.

The population for this study was narrowed to one Midwest school district. The school district had multiple schools with student populations from both high and low-socioeconomic status concentrations (Local School Directory, 2018). Schools were included in the sample if the total percentage of students enrolled in the school equaled a free or reduced price meal rate of greater than 70% or lower than 30% (Local School Directory, 2018). Grades Kindergarten, first, second, third, and fourth were sampled separately at each school and combined to calculate each school's overall proportion at each grade level. Therefore, the data compared were from school buildings containing the same grade levels.

The instrumentation used for this study was the i-Ready Diagnostic Assessment in the area of mathematics. The i-Ready Diagnostic Assessment testing data were proven to be valid and reliable to predict positive correlation to student proficiency in meeting state standards in reading and math (Education Research Institute of America, 2017). The instrumentation provided data for student mathematical proficiency, at the beginning of the year and at the end of the year, and allowed for the calculation of academic growth throughout the school year for each school.

Chapter Four: Analysis of Data

The intent of this study was to explore whether a difference existed in mathematics achievement levels based on socioeconomic status determined by the concentration of free and reduced price meal rates in elementary schools. Student mathematical achievement data from school sites with less than 30% free and reduced meal rate concentration were compared to student math achievement data from school sites with greater than 70% free and reduced meal rates at a beginning-of-the-year (BOY) assessment window and an end-of-the-year (EOY) assessment window. In addition, student math scale score growth was compared to determine if a difference was significant between the growth of students attending schools with below 30% free and reduced meal rates to the growth of students attending schools with above 70% concentration of free and reduced meal rates.

Data Collection

Mathematical student achievement data were collected by the Midwestern school district as part of the school district's yearly assessment plan during the beginning-of-the-year and end-of-the-year (D. Whitham, personal communication, March 29, 2019). After approval from the Lindenwood University Review Board, a data request was made to the Midwestern school district. When the request was processed by the Midwestern school district all data requested were de-identified, analyzed, and protected according to the guidelines outlined in the Lindenwood University Institutional Review Board application.

For research questions one and two, the i-Ready mathematical scale scores from the BOY assessment and EOY assessment of students attending schools with less than 30% free and reduced price meal rates and greater than 70% free and reduced priced meal rates were compared using a two-tail *t*-test and descriptive statistics. Paired scores were required to perform the two-tail *t*-test to measure if a difference in the scale score growth was present for research question three.

Three data sets were collected and deidentified from the analytics, assessment, and accountability department from the Midwestern school district. Each sample size data set varied, the BOY data set contained 5,825 student scale scores, the EOY data set included 5,783 student scale scores, and the final data set of BOY to EOY growth data set contained 5,357 paired scores. The analytics, assessment, and accountability department staff removed any student scale scores from the third data set to ensure the data presented were only from students who tested at the BOY and EOY in the same building during both testing windows.

The first data set analyzed was the i-Ready BOY scale scores for all students attending schools with a combined free and reduced meal rate below 30% and above 70%. This data set had 5,825 student scale scores, with 2,401 scale scores from schools below 30% and 3,421 scale scores from schools above 70%. The second data set analyzed was EOY scale scores in math and included 5,782 scale scores. This data set included 2,417 scale scores from schools with less than 30% free and reduced meal rate and 3,366 scale scores from school with greater than 70% free and reduced meal rate. The final data set was that of the students who were assessed at the BOY and EOY of the academic year in the same building. These were paired scores and represented the quantifiable growth by subtracting the BOY i-Ready scale score from the EOY i-Ready scale score.

Demographics

The population for this research included students in grades K-4 who attended schools with a free and reduced priced meal rate above 70% and below 30%. The students included in this population were all enrolled in a school in K-4 in one urban Midwestern school district. The Midwestern school district served approximately 24,000 students during the 2018 school year (Local School Directory, 2018). The Midwestern school district had nearly 52% of students district-wide who qualified for free and reduced price meals (Local School Directory, 2018). The city of the Midwestern school district had a population of over 150,000 (City Information, 2018). The city had two distinct socioeconomic areas: north and south sides (City Information, 2018). The north side of the city was made up of a majority of multifamily dwellings that replaced older homes after property values dropped (City Information, 2018). The south side of the city had experienced rapid development of new home construction, urban retail, and eateries (City Information, 2018).

The population included six schools that had a school free and reduced price meal rate below 30% and 15 schools with free and reduced price meal rate above 70% (Local School Directory, 2018). The schools with below 30% free and reduced price meal rate were deidentified and coded as NTS(1-6) in Table 1. Of those six schools, five were located on the south side of the city with the sixth school located on the east side of the city with a majority of new home construction outside the city limits (City Information, 2018). Of the 15 schools with a 70% or greater free and reduced price meal rate, 14 were located on the north side of the city with the 15th school located just one-quarter mile south of the north and south dividing road (City Information, 2018).

Table 1

Enrollment of Free and Reduced Price Meal Rate of Schools in Research Study

School Code	Total Enrollment	Free and Reduced Price Meal Rate
NTS-1	502	19.88%
NTS-2	417	22.31%
NTS-3	415	22.40%
NTS-4	458	23.71%
NTS-5	607	28.53%
NTS-6	393	29.45%
TS-1	255	71.37%
TS-2	245	76.25%
TS-3	397	76.92%
TS-4	259	78.42%
TS-5	165	81.15%
TS-6	360	82.22%
TS-7	257	84.82%
TS-8	217	86.63%
TS-9	295	86.64%
TS-10	408	87.95%
TS-11	320	88.66%
TS-12	217	88.83%
TS-13	353	89.43%
TS-14	225	89.90%
TS-15	220	93.58%

Note. Retrieved from website of the Midwestern school district under study.

These schools were also deidentified and coded as TS(1-15) in Table 1. The average school enrollment of the six schools below 30% free and reduced price meal rate was 465 students (Local School Directory, 2018). The average school enrollment of the 15 schools above 70% free and reduced price meal rate was 280 students (Local School Directory, 2018).

Data Analysis

The study was conducted to answer research questions that were quantitative in nature and the data collected were examined statistically. Two types of statistical analyses were used to examine the data collection, a *t*-test method and measures of central tendency via descriptive statistics (Bluman, 2019). The measures of central tendency were determined for exam scores to produce mean and standard deviation values (Bluman, 2019). The *t*-test method was used to "compare the mean scores of two different, or independent, groups" (Fraenkel et al., 2019, p. 234). Two-tailed *t*-tests were performed to determine whether the difference between means was within parameters to reject, or fail to reject, the null hypotheses (Bluman, 2019).

Research question one. *What difference exists in the scale scores of students testing on the beginning-of-the-year (BOY) mathematics i-Ready Diagnostic Assessment in K-4 elementary schools with a free and reduced price meal population above 70% compared to K-4 elementary schools with a free and reduced price meal population below 30%?* A total of 5,825 students were assessed who attended the 21 school sites meeting the criteria of below 30% free and reduced price meal rate and above 70% free and reduced price meal rate. Of the 5, 825 assessed students, 2,405 students in grades Kindergarten through 4th grade attended sites having below 30% free and reduced price meal rate. The remaining 3,421 scale scores came from students attending schools with greater than 70% free and reduced price meal rates.

The two-tailed *t*-test null hypothesis was, $H_0: \mu_1 = \mu_2$, there was no difference between the mean scores of students attending schools with less than 30% free and reduced price meal rates and students attending schools with greater than 70% free and reduced price meal rates. The alternative hypothesis was, $H_1: \mu_1 \neq \mu_2$, there was a difference between the scores of students attending schools with less than 30% free and reduced price meal rates and students attending schools with greater than 70% free and reduced price meal rates. To test the hypothesis, first, the means were calculated from the sample data (Salkind, 2017).

These samples were unpaired in that they were independent of each other. The samples were similar in that they were assessment scores from students who took the same mathematics iReady Diagnostic Assessment in the same Midwestern school district at the same time of the year, but the samples differed because they came from different populations. A two-tailed *t*-test was used to test the difference between the two means of the independent samples that were assumed to be normally or approximately normally distributed (Bluman, 2019).

The mean and median of a data set are commonly known as measures of central tendency as these measures indicate where the data was centered or clustered (Fraenkel et al., 2019). The mean was useful in forecasting future outcomes when the data were void of extreme values; although, the effect of extreme values on the mean may be critical and should be pondered (Bluman, 2019). The median may be more suitable than the mean when the data set has extreme values as the mean was not disturbed by extreme values

(Salkind, 2017). A standard deviation was a tool for assessing data dispersion (Bluman, 2019). The smaller the standard deviation, the more closely the data are clustered around the mean (Salkind, 2017).

The measures of central tendency for the data set containing scale scores from students attending schools with less than 30% free and reduced priced meals were coded as Non-Title Schools and students' scores from schools greater than 70% free and reduced priced meals were coded as Title schools which were displayed in Table 2. The Non-Title scores standard deviation of 43.50 showed a wide dispersion of data around the mean. Similarly, the Title scores standard deviation of 43.20 also showed a wide dispersion of data around the mean. It was also noteworthy that the difference of the standard deviation for the Non-Title and Title scores standard deviation was 0.30, which was a very similar amount of dispersion around the respective means.

Table 2

Summary of Descriptive Statistics for Beginning-of-the-Year i-Ready Math Diagnostic Assessment Scale Score for Kindergarten through 4th Grade

	N	*Mean*	*Median*	*Standard Deviation*
Non-Title	2404	410	411	43.50
Title	3421	391	391	43.20

The results of the independent two-tailed *t*-test analysis yielded a *t* statistic for two samples assuming unequal variances at 16.50 and a *t* critical two-tailed value at

± 1.96. Since 16.50 > 1.96, there was evidence to suggest a statistical difference between means existed that was not due chance (Salkind, 2017). The *p*-value of 1.194E-59 confirmed the difference and the null hypothesis was rejected at $\alpha = .05$ (Bluman, 2019). There was sufficient evidence to conclude that a statistical difference existed in the scale scores of students testing on the beginning-of-the-year (BOY) mathematics i-Ready Diagnostic Assessment in K-4 elementary schools with a free and reduced price meal population above 70% compared to K-4 elementary schools with a free and reduced price meal population below 30%. The independent two-tailed *t*-test, two sample assuming unequal variances, results were displayed in Table 3.

Table 3

Summary of t-test Two-Tailed Analysis for Beginning-of-the-Year i-Ready Math Diagnostic Assessment Scale Score for Kindergarten through 4th Grade

	N	(*df*)	*t*-value	$P(T \leq t)$	$T(t_{crit})$
Non-Title	2404	5150	16.50	*.00	± 1.96
Title	3421				

Note. **p*-value < $\alpha = .05$ indicating a significant difference in means.

Shown in Table 4 were descriptive statistics for the BOY i-Ready Math Diagnostic Assessment scales scores for only students enrolled in Kindergarten. The mean score for Non-Title Schools was 25 scale score points higher than the Title School mean scores. The median of Non-Title Schools scale scores was 355 with a standard deviation of 24.01. The median of the Title Schools scale scores was 338 with a standard deviation of 21.73.

Table 4

Summary of Descriptive Statistics for Beginning-of-the-Year i-Ready Math Diagnostic Assessment Scale Score for Kindergarten

	N	*Mean*	*Median*	*Standard Deviation*
Non-Title	473	354	355	24.01
Title	690	339	338	21.73

The results of the independent two-tailed *t*-test analysis for Kindergarten scale scores yielded a *t* statistic for two samples assuming unequal variances at 10.99 and a *t* critical two-tailed value at ± 1.96. Since 10.99 > 1.96, there was evidence to suggest a statistical difference between means existed that was not due chance (Salkind, 2017). The *p*-value of 8.10153E-27 confirmed the difference and the null hypothesis was rejected at α = .05 (Bluman, 2019). There was sufficient evidence to conclude that a statistical difference existed in the scale scores of students testing on the beginning-of-the-year (BOY) mathematics i-Ready Diagnostic Assessment in K-4 elementary schools with a free and reduced price meal population above 70% compared to K-4 elementary schools with a free and reduced price meal population below 30% at the Kindergarten level. The independent two-tailed *t*-test, two sample assuming unequal variances, results were displayed in Table 5.

Table 5

Summary of t-test Two-Tailed Analysis for Beginning-of-the-Year i-Ready Math Diagnostic Assessment Scale Score for Kindergarten

	N	(*df*)	*t*-value	P(T $\leq$ *t*)	T(t_{crit})
Non-Title	473	946	10.99	*.00	± 1.96
Title	690				

Note. *p-value < α = .05 indicating a significant difference in means.

Shown in Table 6 were descriptive statistics for beginning-of-the-year i-Ready Math Diagnostic Assessment scale scores for only students enrolled in 1st grade. The mean score for Non-Title Schools was 28 scale score points higher than the Title School mean scores. The median of Non-Title Schools scale scores was 390 with a standard deviation of 24.96. The median of the Title Schools scale scores was 373 with a standard deviation of 24.38.

Table 6

Summary of Descriptive Statistics for Beginning of the Year i-Ready Math Diagnostic Scale Score for 1st Grade

	N	*Mean*	*Median*	*Standard Deviation*
Non-Title	470	389	390	24.96
Title	719	371	373	24.38

The results of the independent two-tailed *t*-test analysis for 1st grade scale scores yielded a *t* statistic for two samples assuming unequal variances at 12.06 and a *t* critical two-tailed value at ± 1.96. Since 12.06 > 1.96, there was evidence to suggest a statistical difference between means existed that was not due chance (Salkind, 2017). The *p*-value of 2.32356E-31 confirmed the difference and the null hypothesis was rejected at α = .05 (Bluman, 2019). There was sufficient evidence to conclude that a statistical difference existed in the scale scores of students testing on the beginning-of-the-year (BOY) mathematics i-Ready Diagnostic Assessment in K-4 elementary schools with a free and reduced price meal population above 70% compared to K-4 elementary schools with a free and reduced price meal population below 30% at the 1st grade level. The independent two-tailed *t*-test, two sample assuming unequal variances, results were displayed in Table 7.

Table 7

Summary of t-test Two-Tailed Analysis for Beginning-of-the-Year i-Ready Math Diagnostic Assessment Scale Score for 1st Grade

	N	(*df*)	*t*-value	$P(T \leq t)$	$T(t_{crit})$
Non-Title	470	986	12.06	*.00	± 1.96
Title	719				

Note. **p*-value < α = .05 indicating a significant difference in means.

Shown in Table 8 were descriptive statistics for beginning-of-the-year i-Ready Math Diagnostic Assessment scales scores for only students enrolled in 2nd grade. The mean score for Non-Title Schools was 20 scale score points higher than the Title School mean scores. The median of Non-Title Schools scale scores was 415 with a standard deviation of 23.49. The median of the Title Schools scale scores was 396 with a standard deviation of 26.15.

Table 8

Summary of Descriptive Statistics for Beginning of the Year i-Ready Math Diagnostic Scale Score for 2nd Grade

	N	*Mean*	*Median*	*Standard Deviation*
Non-Title	472	415	415	23.49
Title	655	395	396	26.15

The results of the independent two-tailed *t*-test analysis for 2nd grade scale scores yielded a *t* statistic for two samples assuming unequal variances at 13.42 and a *t* critical two-tailed value at ± 1.96. Since 13.42 > 1.96, there was evidence to suggest a statistical difference between means existed that was not due chance (Salkind, 2017). The *p*-value of 4.30219E-38 confirmed the difference and the null hypothesis was rejected at $\alpha = .05$ (Bluman, 2019). There was sufficient evidence to conclude that a statistical difference existed in the scale scores of students testing on the beginning-of-the-year (BOY) mathematics i-Ready Diagnostic Assessment in K-4 elementary schools with a free and reduced price meal population above 70% compared to K-4 elementary schools with a free and reduced price meal population below 30% at the 2nd grade level. The independent two-tailed *t*-test, two sample assuming unequal variances, results were displayed in Table 9.

Table 9

Summary of t-test Two-Tailed Analysis for Beginning-of-the-Year i-Ready Math Diagnostic Assessment Scale Score for 2nd Grade

	N	(*df*)	*t*-value	P(T $\leq$ *t*)	T(t_{crit})
Non-Title	472	1072	13.42	*.00	± 1.96
Title	655				

Note. *p-value < α = .05 indicating a significant difference in means.

Shown in Table 10 were descriptive statistics for beginning-of-the-year i-Ready Math Diagnostic Assessment scales scores for only students enrolled in 3rd grade. The mean score for Non-Title Schools was 16 scale score points higher than the Title School mean scores. The median of Non-Title Schools scale scores was 437 with a standard deviation of 27.08. The median of the Title Schools scale scores was 416 with a standard deviation of 28.30.

Table 10

Summary of Descriptive Statistics for Beginning of the Year i-Ready Math Diagnostic Scale Score for 3rd Grade

	N	*Mean*	*Median*	*Standard Deviation*
Non-Title	454	432	437	27.08
Title	699	416	416	28.30

The results of the independent two-tailed *t*-test analysis for 3rd grade scale scores yielded a *t* statistic for two samples assuming unequal variances at 9.83 and a *t* critical two-tailed value at ± 1.96. Since 9.83 > 1.96, there was evidence to suggest a statistical difference between means existed that was not due chance (Salkind, 2017). The *p*-value of 7.78556E-22 confirmed the difference and the null hypothesis was rejected at α = .05 (Bluman, 2019). There was sufficient evidence to conclude that a statistical difference existed in the scale scores of students testing on the beginning-of-the-year (BOY) mathematics i-Ready Diagnostic Assessment in K-4 elementary schools with a free and reduced price meal population above 70% compared to K-4 elementary schools with a free and reduced price meal population below 30% at the 3rd grade level. The independent two-tailed *t*-test, two sample assuming unequal variances, results were displayed in Table 11.

Table 11

Summary of t-test Two-tailed Analysis for Beginning-of-the-Year i-Ready Math Diagnostic Assessment Scale Score for 3rd Grade

	N	(*df*)	*t*-value	$P(T \leq t)$	$T(t_{crit})$
Non-Title	454	998	9.83	*.00	± 1.96
Title	699				

Note. **p*-value < α = .05 indicating a significant difference in means.

Shown in Table 12 were descriptive statistics for beginning-of-the-year mathematics i-Ready Diagnostic Assessment scales scores for only students enrolled in 4th grade. The mean score for Non-Title Schools was 18 scale score points higher than the Title School mean scores. The median of Non-Title Schools scale scores was 456 with a standard deviation of 28.03. The median of the Title Schools scale scores was 440 with a standard deviation of 32.05.

Table 12

Summary of Descriptive Statistics for Beginning-of-the-Year i-Ready Math Diagnostic Scale Score for 4th Grade

	N	*Mean*	*Median*	*Standard Deviation*
Non-Title	535	454	456	28.03
Title	658	436	440	32.50

The results of the independent two-tailed *t*-test analysis for 4th grade scale scores yielded a *t* statistic for two samples assuming unequal variances at 10.40 and a *t* critical two-tailed value at ± 1.96. Since 10.40 > 1.96, there was evidence to suggest a statistical difference between means existed that was not due chance (Salkind, 2017). The *p*-value of 2.53331E-24 confirmed the difference and the null hypothesis was rejected at $\alpha = .05$ (Bluman, 2019). There was sufficient evidence to conclude that a statistical difference existed in the scale scores of students testing on the beginning-of-the-year (BOY) mathematics i-Ready Diagnostic Assessment in K-4 elementary schools with a free and reduced price meal population above 70% compared to K-4 elementary schools with a free and reduced price meal population below 30% at the 4th grade level. The independent two-tailed *t*-test, two sample assuming unequal variances, results were displayed in Table 13.

Table 13

Summary of t-test Two-tailed Analysis for Beginning-of-the-Year i-Ready Math Diagnostic Assessment Scale Score for 4th Grade

	N	(*df*)	*t*-value	P(T $\leq$ *t*)	T(t_{crit})
Non-Title	535	1187	10.40	*.00	± 1.96
Title	658				

Note. *p-value < α = .05 indicating a significant difference in means.

Research Question two. *What difference exists in the scale scores of students testing on the end-of-the-year (EOY) mathematics i-Ready Diagnostic Assessment in K-4 elementary schools with a free and reduced price meal population above 70% compared to K-4 elementary schools with a free and reduced price meal population below 30%?* The null hypothesis stated that there was no difference between the scale scores of students testing on the mathematics iReady Diagnostic Assessment at the end-of-the-year in K-4 elementary schools with below 30% free and reduced price meal rates and those schools above 70% free and reduced price meal rates. A total of 5,733 students were assessed on the mathematics i-Ready Diagnostic Assessment who attended the 21 school sites meeting the criteria of below 30% free and reduced price meal rate and above 70% free and reduced price meal rate. The end-of-the-year testing window in the Midwestern school district assessed 2,417 students in grades Kindergarten through 4th grade who attended sites below 30% free and reduced price meal rate schools. The Midwestern school district assessed and retained 3,316 scale scores from students attending schools with greater than 70% free and reduced price meal rates.

The two-tailed *t*-test null hypothesis was, $H_0: \mu_1 = \mu_2$, there was no difference between the mean scores on the end-of-the-year mathematics i-Ready Diagnostic Assessment of students attending schools with less than 30% free and reduced price meal rates and students' scores attending schools with greater than 70% free and reduced price meal rates. The alternative hypothesis was, $H_1: \mu_1 \neq \mu_2$, there was a difference between the scores on the mathematics end-of-the-year i-Ready Diagnostic Assessment of students attending schools with less than 30% free and reduced price meal rates and students' scores attending schools with greater than 70% free and reduced price meal rates. To test the hypothesis, first the means were calculated from the sample data using the data analysis tools in Microsoft Excel (Salkind, 2017).

The mean and median of a data set are commonly known as measures of central tendency as these measures concentrate on where the data was centered or clustered (Fraenkel et al., 2019). The mean was useful in forecasting future outcomes when the data were void of extreme values; although, the effect of extreme values on the mean may be critical and should be pondered (Bluman, 2019). The median may be more suitable than the mean when the data set has extreme values as it was not disturbed by the extreme values (Salkind, 2017). Standard deviation was a tool for assessing data dispersion (Bluman, 2019). The smaller the standard deviation, the more closely the data are clustered around the mean (Salkind, 2017).

The measures of central tendency for the data set containing scale scores from students attending schools with less than 30% free and reduced priced meal rates were coded as Non-Title Schools and students' scores from schools greater than 70% were coded as Title schools which were displayed in Table 14. The Non-Title scores' standard deviation of 42.08 showed a wide dispersion of data around the mean. Similarly, Title scores' standard deviation of 42.98 also showed a wide dispersion of data around the mean. It was also noteworthy that the standard deviation for both the Non-Title and Title scores' standard deviation was within less than one scale score point at 0.90 which was a very similar amount of dispersion around the respective means. The Non-Title scale score mean was 441 with a median score of 443. The Title scale score mean was 421 with a median score of 419. The mean difference of Non-Title and Title scores was 20 scale score points. The median difference of Non-Title and Title scores was 14 scale score points.

Table 14

Summary of Descriptive Statistics for End-of-the-Year i-Ready Math Diagnostic Assessment Scale Score for Kindergarten through 4th Grade

	N	*Mean*	*Median*	*Standard Deviation*
Non-Title	2417	441	443	42.08
Title	3366	421	419	42.98

The results of the independent two-tailed *t*-test analysis for Kindergarten through 4th grade scale scores yielded a *t* statistic for two samples assuming unequal variances at 17.76 and a *t* critical two-tailed value at ± 1.96. Since 17.76 > 1.96, there was evidence to suggest a statistical difference between means existed that was not due chance (Salkind, 2017). The *p*-value of 1.4849E-68 confirmed the difference and the null hypothesis was rejected at α = .05 (Bluman, 2019). There was sufficient evidence to conclude that a statistical difference existed in the scale scores of students testing on the end-of-the-year (EOY) mathematics i-Ready Diagnostic Assessment in K-4 elementary schools with a free and reduced price meal population above 70% compared to K-4 elementary schools with a free and reduced price meal population below 30% at the 4th grade level. The independent two-tailed *t*-test, two sample assuming unequal variances, results were displayed in Table 15.

Table 15

Summary of t-test Two-Tailed Analysis for End-of-the-Year i-Ready Math Diagnostic Assessment Scale Score for Kindergarten through 4th Grade

	N	(*df*)	*t*-value	$P(T \leq t)$	$T(t_{crit})$
Non-Title	2417	5269	17.76	*.00	± 1.96
Title	3366				

Note. **p*-value < α = .05 indicating a significant difference in means.

Shown in Table 16 were descriptive statistics for end-of-the-year mathematics i-Ready Diagnostic Assessment scales scores for only students enrolled in Kindergarten. The mean score for Non-Title Schools was 16 scale score points higher than the Title School mean scores. The median of Non-Title Schools scale scores was 389 with a standard deviation of 23.81. The median of the Title Schools' scale scores was 375 with a standard deviation of 23.46.

Table 16

Summary of Descriptive Statistics for End-of-the-Year i-Ready Math Diagnostic Assessment Scale Score for Kindergarten

	N	*Mean*	*Median*	*Standard Deviation*
Non-Title	480	389	389	23.81
Title	681	373	375	23.46

The results of the independent two-tailed *t*-test analysis for Kindergarten scores yielded a *t* statistic for two samples assuming unequal variances at 11.55 and a *t* critical two-tailed value at ± 1.96. Since 11.55 > 1.96, there was evidence to suggest a statistical difference between means existed that was not due chance (Salkind, 2017). The *p*-value of 4.32684E-29 confirmed the difference and the null hypothesis was rejected at α = .05 (Bluman, 2019). There was sufficient evidence to conclude that a statistical difference existed in the scale scores of students testing on the end-of-the-year (EOY) mathematics i-Ready Diagnostic Assessment in K-4 elementary schools with a free and reduced price meal population above 70% compared to K-4 elementary schools with a free and reduced price meal population below 30% at the Kindergarten grade level. The independent two-tailed *t*-test, two sample assuming unequal variances, results were displayed in Table 17.

Table 17

Summary of t-test Two-Tailed Analysis for End-of-the-Year i-Ready Math Diagnostic Assessment Scale Score for Kindergarten

	N	(*df*)	*t*-value	$P(T \leq t)$	$T(t_{crit})$
Non-Title	480	1022	11.55	*.00	± 1.96
Title	681				

Note. *p-value < α = .05 indicating a significant difference in means.

Shown in Table 18 were descriptive statistics for end-of-the-year mathematics i-Ready Diagnostic Assessment scales scores for only students enrolled in 1st grade. The mean score for Non-Title Schools was 19 scale score points higher than the Title School mean scores. The median of Non-Title Schools' scale scores was 422 with a standard deviation of 23.50. The median of the Title Schools' scale scores was 401 with a standard deviation of 26.02.

Table 18

Summary of Descriptive Statistics for End-of-the-Year i-Ready Math Diagnostic Assessment Scale Score for 1st Grade

	N	*Mean*	*Median*	*Standard Deviation*
Non-Title	475	421	422	23.50
Title	709	402	401	26.02

The results of the independent two-tailed *t*-test analysis for 1st grade scores yielded a *t* statistic for two samples assuming unequal variances at 13.05 and a *t* critical two-tailed value at ± 1.96. Since 13.05 > 1.96, there was evidence to suggest a statistical difference between means existed that was not due chance (Salkind, 2017). The *p*-value of 2.82733E-36 confirmed the difference and the null hypothesis was rejected at α = .05 (Bluman, 2019). There was sufficient evidence to conclude that a statistical difference existed in the scale scores of students testing on the end-of-the-year (EOY) mathematics i-Ready Diagnostic Assessment in K-4 elementary schools with a free and reduced price meal population above 70% compared to K-4 elementary schools with a free and reduced price meal population below 30% at the 1st grade level. The independent two-tailed *t*-test, two sample assuming unequal variances, results were displayed in Table 19.

Table 19

Summary of t-test Two-Tailed Analysis for End-of-the-Year i-Ready Math Diagnostic Assessment Scale Score for 1st Grade

	N	(*df*)	*t*-value	$P(T \leq t)$	$T(t_{crit})$
Non-Title	475	1083	13.05	*.00	± 1.96
Title	709				

Note. *p-value < α = .05 indicating a significant difference in means.

Shown in Table 20 were descriptive statistics for end-of-the-year mathematics i-Ready Diagnostic Assessment scales scores for only students enrolled in 2nd grade. The mean score for Non-Title Schools was 20 scale score points higher than the Title School mean scores. The median of Non-Title Schools' scale scores was 447 with a standard deviation of 23.40. The median of the Title Schools' scale scores was 424 with a standard deviation of 28.69.

Table 20

Summary of Descriptive Statistics for End-of-the-Year i-Ready Math Diagnostic Assessment Scale Score for 2nd Grade

	N	*Mean*	*Median*	*Standard Deviation*
Non-Title	475	443	447	23.40
Title	651	423	424	28.69

The results of the independent two-tailed *t*-test analysis for 2nd grade scores yielded a *t* statistic for two samples assuming unequal variances at 13.14 and a *t* critical two-tailed value at ± 1.96. Since 13.14 > 1.96, there was evidence to suggest a statistical difference between means existed that was not due chance (Salkind, 2017). The *p*-value of 1.02752E-36 confirmed the difference and the null hypothesis was rejected at α = .05 (Bluman, 2019). There was sufficient evidence to conclude that a statistical difference existed in the scale scores of students testing on the end-of-the-year (EOY) mathematics i-Ready Diagnostic Assessment in K-4 elementary schools with a free and reduced price meal population above 70% compared to K-4 elementary schools with a free and reduced price meal population below 30% at the 2nd grade level. The independent two-tailed *t*-test, two sample assuming unequal variances, results were displayed in Table 21.

Table 21

Summary of t-test Two-Tailed Analysis for End-of-the-Year i-Ready Math Diagnostic Assessment Scale Score for 2nd Grade

	N	(*df*)	*t*-value	P(T $\leq$ *t*)	T(t_{crit})
Non-Title	475	1098	13.14	*.00	± 1.96
Title	651				

Note. *p-value < α = .05 indicating a significant difference in means.

Shown in Table 22 were descriptive statistics for end-of-the-year mathematics i-Ready Diagnostic Assessment scales scores for only students enrolled in 2nd grade. The mean score for Non-Title Schools was 15 scale score points higher than the Title School mean scores. The median of Non-Title Schools' scale scores was 464 with a standard deviation of 28.70. The median of the Title Schools' scale scores was 450 with a standard deviation of 32.50.

Table 22

Summary of Descriptive Statistics for End-of-the-Year i-Ready Math Diagnostic Assessment Scale Score for 3rd Grade

	N	*Mean*	*Median*	*Standard Deviation*
Non-Title	452	462	464	28.70
Title	701	447	450	32.50

The results of the independent two-tailed *t*-test analysis for 3rd grade scores yielded a *t* statistic for two samples assuming unequal variances at 8.27 and a *t* critical two-tailed value at ± 1.96. Since 8.27 > 1.96, there was evidence to suggest a statistical difference between means existed that was not due chance (Salkind, 2017). The *p*-value of 4.01099E-16 confirmed the difference and the null hypothesis was rejected at α = .05 (Bluman, 2019). There was sufficient evidence to conclude that a statistical difference existed in the scale scores of students testing on the end-of-the-year (EOY) mathematics i-Ready Diagnostic Assessment in K-4 elementary schools with a free and reduced price meal population above 70% compared to K-4 elementary schools with a free and reduced price meal population below 30% at the 3rd grade level. The independent two-tailed *t*-test, two sample assuming unequal variances, results were displayed in Table 23.

Table 23

Summary of t-test Two-Tailed Analysis for End-of-the-Year i-Ready Math Diagnostic Assessment Scale Score for 3rd Grade

	N	(*df*)	*t*-value	$P(T \leq t)$	$T(t_{crit})$
Non-Title	452	1045	8.27	*.00	± 1.96
Title	701				

Note. *p-value < α = .05 indicating a significant difference in means.

Shown in Table 24 were descriptive statistics for end-of-the-year mathematics i-Ready Diagnostic Assessment scales scores for only students enrolled in 4th grade. The mean score for Non-Title Schools was 22 scale score points higher than the Title Schools' mean scores. The median of Non-Title Schools' scale scores was 488 with a standard deviation of 28.80. The median of the Title Schools' scale scores was 469 with a standard deviation of 34.91.

Table 24

Summary of Descriptive Statistics for End-of-the-Year i-Ready Math Diagnostic Assessment Scale Score for 4th Grade

	N	*Mean*	*Median*	*Standard Deviation*
Non-Title	535	484	488	28.80
Title	624	462	469	34.91

The results of the independent two-tailed *t*-test analysis for 4th grade scores yielded a *t* statistic for two samples assuming unequal variances at 11.70 and a *t* critical two-tailed value at ± 1.96. Since 11.70 > 1.96, there was evidence to suggest a statistical difference between means existed that was not due chance (Salkind, 2017). The *p*-value of 5.29296E-30 confirmed the difference and the null hypothesis was rejected at $\alpha = .05$ (Bluman, 2019). There was sufficient evidence to conclude that a statistical difference existed in the scale scores of students testing on the end-of-the-year (EOY) mathematics i-Ready Diagnostic Assessment in K-4 elementary schools with a free and reduced price meal population above 70% compared to K-4 elementary schools with a free and reduced price meal population below 30% at the 4th grade level. The independent two-tailed *t*-test, two sample assuming unequal variances, results were displayed in Table 25.

Table 25

Summary of t-test Two-tailed Analysis for End-of-the-Year i-Ready Math Diagnostic Assessment Scale Score for 4th Grade

	N	(*df*)	*t*-value	$P(T \leq t)$	$T(t_{crit})$
Non-Title	535	1155	11.71	*.00	± 1.96
Title	624				

Note. *p-value < α = .05 indicating a significant difference in means.

Research question three. *What difference exists in student scale score growth on the mathematics i-Ready Diagnostic Assessment in K-4 elementary schools with a free and reduced price meal population above 70% and K-4 elementary schools with a free and reduced price meal population below 30%?* The null hypothesis stated that there was no difference between the scale score growth of students testing on the mathematics iReady Diagnostic Assessment during the school year in K-4 elementary schools with below 30% free and reduced price meal rates and those schools above 70% free and reduced price meal rates. A total of 5,357 students were assessed on the mathematics i-Ready Diagnostic Assessment at the beginning-of-the-year and end-of-the-year who attended the 21 school sites meeting the criteria of below 30% free and reduced price meal rate and above 70% free and reduced price meal rate. The Midwestern school district assessed 2,320 students who had growth scale scores in grades Kindergarten through 4th grade who attended sites below 30% free and reduced price meal rate schools. The Midwestern school district assessed and retained 3,037 growth scale scores from students attending schools with greater than 70% free and reduced price meal rates.

The two-tailed *t*-test null hypothesis was, $H_0: \mu_1 = \mu_2$, there was no difference between the beginning-of-the-year to the end-of-the-year growth scores on the mathematics i-Ready Diagnostic Assessment of students attending schools with less than 30% free and reduced price meal rates and students' scores attending schools with greater than 70% free and reduced price meal rates. The alternative hypothesis was, $H_1: \mu_1 \neq \mu_2$, there was a difference between the beginning-of-the-year to the end-of-the-year growth scores on the i-Ready Diagnostic Assessment of students attending schools with less than 30% free and reduced price meal rates and students' scores attending schools with greater than 70% free and reduced price meal rates. To test the hypothesis, first the means were calculated from the sample data using the data analysis tools in Microsoft Excel (Salkind, 2017).

The mean and median of a data set are commonly known as measures of central tendency as these measures concentrate on where the data was centered or clustered (Fraenkel et al., 2019). The mean was useful in forecasting future outcomes when the data were void of extreme values; although, the effect of extreme values on the mean may be critical and should be pondered (Bluman, 2019). Standard deviation was a tool for assessing data dispersion (Bluman, 2019). The smaller the standard deviation, the more closely the data are clustered around the mean (Salkind, 2017).

The measures of central tendency for the data set containing scale scores from students attending schools with less than 30% free and reduced priced meal were coded as Non-Title Schools and students' scores from schools greater than 70% were coded as Title schools which were displayed in Table 26. The Non-Title scores standard deviation of 17.68 showed a wide dispersion of data around the mean. Similarly, Title scores' standard deviation of 18.31 also showed a wide dispersion of data around the mean. The standard deviation for both the Non-Title and Title scores' standard deviation was within less than one scale score point at 0.63 which was a very similar amount of dispersion around the respective means. The Non-Title scale score mean was 31 with a median score of 30. The Title scale score mean was 30 with a median score of 29. The mean difference of Non-Title and Title scores was 1 scale score point. The median difference of Non-Title and Title scores was 1 scale score point.

Table 26

Summary of Descriptive Statistics for Beginning-of-the-Year to End-of-the-Year i-Ready Math Diagnostic Assessment Scale Score Growth for Kindergarten through 4th Grade

	N	*Mean*	*Median*	*Standard Deviation*
Non-Title	2320	31	30	17.68
Title	3037	30	29	18.31

The results of the independent two-tailed *t*-test analysis for Kindergarten through 4th grade growth scores yielded a *t* statistic for two samples assuming unequal variances at 3.00 and a *t* critical two-tailed value at ± 1.96. Since 3.00 > 1.96, there was evidence to suggest a statistical difference between means existed that was not due to chance (Salkind, 2017). The *p*-value of 0.002719891 confirmed the difference and the null hypothesis was rejected at $\alpha = .05$ (Bluman, 2019). There was sufficient evidence to conclude that a statistical difference existed in the scale score growth of students testing on the mathematics i-Ready Diagnostic Assessment in K-4 elementary schools with a free and reduced price meal population above 70% compared to K-4 elementary schools with a free and reduced price meal population below 30% at the Kindergarten through 4th grade levels. The independent two-tailed *t*-test, two sample assuming unequal variances, results were displayed in Table 27.

Table 27

Summary of t-test Two-Tailed Analysis for Beginning-of-the-Year to End-of-the-Year i-Ready Math Diagnostic Assessment Scale Score Growth for Kindergarten through 4th Grade

	N	(*df*)	*t*-value	P(T $\leq t$)	T(t_{crit})
Non-Title	2330	5075	3.00	*.00	± 1.96
Title	3037				

Note. *p-value < α = .05 indicating a significant difference in means.

Shown in Table 28 were descriptive statistics for growth achieved from the beginning-of-the-year to the end-of-the-year on the mathematics i-Ready Diagnostic Assessment scale scores for only students enrolled in Kindergarten. The mean scale score growth for Non-Title Schools was 1 scale score point higher than the Title Schools' mean score growth. The median of Non-Title Schools scale score growth was 34 with a standard deviation of 18.82. The median of the Title Schools scale score growth was 34 with a standard deviation of 19.49.

Table 28

Summary of Descriptive Statistics for Beginning-of-the-Year to End-of-the-Year i-Ready Math Diagnostic Assessment Scale Score Growth for Kindergarten

	N	*Mean*	*Median*	*Standard Deviation*
Non-Title	460	35	34	18.82
Title	597	34	34	19.49

The results of the independent two-tailed *t*-test analysis for Kindergarten growth scores yielded a *t* statistic for two samples assuming unequal variances at 0.88 and a *t* critical two-tailed value at ± 1.96. Calculations conveyed a *p*-value of .38, which was larger than $\alpha = .05$ indicating the null hypothesis should not be rejected and that there was no significant difference between growth of Non-Title Schools and Title Schools on the mathematics i-Ready Diagnostic Assessment (Bluman, 2019). Since the *t* statistic of 0.88 < 1.96, the *t* critical, the null hypothesis was not rejected. It was concluded there was no statistical difference between the mathematics i-Ready Diagnostic Assessment at Non-Title Schools and Title Schools, which was further substantiated since $p = .38$ (Salkind, 2017). There was sufficient evidence to conclude that there was not a statistical difference in the scale score growth of students testing on mathematics i-Ready Diagnostic Assessment in K-4 elementary schools with a free and reduced price meal population above 70% compared to K-4 elementary schools with a free and reduced price meal population below 30% at the Kindergarten level. The independent two-tailed *t*-test, two sample assuming unequal variances, results were displayed in Table 29.

Table 29

Summary of t-test Two-Tailed Analysis for Beginning-of-the-Year to End-of-the-Year i-Ready Math Diagnostic Assessment Scale Score Growth for Kindergarten

	N	(*df*)	*t*-value	$P(T \leq t)$	$T(t_{crit})$
Non-Title	460	1004	0.88	0.38	± 1.96
Title	597				

Shown in Table 30 were descriptive statistics for growth achieved from beginning-of-the-year to the end-of-the-year on the mathematics i-Ready Diagnostic Assessment scale scores for only students enrolled in 1st grade. The mean scale score growth for Non-Title Schools was 1 scale score point higher than the Title Schools' mean score growth. The median of Non-Title Schools' scale score growth was 31 with a standard deviation of 17.07. The median of the Title Schools' scale score growth was 30 with a standard deviation of 18.10.

Table 30

Summary of Descriptive Statistics for Beginning-of-the-Year to End-of-the-Year i-Ready Math Diagnostic Assessment Scale Score Growth for 1st Grade

	N	*Mean*	*Median*	*Standard Deviation*
Non-Title	452	33	31	17.07
Title	657	32	30	17.10

The results of the independent two-tailed *t*-test analysis for 1st grade growth scores yielded a *t* statistic for two samples assuming unequal variances at 1.19 and a *t* critical two-tailed value at ± 1.96. Calculations conveyed a *p*-value of .24, which was larger than α = .05 indicating the null hypothesis should not be rejected and that there was no significant difference between growth of Non-Title Schools and Title Schools on the mathematics i-Ready Diagnostic Assessment (Bluman, 2019). Since the *t* statistic of 1.19 < 1.96, the *t* critical, the null hypothesis was not rejected. It was concluded there was no statistical difference between the mathematics i-Ready Diagnostic Assessment at Non-Title Schools and Title Schools, which was further substantiated since *p* = .24 (Salkind, 2017). There was sufficient evidence to conclude that there was not a statistical difference in the scale score growth of students testing on the mathematics i-Ready Diagnostic Assessment in K-4 elementary schools with a free and reduced price meal population above 70% compared to K-4 elementary schools with a free and reduced price meal population below 30% at the 1st grade level. The independent two-tailed *t*-test, two sample assuming unequal variances, results were displayed in Table 31.

Table 31

Summary of t-test Two-tailed Analysis for Beginning-of-the-Year to End-of-the-Year i-Ready Math Diagnostic Assessment Scale Score Growth for 1st Grade

	N	(*df*)	*t*-value	$P(T \leq t)$	$T(t_{crit})$
Non-Title	452	971	1.19	0.24	± 1.96
Title	657				

Note. *p-value < α = .05 indicating a significant difference in means.

Shown in Table 32 were descriptive statistics for growth achieved from beginning-of-the-year to the end-of-the-year on the mathematics i-Ready Diagnostic Assessment scales scores for only students enrolled in 2nd grade. The mean scale score growth for Non-Title Schools was 1 scale score point higher than the Title Schools' mean score growth. The median of Non-Title Schools' scale score growth was 28 with a standard deviation of 17.48. The median of the Title Schools' scale score growth was 27 with a standard deviation of 17.82.

Table 32

Summary of Descriptive Statistics for Beginning-of-the-Year to End-of-the-Year i-Ready Math Diagnostic Assessment Scale Score Growth for 2nd Grade

	N	*Mean*	*Median*	*Standard Deviation*
Non-Title	455	28	28	17.48
Title	582	27	27	17.82

The results of the independent two-tailed *t*-test analysis for 2nd grade growth scores yielded a *t* statistic for two samples assuming unequal variances at 0.78 and a *t* critical two-tailed value at ± 1.96. Calculations conveyed a *p*-value of .43, which was larger than $\alpha = .05$ indicating the null hypothesis should not be rejected and that there was no significant difference between growth of Non-Title Schools and Title Schools on the mathematics i-Ready Diagnostic Assessment (Bluman, 2019). Since the *t* statistic of 0.78 < 1.96, the *t* critical, the null hypothesis was not rejected. It was concluded there was no statistical difference between mathematics i-Ready Diagnostic Assessment at Non-Title

Schools and Title Schools, which was further substantiated since *p* = .43 (Salkind, 2017). There was sufficient evidence to conclude that there was not a statistical difference in the scale score growth of students testing on mathematics i-Ready Diagnostic Assessment in K-4 elementary schools with a free and reduced price meal population above 70% compared to K-4 elementary schools with a free and reduced price meal population below 30% at the 2nd grade level. The independent two-tailed *t*-test, two sample assuming unequal variances, results were displayed in Table 33.

Table 33

Summary of t-test Two-Tail Analysis for Beginning-of-the-Year to End-of-the-Year i-Ready Math Diagnostic Assessment Scale Score Growth for 2nd Grade

	N	(*df*)	*t*-value	$P(T \leq t)$	$T(t_{crit})$
Non-Title	455	984	0.78	0.43	± 1.96
Title	582				

Shown in Table 34 were descriptive statistics for growth achieved from beginning-of-the-year to the end-of-the-year on the mathematics i-Ready Diagnostic Assessment scales scores for only students enrolled in 3rd grade. The mean scale score growth for Non-Title Schools was the same as the Title Schools' mean score growth. The median of Non-Title Schools' scale score growth was 30 with a standard deviation of 17.60. The median of the Title Schools' scale score growth was 30 with a standard deviation of 17.77.

Table 34

Summary of Descriptive Statistics for Beginning-of-the-Year to End-of-the-Year i-Ready Math Diagnostic Assessment Scale Score Growth for 3rd Grade

	N	*Mean*	*Median*	*Standard Deviation*
Non-Title	439	30	30	17.60
Title	633	30	30	17.77

The results of the independent two-tailed *t*-test analysis for 3rd grade growth scores yielded a *t* statistic for two samples assuming unequal variances at 0.56 and a *t* critical two-tailed value at ± 1.96. Calculations conveyed a *p*-value of .58, which was larger than $\alpha = .05$ indicating the null hypothesis should not be rejected and that there was no significant difference between growth of Non-Title Schools and Title Schools on the mathematics i-Ready Diagnostic Assessment (Bluman, 2019). Since the *t* statistic of 0.56 < 1.96, the *t* critical, the null hypothesis was not rejected. It was concluded there was no statistical difference between mathematics i-Ready Diagnostic Assessment at Non-Title Schools and Title Schools, which was further substantiated since $p = .58$ (Salkind, 2017). There was sufficient evidence to conclude that there was not a statistical difference in the scale score growth of students testing on mathematics i-Ready Diagnostic Assessment in K-4 elementary schools with a free and reduced price meal population above 70% compared to K-4 elementary schools with a free and reduced price meal population below 30% at the 3rd grade level. The independent two-tailed *t*-test, two sample assuming unequal variances, results were displayed in Table 35.

Table 35

Summary of t-test Two-Tailed Analysis for Beginning-of-the-Year to End-of-the-Year i-Ready Math Diagnostic Assessment Scale Score Growth for 3rd Grade

	N	(*df*)	*t*-value	$P(T \leq t)$	$T(t_{crit})$
Non-Title	439	948	0.56	0.58	± 1.96
Title	633				

Shown in Table 36 were descriptive statistics for growth achieved from beginning-of-the-year to the end-of-the-year on the mathematics i-Ready Diagnostic Assessment scales scores for only students enrolled in 4th grade. The mean scale score growth for Non-Title Schools was 4 scale score points higher than the Title Schools' mean score growth. The median of Non-Title Schools scale score growth was 29 with a standard deviation of 16.57. The median of the Title Schools scale score growth was 25 with a standard deviation of 18.06.

Table 36

Summary of Descriptive Statistics for Beginning-of-the-Year to End-of-the-Year i-Ready Math Diagnostic Assessment Scale Score Growth for 4th Grade

	N	*Mean*	*Median*	*Standard Deviation*
Non-Title	514	29	29	16.57
Title	568	25	25	18.06

The results of the independent two-tailed *t*-test analysis for 4th grade growth scores yielded a *t* statistic for two samples assuming unequal variances at 4.11 and a *t* critical two-tailed value at ± 1.96. Since 4.11 > 1.96, there was evidence to suggest a statistical difference between means existed that was not due to chance (Salkind, 2017). The *p*-value of 4.33518E-05 confirmed the difference and the null hypothesis was rejected at α = .05 (Bluman, 2019). There was sufficient evidence to conclude that a statistical difference existed in the scale score growth of students testing on the mathematics i-Ready Diagnostic Assessment in K-4 elementary schools with a free and reduced price meal population above 70% compared to K-4 elementary schools with a free and reduced price meal population below 30% at the 4th grade level. The independent two-tailed *t*-test, two sample assuming unequal variances, results were displayed in Table 37.

Table 37

Summary of t-test Two-tailed Analysis for Beginning-of-the-Year to End-of-the-Year i-Ready Math Diagnostic Assessment Scale Score Growth for 4th Grade

	N	(*df*)	*t*-value	P(T ≤ *t*)	T(t_{crit})
Non-Title	514	1080	4.11	*.00	± 1.96
Title	568				

Note. **p*-value < α = .05 indicating a significant difference in means.

Summary

The purpose of this research was to investigate if differences existed in mathematics i-Ready Diagnostic Assessment scores and growth between K-4 elementary school sites with less than 30% free and reduced price meal rates and K-4 elementary school sites with greater than 70% free and reduced price meal rates. The study was conducted with secondary data collected from one Midwestern school district. The data was collected from 21 school sites in the Midwestern school district and deidentified by the Midwestern school district's Analytics, Assessment, and Accountability department and included beginning-of-the-year, end-of-the-year, and growth scale scores. The study was framed by three research questions, which were answered using a quantitative approach.

Through data analysis of research question one, a significant difference between beginning-of-the-year mathematics i-Ready Diagnostic Assessment scale scores between school sites with less than 30% free and reduced meal rates and greater than 70% free and reduced price meal rates were discovered. The data analysis also displayed a significant difference between the end-of-the-year mathematics i-Ready Diagnostic Assessment scale scores between school sites with less than 30% free and reduced price meal rates and greater than 70% free and reduced price meal rates through research question two. Research question three revealed mixed results. There was a statistical difference present in growth scores at the site level between school sites with less than 30% free and reduced price meal rates and greater than 70% free and reduced price meal rates and at the 4th grade level. However, there was not a statistical difference in grade levels Kindergarten, 1st, 2nd, and 3rd.

In Chapter Five, a detailed summary of findings and conclusions were provided. The discoveries and conclusions for each research question yielded from the quantitative data analysis were described. A section with implications of the discoveries and conclusions were presented. In addition, recommendations for future research were suggested. Finally, a summary of Chapter Five and the study was delivered.

Chapter Five: Summary and Conclusions

The achievement gap between socioeconomic classes has continued to be a significant area targeted for improvement in educational settings (Bohrnstedt et al., 2015). Rector and Sheffield (2014) noted that since President Johnson declared a war on poverty in 1964 more than $22 trillion has been spent and multiple educational reforms have been implemented (p. 8). Mathematics has also been identified as having a wide gap in achievement between students of differing socioeconomic classes (Wagner, 2014). In addition, mathematics has become one of the fastest-growing areas of need in careers today and will become a great equalizer in ending generational poverty if mathematics skills are attained (Tosto et al., 2016). In this study of early grades, Kindergarten through 4th grade, mathematics achievement and growth attainment levels were gathered to determine if an achievement gap existed. In addition to examining schools as a whole, student mathematics achievement and growth attainment levels at each grade level were examined independently.

This study was designed to conclude the difference in mathematics achievement levels and growth based on socioeconomic status determined by the concentration of free and reduced meal rates in elementary schools during one school year. In this chapter, the findings from Chapter Four were reiterated. The following sections include conclusions, implication for practice, and recommendations for future research. The chapter concludes with a summary of the study.

Findings

The following research questions guided the study and informed the hypothesis of the study:

Research question one. What difference exists in the scale scores of students testing on the beginning-of-the-year (BOY) mathematics i-Ready Diagnostic Assessment in K-4 elementary schools with a free and reduced price meal population above 70% compared to K-4 elementary schools with a free and reduced price meal population below 30%?

(*$H1_0$*) There is no difference in the scale scores of students on the beginning-of-the-year (BOY) mathematics i-Ready Diagnostic Assessment in K-4 elementary schools with a free and reduced price meal population above 70% compared to K-4 elementary schools with a free and reduced price meal population below 30%.

After conducting statistical analyses of mathematics scores from the beginning-of-the-year i-Ready Diagnostic Assessment, a statistical difference was determined to be prevalent. The mean mathematics student scale scores from schools with less than 30% free and reduced price meal populations were higher than the mean mathematics student scale scores from schools with greater than 70% free and reduced priced meal rates. The mean mathematics scale scores from each individual grade level, Kindergarten through 4th grade, were higher at schools with less than 30% free and reduced price meal rates when compared to mathematics students' scale scores from schools with greater than 70% free and reduced priced meal rates. The smallest difference in mathematics scale scores were present at the Kindergarten level while the largest difference in mathematics scale scores occurred at the 2nd grade level.

Research question two. What difference exists in the scale scores of students testing on the end-of-the-year (EOY) mathematics i-Ready Diagnostic Assessment in K-4 elementary schools with a free and reduced price meal population above 70% compared to K-4 elementary schools with a free and reduced price meal population below 30%?

(*H1₀*) There is no difference in the scale scores of students on the end-of-the-year (EOY) mathematics i-Ready Diagnostic Assessment in K-4 elementary schools with a free and reduced price meal population above 70% compared to K-4 elementary schools with a free and reduced price meal population below 30%.

After conducting statistical analysis of mathematics scores from the end-of-the-year i-Ready Diagnostic Assessment, a statistical difference was determined to be evident. The end-of-the-year i-Ready Diagnostic Assessment mean mathematics students' scale scores from schools with less than 30% free and reduced price meal populations were higher than the mean mathematics students' scale scores from schools with greater than 70% free and reduced priced meal rates. The mean mathematics scale scores from each individual grade level, Kindergarten through 4th grade, were higher at schools with less than 30% free and reduced price meal rates when compared to mathematics student scale scores from schools with greater than 70% free and reduced priced meal rates. The smallest difference in mathematics scale scores was present at the 3rd grade level while the largest difference in mathematics scale scores occurred at the 4th grade level.

Research question three. What difference exists in student scale score growth on the mathematics i-Ready Diagnostic Assessment in K-4 elementary schools with a free and reduced price meal population above 70% and K-4 elementary schools with a free and reduced price meal population below 30%?

(*H1₀*) There is no difference between the student scale score growth on the mathematics i-Ready Diagnostic Assessment in K-4 elementary schools with a free and reduced price meal population above 70% and K-4 elementary schools with a free and reduced price meal population below 30%.

After conducting statistical analyses of growth from the beginning-of-the-year scale scores to the end-or-the-year scale scores on the i-Ready Diagnostic Assessment, a difference was observed but not at each independent grade level. The mean mathematics student scale score growth of schools with less than 30% free and reduced price meal rates was 1.2 scale score points higher than the mean mathematics student scale score growth from schools with greater than 70% free and reduced priced meal rates. The mean mathematics scale score growth was not found to be significantly different in Kindergarten, 1st grade, 2nd grade, or 3rd grade with $\alpha = .05$. The difference in mean scale score growth at the Kindergarten level was 1.0 scale score point higher in schools with less than 30% free and reduced price meal rates than the mean mathematics student scale score growth from schools with greater than 70% free and reduced priced meal rates. The mean mathematics scale score growth in Kindergarten was not statistically significant at $\alpha = .05$. The difference in mean scale score growth in 1st grade was 1.2 scale score points higher in schools with less than 30% free and reduced price meal rates than the mean mathematics student scale score growth from schools with greater than 70% free and reduced priced meal rates. The mean mathematics scale score growth in 1st grade was not statistically significant at $\alpha = .05$. The difference in mean scale score growth in 2nd grade was 0.8 scale score points higher in schools with less than 30% free and reduced price meal rates than the mean mathematics student scale score growth from schools with greater than 70% free and reduced priced meal rates. The mean mathematics scale score growth in 2nd grade was not statistically significant at $\alpha = .05$. The difference in mean scale score growth in 3rd grade was 0.6 scale score points higher in schools with less than 30% free and reduced price meal rates than the mean mathematics student scale score growth from schools with greater than 70% free and reduced priced meal rates. The mean mathematics scale score growth in 3rd grade was not statistically significant at $\alpha = .05$. The difference in mean scale score growth in 4th grade was 4.3 scale score points higher in schools with less than 30% free and reduced price meal rates than the mean mathematics student scale score growth from schools with greater than 70% free and reduced priced meal rates. The mean mathematics scale score growth in 4th grade was statistically significant at $\alpha = .05$.

Conclusions

When examining research questions one and two there was clear evidence that students attending Title schools scored lower than students attending Non-Title schools in terms of mathematical achievement as measured by the i-Ready Diagnostic Assessment. This data supported Jensen's (2009) statement, "Many children raised in poverty enter school a step behind their well-off peers" (p. 38). While the data supported the conclusion that students in poverty were entering school a step behind, the data also revealed that the smallest gap in mathematical achievement level occurred at the beginning of the year at the Kindergarten level. In addition, the building wide beginning of the year achievement gap was higher than four of the five individual grade level achievement gaps at the beginning of the year.

The same trend was true at the end of the school year according to i-Ready Diagnostic Assessment data in mathematics. Students attending Title Schools performed lower on average than students attending Non-Title Schools. The achievement gap actually widened slightly throughout the school year as the achievement gap grew from 19 scale score points to 20 scale scores points at the end of the school year.

While the data revealed an achievement gap in regard to research questions one and two, student growth was further examined in research question three. Student scores in Kindergarten, 1st grade, 2nd grade, and 3rd grade did not reveal a gap in mathematical growth at a statistically significant rate. However, when the data set was viewed cumulatively (grades Kindergarten through 4th grade), statistical significance was evident. The mathematical achievement growth gap present at grade 4 was large enough to skew the entirety of the set and produce statistical significance across all grade levels.

Researchers, such as Caine et al. (2009), Claro et al. (2016), Hattie (2015), Jensen (2016), Payne (2018), and Sousa and Tomlinson (2018), have identified a gap in learning of students from poverty. The achievement gap identified in this study was not a surprise, however, the lack of a narrowing of the gap was surprising. When considering the amount of additional resources accessible to local educational agencies in Title designated buildings, an expectation of a narrowing of the gap was reasonable. Data in this study revealed a clear gap in mathematical achievement during the primary grades (Kindergarten through 3rd grade). With evidence that supported there was no narrowing of the achievement gap, it was vital for educational decision makers at the federal, state, and local levels to investigate alternative solutions. A contradictory viewpoint could also be presented. Decision makers at each level, federal, state, and local, could argue that due to differentiated instruction, interventions available via Title I funds, and an understanding of supporting students in poverty, the achievement gap actually remained consistent. The viewpoint could be presented that targeted interventions for both teacher learning and student learning ensured that the achievement gap was not widening during students' early years. Implications for practice were reviewed in the next section.

Implications for Practice

As a result of the research conducted, the following three practices were suggested to have a positive impact on closing the mathematical achievement level differences revealed by data analysis to answer the research questions: targeted and intentional professional learning for mathematics educators; heightened awareness of mathematical practices for policy makers; and clear development of instructional models of mathematics across grade spans.

Professional learning. First, mathematics educators need to be taught specific skills to help address poverty from the brain-based aspect. Therefore, professional learning opportunities with the goal of raising awareness and understanding of behaviors and triggers associated with students in poverty would assist educators in addressing student needs such as a shift in mindset. Tanner (2017) argued creation of opportunities for educators to learn about the symptoms of poverty that show up in classrooms supported student learning overall. Educators needed an increased knowledge base and skills directed toward actionable in-class steps such as giving students a sense of control, using a calm voice to teach, and explicit teaching of emotional skills (Jensen, 2017). Additionally, students in poverty needed help with cognitive skills such as building short-term working memory (Sousa & Tomlinson, 2018). Brains can and do change but educators must have the knowledge and actionable strategies to implement brain-based learning approaches to address the impact of poverty on the brain (Reardon, 2016).

In addition to professional learning focused on the implications of poverty and brain based learning, proper professional learning was necessary for educators to understand how to teach for conceptual knowledge in mathematics (Chandler, Fortune, Lovett, & Scherrer, 2016). While the implementation of Common Core standards did not offer detail on providing elementary educators the learning they need to teach for conceptual understanding, (Boaler, 2016) mathematics professional learning must meet the same level of rigor required in students' learning standards for teachers to be successful in instructional practice.

Finally, targeted professional learning should be provided to early career educators regarding reduction of math anxiety. Math anxiety in educators must be addressed first, especially for elementary teachers (Ferguson et al., 2018). Research and training focused around the topic of math anxiety and guidance on how to reduce the anxiety should be provided since math anxiety could be transmitted from teacher to student (Furner, 2017). After foundational knowledge of what math anxiety was and where it stems from was presented to teachers, research about math anxiety should be disseminated through teachers to help students reduce their level of math anxiety (Foley et al., 2017).

Policy makers. In order to address mathematics achievement gaps, it was essential that equity of importance for mathematics education was prevalent from the policy makers down to the classroom teachers. Advocacy at the legislative level when enacting educational reform and initiatives related to mathematics was a crucial component to student achievement and success. All stakeholders supporting students must feel an urgency to reduce the achievement gap in mathematics specifically for students in poverty. Poverty was the top predictor of determining a student's performance level in mathematics (Lubell, 2015). Therefore, all educational policy makers must understand the increased needs of learners who come from socioeconomically disadvantaged backgrounds. The mathematics field was the fastest growing job market (Harmon & Wilborn, 2016). To ensure students in poverty had a higher probability of escaping poverty, mathematics education could not be ignored (Boaler, 2016). Similarly, there was a need for ongoing advocacy for early interventions at the elementary grade levels when academic gaps were first present to mitigate continued disparities.

Instructional models. Teachers of mathematics should ensure they were using the Standards of Mathematical Practice endorsed by the National Council of Teachers of Mathematics to support student achievement in math and prevent academic achievement gaps. The Standards of Mathematical Practice included the following: math goals to focus learning, tasks that promote reasoning and problem solving, use and connect mathematical representations, mathematical discourse, purposeful questioning, building of procedural fluency from conceptual understanding, use of student thinking, and support of productive struggle (NCTM, 2017). Prioritization of mathematical discourse as a foundational part of the mathematical instructional model should begin as early as Kindergarten and should remain consistent throughout programming. Due to the shift in teacher instructional practice to facilitate mathematical discourse, additional training for teachers in the classroom setting was necessary (Kaplan and Dance, 2018). Additionally, differentiation in the mathematics classroom should be another essential component within the instructional model. Educators needed professional learning and feedback in mathematics pedagogy to ensure teachers possess self-efficacy in teaching mathematics at the level the learner required (Althauser, 2018; Tomlinson, 2014).

Recommendations for Future Research

Recommendations for future research were divided into two distinct categories: research to further the current study and additional avenues of research that would extend the scholarly conversation around the topic of study. Both were described below.

First, researchers looking to further the current study could consider additional research that included collection of mathematical achievement across multiple school years. This would allow for cohorts of student data to be analyzed over time which would create a more robust data set. Secondarily, expanding the current grade level band of Kindergarten through 4th grade achievement data to include achievement data through 8th grade would be another option for future research. The Midwestern school district collects data from Kindergarten through 8th grade. More information was needed to determine if there was a difference in growth and achievement at the higher-grade levels. Lastly, further research could be conducted to include an analysis of the scale scores in each mathematical domain assessed on the i-Ready Diagnostic Assessment: Numbers and Operations, Algebra and Algebraic Thinking, Measurement and Data, and Geometry. This data would be useful for supporting district and building leaders with instructional programming and planning.

Similarly, there existed opportunity for other bodies of research that would extend the boundaries of the current study. Initially, research specific to the amount of mathematical instructional time allotted and used by elementary grade level teachers would be a lens for comparison of findings within the study. Likewise, research regarding the number of grade level mathematics standards and the time allotted to teach and reteach each standard could provide further frames for investigation. With existing bodies of research available tied to intervention, continued research regarding Title I interventions specifically having a highly positive impact on mathematical achievement could support future planning and allocation of resources for schools and districts alike. Finally, continued research related to both mathematics professional learning and teacher perceptions of math anxiety were valuable contributions to the body of research on the study topic and deserve further study.

Summary

The achievement gap has remained a significant issue in nations around the world (Bohrnstedt et al., 2015). In the United States, the government has spent in excess of $22 trillion to combat poverty in the last 50 years (Rector & Sheffield, 2014, p. 8). Unfortunately, more than half of the students in the U.S. met the federal standards for poverty (Jensen, 2016, p. 7). While poverty and academic achievement gaps continue to be at the forefront of educational reform initiatives, research was needed to determine where the mathematic achievement gap began to occur for students in poverty. Mathematics is one of the fastest-growing needs in careers today, and capability in mathematics may provide opportunities for higher wages more than ever before (Tosto et al., 2016). A critical factor for positive wage attainment is mathematics education and training (Tosto et al., 2016). The Every Student Succeeds Act gave more power to state legislators to enact accountability measures for their own states (U.S. Department of Education, 2018). With more decision making power being yielded to state legislators, more research was needed to determine if a difference in mathematical achievement level based on socioeconomic status was present and at what grade level it became a difference. The purpose of this study was to conclude the difference in mathematics achievement levels based on socioeconomic status determined by the concentration of free and reduced price meal rates in elementary schools.

In Chapter Two, a review of literature revealed a connection between poverty and negative impacts on academic achievement (Brown, Bynum, & Beziat, 2017; Egalite, 2016; Jensen, 2017; Metzler et al., 2017; Payne, 2018;). The barriers to closing the gap begin with not addressing the effects poverty has had on the brain (Jensen, 2017; Sorrels, 2017; Tanner, 2017; Sousa & Tomlinson, 2018). Brain-based learning allows educators to address the negative effects poverty and trauma have had on the student brain (Fisher, 2014; Jensen, 2016; Jensen, 2017; Payne, 2016; Sorrels, 2017; Wilkinson, 2017). In addition, 21st century educational reforms and initiatives revealed the shifts in standards and practices during a new age of educational accountability (Hess & Eden, 2017; NCTM, 2019; Polikoff, 2017; Raun, 2018; U.S. Department of Education, 2018). In addition, shifts in math practices and pedagogy were identified which required continual learning for educators to assist students in meeting new math standards and practices (Althauser, 2018; Boaler et al., 2018; Mutlu, 2019; NCTM, 2017; Williams, 2017).

Chapter Three contained an overview of the methodology of the study. The study was conducted to conclude the difference in mathematics achievement levels based on socioeconomic status determined by the concentration of free and reduced price meal rates in elementary schools. Additionally, the differences in mathematical achievement levels were examined by combined grade level scale scores and individual grade level scale scores. The mathematical achievement growth from beginning-of-the-year to the end-of-the-year i-Ready scale scores were also examined.

The findings, revealed in Chapter Four, displayed a significant difference in beginning-of-the-year mathematics i-Ready Diagnostic Assessment scale scores between school sites with less than 30% free and reduced price meal rates and greater than 70% free and reduced price meal rates. The significant difference was also present at each grade level, Kindergarten through 4th grade. The results also revealed a significant difference between the end-of-the-year mathematics i-Ready Diagnostic Assessment scale scores between school sites with less than 30% free and reduced price meal rates and greater than 70% free and reduced price meal. The significant difference on the end-of-the-year assessment was also present at each grade level, Kindergarten through 4th grade. Additionally, mixed results were found when examining mathematical growth. There was a statistical difference present in growth scores between school sites with less than 30% free and reduced price meal rates and greater than 70% free and reduced price meal rates at the 4th grade level. However, there was not a statistical difference for grade levels Kindergarten, 1st, 2nd, and 3rd.

Educational decision makers at all levels, federal, state, local, building, and classroom could leverage these findings to ensure professional learning and interventions were provided at the earliest of educational levels. The future research considerations would be to examine mathematical achievement data on a more longitudinal scale while focusing on mathematical domains. In addition, recommendations for professional learning, accountability measures, and perception data that could impact teacher efficacy and pedagogy were outlined. In conclusion, a multitude of variables impacted student learning of mathematics, and it was paramount that all educators equip themselves with knowledge of student needs as well as content pedagogy to meet the mathematical rigor required for all learners to compete in the global marketplace.

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Appendix A

NCLB Statement of Purpose (SEC. 1001.)

(1) Ensuring that high-quality academic assessments, accountability systems, teacher preparation and training, curriculum, and instructional materials are aligned with challenging State academic standards so that students, teachers, parents, and administrators can measure progress against common expectations for student academic achievement;

(2) Meeting the educational needs of low-achieving children in our Nation's highest-poverty schools, limited English proficient children, migratory children, children with disabilities, Indian children, neglected or delinquent children, and young children in need of reading assistance;

(3) Closing the achievement gap between high- and low-performing children, especially the achievement gaps between minority and nonminority students, and between disadvantaged children and their more advantaged peers;

(4) Holding schools, local educational agencies, and States accountable for improving the academic achievement of all students, and identifying and turning around low-performing schools that have failed to provide a high-quality education to their students, while providing alternatives to students in such schools to enable the students to receive a high-quality education;

(5) Distributing and targeting resources sufficiently to make a difference to local educational agencies and schools where needs are greatest;

(6) Improving and strengthening accountability, teaching, and learning by using State assessment systems designed to ensure that students are meeting challenging State

academic achievement and content standards and increasing achievement overall, but especially for the disadvantaged;

(7) Providing greater decision making authority and flexibility to schools and teachers in exchange for greater responsibility for student performance;

(8) Providing children an enriched and accelerated educational program, including the use of schoolwide programs or additional services that increase the amount and quality of instructional time;

(9) Promoting schoolwide reform and ensuring the access of children to effective, scientifically based instructional strategies and challenging academic content;

(10) Significantly elevating the quality of instruction by providing staff in participating schools with substantial opportunities for professional development;

(11) Coordinating services under all parts of this title with each other, with other educational services, and, to the extent feasible, with other agencies providing services to youth, children, and families; and

(12) Affording parents substantial and meaningful opportunities to participate in the education of their children. (pp. 1-2)

Appendix B

Lindenwood IRB Approval Letter

Sep 16, 2019 7:35 PM CDT

RE: IRB-20-20: Initial - The Effects of Socioeconomic Status on Mathematical Achievement

Dear Joshua Holt,

The study, The Effects of Socioeconomic Status on Mathematical Achievement, has been Exempt.

Category: Category 1. Research, conducted in established or commonly accepted educational settings, that specifically involves normal educational practices that are not likely to adversely impact students' opportunity to learn required educational content or the assessment of educators who provide instruction. This includes most research on regular and special education instructional strategies, and research on the effectiveness of or the comparison among instructional techniques, curricula, or classroom management methods.

The submission was approved on September 16, 2019.

Here are the findings: Regulatory Determinations

This study has been determined to be minimal risk because the research is not obtaining data considered sensitive information or performing interventions posing harm greater than those ordinarily encountered in daily life or during the performance of routine physical or psychological examinations or tests.

Sincerely, Lindenwood University (lindenwood) Institutional Review Board

Vita

Joshua Holt currently serves as the elementary principal at David Harrison Elementary School in Springfield, Missouri. He graduated from Central Methodist University in Fayette, Missouri with a Bachelor of Science in Education degree in 2006. Joshua then attended the University of Missouri in Columbia, Missouri where he earned a Master of Education in Curriculum and Instruction degree in 2007. He also completed a Masters of Education in Elementary Educational Administration from Missouri State University in Springfield, Missouri in 2009.