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The Impact Math Interventions Have on Student Achievement in an Urban School Setting

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THE IMPACT MATH INTERVENTIONS HAVE ON STUDENT ACHIEVEMENT IN AN URBAN SCHOOL SETTING

by

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ABSTRACT

Intense intervention is needed for students who have persistent math challenges and perform below grade level. In the classroom setting, teachers need to provide additional support for some students based on their specific needs. This correlational study was an examination of interventions' impact on student achievement in math. The sample comprised students enrolled in Algebra I during the 2021–2022 school year. The results of this study showed that interventions may have a positive impact on student performance, especially when carried out in the proper educational setting. The findings from the research showed that there is no significant statistical correlation between students who received the intervention and those who didn't, as observed through the Algebra 1 EOC. Further studies are required to determine the impact of the interventionist on the academic performance of the students.

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CHAPTER ONE: INTRODUCTION

Background

The No Child Left Behind Act NCLB;2002 introduced a new level of accountability in U.S. education. It required states and local school districts to focus on enhancing academic performance for all groups of students. States and local school districts had to address improving academic outcomes for all student subgroups. Enacted in 2015, the Every Student Succeeds Act (ESSA) focused on increased school accountability. ESSA aims to ensure that public schools provide a quality education for all students. Under ESSA, states must set achievement goals for students. The goals established for students should help struggling students catch up and close the opportunity to learn gaps. ESSA provides guidance for the U.S. PreK–12 education system and requires schools to intervene when students struggle to make Adequate Yearly Progress (AYP).

Poor student performance in mathematics is a national and international problem for several reasons. Math is a foundational subject essential for success in many other academic disciplines and various career fields. Math skills are critical for participation in an increasingly technological and data-driven world.

Poor math performance is linked to economic disadvantage and lower overall academic achievement. According to the National Assessment of Educational Progress (NAEP; 2021), students from low-income families are much more likely to perform poorly in math than their higher-income peers. This opportunity to learn gap has significant long-term implications for these students, as it may limit their access to higher education and career opportunities.

Limited access to programs like gifted, Advanced Placement (AP), and International Baccalaureate (IB) courses can contribute to the correlation between economic disadvantage and poor math performance. These programs often provide enriched and challenging learning opportunities for students, allowing them to explore advanced math concepts and develop critical thinking skills. However, students from low-income backgrounds may face barriers in accessing these programs. These barriers may include financial constraints, lack of information about available opportunities, and limited resources in their schools or communities. As a result, these students cannot benefit from the rigorous curriculum and specialized instruction offered in gifted, AP, and IB courses. Without access to these programs, students from economically disadvantaged backgrounds may not receive the same academic preparation and exposure to advanced math topics as their peers from higher-income families. This unequal access can lead to a gap in math proficiency and hinder their overall academic achievement. Moreover, these programs often play a crucial role in college admissions, scholarships, and opportunities for higher education. By not having access to such programs, students from low-income families may face additional obstacles in gaining admission to selective colleges and universities, limiting their chances for future career advancement in fields that require strong math skills. Limited access to programs like gifted, AP, and IB courses can perpetuate the correlation between economic disadvantage and poor math performance by denying students from low-income families the opportunity to receive advanced math instruction and develop the necessary skills for academic success and future career prospects.

Poor math performance may hinder a country's economic growth and competitiveness. The Organization for Economic Co-operation and Development (OECD; 2021) found that high math proficiency among a country's workforce is associated with higher economic growth rates. As such, countries with low math proficiency levels may struggle to remain competitive in the global economy. Many factors contribute to poor math performance, including inadequate teacher training, insufficient instructional materials, and low student motivation (OCED, 2021). Addressing these issues requires a multifaceted approach that involves collaboration among educators, policymakers, and other stakeholders.

Systemic factors like school segregation, tracking practices, and resource allocation cause inequalities in quality math curricula for Black students. Segregation, tracking practices, and resource allocation cause inequalities in quality math curricula for Black students Stereotypes and biases limit opportunities for advancement in math, and standardized tests like the ACT reinforce cultural norms that disadvantage diverse students (Joseph & Cobb, 2019; Sulik, Blair, & Cooper, 2018). However, research shows that resilience, mentorship, and a strong sense of identity can help Black students excel in math (Jett, 2019). Educators can improve math achievement by promoting interest and engagement among students with perceived higher math ability (Bong et al., 2015; Durik et al., 2015; Kim et al., 2015b; Matthews, 2018; Prendergast & Donoghue, 2014; Turner et al., 2015), using the expectancy-value theory (EVT) to create equitable learning environments that support all students.

Educators and researchers constantly explore ways to enhance student math outcomes, recognizing that strong math skills are crucial for educational and career advancement in various fields. The "Future of Jobs Report 2020" published by the World Economic Forum emphasizes the growing significance of math skills in the workplace, particularly in data analysis, artificial intelligence, and machine learning. The report underscores the importance of mathematical reasoning as one of the top skills required across all industries.

This evidence supports the notion that proficiency in mathematics is integral to success in a wide range of occupations. Consequently, students struggling with math may encounter challenges in accessing diverse educational and employment opportunities. Recognizing this, teachers strive to support the learning of all students. However, it is essential that students with gaps in their mathematical understanding receive targeted interventions that are specifically tailored to address their individual needs.

To ensure that all students receive the necessary support, school and school district leaders must design solutions based on research and evidence. These solutions can include differentiated instruction, personalized learning plans, remedial programs, and additional resources. By carefully assessing the needs of each student and implementing strategies that align with their individual requirements, educators can foster better math outcomes for all learners.

Ultimately, by prioritizing the development of math skills and providing targeted interventions, schools can empower students to overcome their challenges and open a world of educational and career possibilities. This proactive approach is essential in equipping students with the mathematical competencies required to succeed in the ever-evolving job market.

Schools may go beyond the district-provided textbooks and resources and employ supplementary interventions to enhance students' mathematical skills. These schools can implement various strategies, such as Response to Intervention (RtI) and alternative techniques, based on the students' needs and available resources. Short-term interventions targeting students' specific strengths and weaknesses will likely be successful. Xu et al. (2017), asserted that peer tutoring is an effective short-term intervention to improve mathematical skills. Peer tutoring involves pairing students to teach and learn from each other. Teachers may provide individualized mathematical training by using computer-assisted instruction with computer programs or apps. According to Mullis et al. (2016), computer-assisted education could be an efficient short-term intervention to enhance mathematical abilities. Math fact fluency practice entails performing fundamental arithmetic operations, such as addition, subtraction, multiplication, and division, multiple times in succession. Dowker et al. (2019) found that mathematical fact fluency practice could be an effective short-term intervention to enhance mathematical skills. Educators often teach mathematical problem-solving tactics to students as part of problem-solving treatments. These strategies may include drawing diagrams, creating tables, or using equations. According to Rittle-Johnson et al. (2017), problem-solving therapies could be successful short-term interventions to increase mathematical skills.

Progress monitoring is an essential practice that enables educators to closely track students' learning trajectories, identify areas of improvement, and tailor instruction. Progress monitoring is crucial to providing educational interventions to support student learning. It involves regularly collecting and analyzing data to evaluate students' progress toward specific learning goals or benchmarks. This ongoing assessment process helps educators identify areas of strength and areas where students may be struggling, enabling them to adjust their instructional strategies.

Here are a few key aspects of progress monitoring in education:

1. Continuous Assessment: Progress monitoring involves the frequent and ongoing assessment of students' skills and knowledge. Depending on the specific educational context and goals, this can be done through various methods, such as curriculum-based measurements, formative assessments, and standardized tests (Stecker & Fuchs, 2017).
2. Data-Driven Decision Making: The collected data from progress monitoring are analyzed to gain insights into students' learning progress. Educators use this information to make informed decisions about instructional adjustments, such as

modifying teaching strategies, providing targeted interventions, or offering additional support to individual students or groups.

3. Individualized Instruction: Progress monitoring facilitates the identification of students' specific learning needs and enables educators to tailor instruction accordingly. By tracking individual progress, teachers can differentiate instruction, provide personalized learning experiences, and offer appropriate challenges to students based on their abilities (Alonzo et al., 2020).

3. Goal Setting and Feedback: Progress monitoring helps establish clear learning goals and benchmarks for students. Regular feedback on their progress allows students to understand their strengths and areas for improvement, fostering a sense of ownership and motivation in their learning journey.

Research shows that progress monitoring systems in schools offer significant benefits. Gersten and Dimino (2021) emphasized the importance of progress monitoring in supporting evidence-based interventions for students with learning disabilities and identifying challenges and opportunities in implementing such systems in schools. In their 2020 meta-analysis titled Progress Monitoring for Special Education, Rivera and Park conducted a systematic review of evidence-based practices to examine the effects of progress monitoring on student achievement. Their study revealed that progress monitoring has a positive influence on student outcomes.

Algebra

The Florida Department of Education (n.d.) states that Algebra 1 is a graduation requirement in Florida and is typically taken by ninth- or tenth-graders. The Florida Standards Assessment (FSA) Algebra 1 End-of-Course (EOC) Assessment is a state-mandated exam used to evaluate students' performance in Algebra 1 (Florida Department of Education, 2014). The assessment evaluates students' knowledge of fundamental algebraic concepts such as linear and quadratic functions, solving equations and inequalities, and data analysis (Florida Department of Education, 2014).

ESSER III Funding and Tier 1 Instruction

Tier 1 interventionists supported Algebra 1 classes in a large urban school district post-pandemic to enhance student outcomes. Through small groups and one-on-one sessions, these interventionists provided individualized instruction to struggling students, assisting them in mastering key concepts and skills. Additionally, the district utilized ESSER III funding to strengthen math instruction in a broader sense by providing additional resources, professional development for math instructors, technology upgrades, and curriculum materials. The district invested in these areas to increase the quality of mathematics instruction and boost student achievement.

Benchmarks for Excellent Student Thinking Standards

One of the many methods to close learning gaps in mathematics is providing low-performing students with specific interventions tailored to their needs. Like other states, Florida has increased mathematics expectations by adopting the Benchmark for Excellent Student Thinking (B.E.S.T.). The B.E.S.T. Standards are the state's attempt to improve previous standards with higher expectations, clarity, and alignment. Florida's B.E.S.T. Standards are a means to provide educational equity and access for all students. The B.E.S.T. Standards are clear and concise, written for parents, students, and educators to understand. Meeting the standards requires a consistent progression of mathematical strands, vertical alignment across grade levels, and horizontal alignment at the course level (CPalms, 2019). Beyerlein and Harris (2021) state that implementing the BEST standards requires a systematic approach that includes ongoing assessment, data analysis, and targeted interventions to resolve areas of weakness. The authors contend that interventions should be designed to address learning needs and should be based on data collected through ongoing evaluation and monitoring. Similarly, Love et al. (2018) discovered that interventions were necessary to support student learning and achievement in their study of the implementation of B.E.S.T. standards in a middle school setting. The authors noted that targeted interventions were used to address areas of vulnerability and provide additional assistance to struggling students.

Recent research indicates that incorporating updated guidelines can give teachers more time to focus on teaching key concepts for student mastery instead of merely covering multiple standards in preparation for high-stakes testing. According to the National Education Association (NEA), the updated guidelines provide greater clarity and specificity in defining the standards, which enables teachers to comprehend better the knowledge and skills their students must acquire (NEA, 2019). In turn, this allows teachers to devise instruction that is more targeted and effective at fostering student learning. Additionally, as the NEA noted, it is crucial for teachers to have a thorough understanding of the actual standards involved rather than relying on general strategies or looking for keywords that may provide hints regarding solutions. This highlights the significance of ongoing professional development and support to assist instructors in enhancing their content knowledge and pedagogical abilities.

The B.E.S.T. Standards focus on ensuring that students learn multiple strategies in an accessible way. The mathematical work of students will be easier for parents to understand. Complicated or challenging statements have been simplified. There is less emphasis on the specific steps to reach a solution and more emphasis on the learning goal. Florida's B.E.S.T.

Standards for Mathematics 9-12 have been organized to allow for multiple paths for Florida students to succeed (CPalms, 2019).

To ensure that every student has access to a high-quality education and achieves success, it is of utmost importance that school leaders proactively identify interventions to support student learning specifically in the field of mathematics. According to the National Council of Teachers of Mathematics (NCTM), school administrators play a critical role in championing effective mathematics instruction within their institutions (NCTM, 2018). They are responsible for providing the necessary resources, guidance, and support to teachers, students, and families. By doing so, they contribute to creating an optimal learning environment that maximizes every students potential in the realm of mathematics. Through the collective efforts of school administrators, teachers, and families, students are empowered to excel and succeed in mathematics education.

Statement of the Problem

Despite efforts to increase student achievement, a significant number of students continue to have difficulty with Algebra, even though this is an essential subject for success in higher education and the workforce. In Florida, passing the Algebra I EOC is a graduation requirement for all students. Interventions are one potential answer that can offer additional support to students who are having difficulty. However, sufficient research has not been conducted to determine whether interventions improve students' performance in Algebra. Therefore, this study aims to analyze the impact interventions have on student achievement as measured by the Algebra 1 EOC.

Purpose of the Study

School leaders continue to identify interventions and best practices to improve student achievement in math to promote academic success for all students. Math proficiency is essential for success in many career paths and a key indicator of college readiness. School leaders are responsible for ensuring that all students have access to high-quality math instruction and support. School leaders may help improve math achievement and increase student opportunities by identifying effective interventions and best practices. The purpose of this correlational study was to analyze the impact interventions have on student achievement as measured by the Algebra I EOC.

Significance of the Study

The purpose of this study was to discover successful mathematical strategies that can enhance educational support and interventions for high school students in an urban school setting and identify effective math strategies to improve educational support and interventions for high school students. The findings could benefit principals, school district leaders, and decision-makers in identifying interventions for secondary students. Researchers could use the findings to understand how distributed leadership and interventions impact student achievement in math. Researchers have identified the long-term impact of interventions, but there is a significant gap in research focused on high school.

Definition of Terms

The vocabulary that educators of various stakeholder groups employ is extremely diverse from one another. The purpose of this section is to define key terms and phrases that will be used throughout the rest of the study. Doing so will allow us to build a common vocabulary for this research.

Algebra: Algebra is a branch of mathematics. Algebra I is a mathematics subject that expands on the mathematics that high school students acquired in the middle school by formalizing structures revolving around linear and exponential relationships and modeling relationships using patterns and numbers (CPALMS, 2022).

Algebra I: The Algebra I End-of-Course Assessment is a computer-based summative assessment that tests students' mastery of the Florida Standards for Algebra I. This assessment is given to students who have successfully finished the Algebra I course. Students are graded based on a competence scale with five points, a scale score, and sub scores for each of the three groups of criteria covered in the course. Students must receive a passing score of level 3 on the Algebra I End-of-Course assessment in order to earn a high school diploma that meets the requirements of the state of Florida (FLDOE, 2022a).

Assessment*:* An assessment is a process of evaluating or measuring something, such as a student's knowledge, skills, or performance. In the context of education, assessments can take many forms, including tests, quizzes, projects, essays, and performance tasks. The primary purpose of assessments is to provide feedback to students and teachers about what students have learned and where they may need additional support or instruction (Pellegrino, 2018).

B.E.S.T. Standards: Florida State standards in Language Arts and Math, which stands for Benchmark for Excellent Student thinking (FLDOE, 2020).

Every Student Succeeds Act*:* The Every Student Succeeds Act (ESSA) is a federal education law that was enacted into law in 2015 by President Barack Obama. ESSA replaced No Child Left Behind and describes the federal government's position in supporting K-12 education and improving outcomes for all students, especially those who are disadvantaged or at risk (USDOE, 2017).

Florida Standards Assessment Mathematics: A computer-based test that evaluates students' mastery of the Florida Standards for Mathematics in Grades 3 through 8. Students earn an overall scale score, and sub score for each of the five standards clusters, and a competency level from 1 to 5, with 3 being deemed passing. According to their grade level, students must take this test (FLDOE, 2022a).

Intervention: An intervention is a targeted approach or strategy designed to address a specific problem or challenge. Interventions are often used to provide additional support or instruction to students who are struggling academically or behaviorally (National center on Intensive Intervention, 2019).

Interventionist: An interventionist is a professional who is trained to implement and facilitate interventions in a variety of contexts, including education, healthcare, and social services. In education, interventionists may work with students who are at risk of academic failure or who have specific learning needs (Helfrich &Simpson, 2017).

Learning Gap*:* The term "learning gap" is frequently used to characterize the difference between a student's current level of achievement and the expectations for their age or grade. The state of Florida has established learning standards outlining what students are expected to know and be able to do in English Language Arts (ELA), Mathematics, and other subjects at each grade level (FLDOE, 2017).

Low Socioeconomic Status: For accountability measures, the Florida Department of Education classifies students as having a low socioeconomic status if they are eligible for free or reduced lunch pricing under the National School Lunch Program. On the other hand, students who are not eligible for free or reduced lunch pricing are considered to have a high socioeconomic status for the purposes of subgroup calculation (FLDOE, 2021d).

Opportunity Gap: An opportunity gap refers to the unequal access and distribution of resources, opportunities, and outcomes among different groups of people, particularly in education and employment. This gap often results in disparities in academic achievement, career advancement, and economic mobility (Reardon et al. 2018).

Response to Intervention*:* Interventions required by the No Child Left Behind Act (NCLB; 2002) to provide struggling learners with extra, tiered support to improve academic achievement.

Students with Disabilities: Students who have been diagnosed with a language issue that may hinder their ability to learn. The ability of a student to listen, talk, read, write, spell, or perform math may be affected by various disabilities, including cognitive, physical, or both (FLDOE, 2022).

Conceptual Framework

Constructivism is a learning theory that emphasizes students active construction of knowledge as opposed to passive acquisition of information from their environment. According to Schunk and Greene (2018), constructivist approaches to instruction engage students in meaning-making activities that encourage them to connect new information to prior knowledge, ruminate on their thought processes, and construct their own understanding of the content.

Constructivism continues to play an important role in education. Constructivism has been implemented in a range of educational settings, including K–12 classrooms, postsecondary education, and professional development. Through problem-solving, exploration, and collaboration, learners should actively construct their own knowledge and comprehension of the world around them, according to fundamental constructivist principles. Teachers play a crucial role in facilitating this process by providing students with direction, feedback, and resources to support their learning.

In recent years, there has been a shift toward instructional models that emphasize the development of students' mathematical reasoning skills rather than solely content mastery. According to the National Council of Teachers of Mathematics (NCTM), effective mathematics instruction should include problem-solving, reasoning and proof, communication, representation, and connections (NCTM, 2020).

Researchers shifted to developing cognitive theories, including the information processing theory. Information processing theory focuses on the importance of conceptual understanding in the learning process by identifying how students learn best. Students have a choice of learning models and select the one that best fits their needs. It is essential to consider individual students' needs instead of a one-size-fits-all approach. Practical mathematics learning requires students to understand what they know and what they need to learn (Bhowmik, 2015; Jazim et al., 2017). The authors argue that constructivist practices can enhance students' understanding of algebraic concepts and problem-solving abilities.

Figure 1

Constructivist Learning Design

Note. From "Using Cartoon in Language Classroom From a Constructivist Point of View," by N. Abuzahra, M. A. H. Farrah, and S. Zalloum, 2016, *Arab World English Journal (AWEJ)*, (3), 229–245. (https://doi.org/10.2139/ssrn.2822995)

Research Questions

The following research questions guided this study:

Research Question 1

1. Is there a difference in student performance between students receiving an intervention or not as measured by the Algebra 1 EOC?

    Null: There is no difference in student performance between students receiving an intervention or not as measured by the Algebra 1 EOC.

    ALT: There is a difference in student performance between students receiving an intervention or not as measured by the Algebra 1 EOC.

Research Question 2

2. Is there a relationship between school and students receiving an intervention or not as measured by the Algebra 1 EOC?

    Null: There is no relationship between school and students receiving an intervention or not as measured by the Algebra 1 EOC.

    ALT: There is a relationship between school and students receiving an intervention or not as measured by the Algebra 1 EOC.

Delimitations

This study is delimited to one large urban school district in the United States and focuses on the impact of interventions on student achievement as measured by the Algebra 1 End-of-Course (EOC) assessment for the 2021-2022 school year. The study is limited to students enrolled in Algebra 1 courses within the selected school district and excludes students enrolled in other math courses. The study only focuses on the impact of interventions on student achievement and does not examine the specific types of interventions used. The study uses correlational research methodology, and data is collected by analyzing student scores on the Algebra 1 EOC assessment. This study does not consider other factors that may impact student achievement, such as socioeconomic status or prior academic performance.

Limitations

This study has limitations as follows:

1. The sample method is all students from a single cohort of Algebra 1 in one large, urban school district in a single state. This will limit the ability to generalize the findings beyond the district.
2. The sample will exclude students who do not have data in each of the sampled variables, which may alter the outcome.
3. There may be significant variations in the instruction students receive in the courses that may skew the outcome. These variations may be due to differences in teacher quality and experience, mobility rates, high absence rates, extracurricular support needed that is provided to some, but not all students, and the quality of the school of attendance and its programs.
4. This study's cohort of students took Algebra 1 in 2021-22, which was the first complete year that all students returned to a face-to-face learning environment. The blended learning environment that existed during the 2020-21 school year may have had an impact on their math learning the previous year. The fourth quarter of the 2019-2020 school year was transitioned to a virtual learning environment. These occurrences are not deemed to have a measurable effect on the results of this study and may hinder the ability to generalize the findings.

5. The study focused only on Algebra 1 EOC results and did not address other indicators of student achievement.
6. The study did not consider how other elements, such as student motivation, instructor effectiveness, and parental support, affect students' academic success.
7. The study did not focus on how interventions could affect student achievement over several years.

8. The study utilized convenience sampling, but it's important to acknowledge its limitations. This method of gathering participants may not provide an accurate representation of the entire population, as it relies on readily available and accessible individuals. This introduces the risk of bias and limits the generalizability of the findings. Additionally, convenience sampling lacks random selection, which can undermine the statistical validity and the ability to make inferences about the larger population. It's important to note that this sampling technique may result in a sample that lacks diversity, failing to account for the heterogeneity within the population and limiting the applicability of the findings to other contexts or groups.

Assumptions

1. The students sampled were taught the same standards for the course and received instruction that was reasonably similar despite the pacing disparity that may have existed between standard level and honors level pacing and coursework.
2. Students maintained regular attendance to their Algebra class during the 2021-2022 school year.
3. Testing environments reasonably followed the requirements the Florida Department of education set forth. `

4. The reliability and validity of the Florida Standards Assessments Algebra I End-of-Course Assessment is adequate, as reported by the Department of Education (FLDOE, 2017b)

Organization of the Study

This study is organized into five chapters. Chapter 1 includes the background information to support the study, the statement of the problem, the purpose of the study, the significance of the study, the conceptual framework, the definition of terms, the research questions, the delimitations, limitations, and assumptions. Chapter 2 includes an overview of the review of the literature on mathematics within the K–12 educational environment. There is an examination of the effectiveness of mathematics intervention on student achievement in math. There is also an exploration of the challenges students of color face that could hinder their math achievement.

Chapter 3 explains the methodology that will be used to capture the sample, the instruments of measurement, and the analysis that will be deployed to be able to draw conclusions about the study. Chapter 4 will explain the results for each of the research questions set forth in this study. Chapter 5 will include a summary of the study, a review of the methodology, a discussion of the findings, implications for practice, and recommendations for continued research on this study.

Summary

Chapter 1 provided an introduction to the study, highlighting the background and context of the research. The chapter began with the educational policies implemented in the United States, such as the NCLB (the primary law for K–12 general education) and the ESSA. These policies have garnered considerable attention and generated a sense of intricacy due to their impact on the education system and the students it serves. The acts emphasize school accountability and the imperative of ensuring high-quality education for every student.

Schools often implement interventions such as Response to Intervention (RtI) and various instructional strategies tailored to students' needs to address this issue. Chapter 1 emphasized the importance of research-based strategies and the role of school leaders in implementing effective learning support. There was a discussion of the evolution of math curriculum, highlighting the shift toward conceptualizing math and engaging students in activities such as modeling and argumentation.

The chapter presented Florida's B.E.S.T. Standards as an example of raising expectations in math education. The standards provide clarity, higher expectations, and alignment in math instruction. There was a discussion of the need for specific interventions, such as RtI, to address learning gaps in math and reduce the overclassification of students with learning disabilities. The role of school leaders in implementing the RtI model appeared, emphasizing the importance of leadership support, clear expectations, and professional development for teachers. There was also a discussion of the three tiers of student support in the RtI model and the need for early interventions to prevent future difficulties in math.

Chapter 1 presented constructivism as the theoretical framework, which accentuates learner-focused education, the process of knowledge construction, and the facilitative role of teachers. Constructivism indicates the importance of conceptual understanding and individualized instruction to meet the diverse needs of students. Overall, the chapter provided an overview of the background, challenges, and theoretical foundations related to math education, interventions, and the role of school leaders in promoting student achievement.

CHAPTER TWO: LITERATURE REVIEW

Introduction

Mathematics education in PreK–12 settings play a crucial role in shaping students' academic success and future opportunities. Current legislation requires schools to provide interventions for struggling learners. Although researchers have spent considerable time evaluating reading instruction and improving curriculum and teacher practice, less research is available on math interventions. Math researchers focus more on specific intervention programs than the intervention's impact on student achievement. The purpose of this literature review was to discuss the current research surrounding mathematics within the K–12 educational environment. The research will examine the impact of mathematics intervention programs on students' math achievement. Additionally, it delves into the obstacles faced by students of color that may hinder their progress in math.

Algebra

According to Hill and Correnti (2019), the literature suggests that Algebra is critical in preparing students for college and career readiness. They argue that Algebra is a gateway subject that provides the foundation for advanced mathematics, science, and engineering courses, and is essential for many careers in STEM fields. Students who have a strong foundation in Algebra are better equipped to succeed in these fields and are more likely to pursue higher education (Hill & Correnti, 2019). A study published in the Journal of Educational Psychology in 2019 found that students who took Algebra in eighth grade were more likely to enroll in advanced mathematics courses in high school and were more likely to pursue STEM majors in college. The study also found that early Algebra achievement was a strong predictor of college readiness in mathematics.

In addition, research indicates that Algebra instruction can have a positive effect on students' problem-solving and mathematical reasoning. Algebraic thinking requires students to use logical reasoning and critical thinking to solve complex problems; these skills are transferable to other academic and personal contexts. For instance, according to a 2018 study published in the Journal for Research in Mathematics Education, students who received Algebra instruction that emphasized reasoning and sense-making demonstrated significant gains in their mathematical reasoning abilities compared to students who received instruction that emphasized procedures and algorithms.

Instructional Strategies and Interventions

According to Allsopp et al. (2016), instruction aligned with the Common Core State Standards can help struggling learners improve their math skills. Additionally, economically disadvantaged students that struggle with math may benefit from increased instructional time and differentiated instruction within the classroom. According to Gersten et al. (2017), effective math instruction requires evidence-based instructional strategies that are adapted according to the requirements of the students and the content being taught. According to this study, the recommended procedure for teaching mathematics includes adhering to the Common Core State Standards, using student data to inform instruction, fostering conceptual understanding, developing problem-solving skills, promoting fluency, and creating opportunities for generalization.

Children's mathematical abilities are shaped before kindergarten (Merkley & Ansari, 2016). Math concepts progress from foundational skills to Algebra, functions, modeling, geometry, and calculus topics such as integration and differentiation. Mathematical engagement is a predictor of student performance in national and international assessments and participation in STEM-related disciplines (English, 2016). STEM students need strong math and science backgrounds, and those without a solid foundation in math may lack the talent necessary to be successful in the STEM fields.

Evidenced-based practices that build mathematical reasoning and problem-solving include the following: (a) requiring students to justify their reasoning; (b) using mistakes as an opportunity for learning; (c) using problems to help students learn new concepts; (d) allowing students to explore new problems on their own as an introduction to new material; and (e) choosing relevant problems (Seeley, 2016a). The National Council of Teachers of Mathematics (NCTM; 2014) recommends evidence-based instructional practices for teaching mathematics to all students. These practices include establishing mathematics goals, implementing tasks that promote reasoning and problem-solving, using mathematical representations, facilitating meaningful discourse, posing purposeful questions, building procedural fluency from conceptual understanding, supporting productive struggle, and eliciting evidence of student thinking. Evidence-based interventions are an essential component of Response to Intervention (RtI) programs, and teachers must use research-based instruction to effectively support at-risk students (Gersten et al., 2017). A scientifically rigorous research design is appropriate for evaluating the effectiveness of instructional practices in RtI (Hedges & Rhoads, 2019).

According to a recent study by Powell et al. (2021), there is a need for further research on the implementation of response to intervention (RtI) in mathematics education. The authors suggest that future research should focus on identifying effective instructional practices for teaching mathematics, examining the impact of interventions on diverse student populations, and exploring how to best support struggling students in mathematics. Additionally, Powell et al.

(2021) suggest that researchers should examine the implementation of RtI in mathematics education within the context of larger educational policies and systems.

Solving a word problem requires ignoring irrelevant information, organizing a strategy for a solution, following the steps, rephrasing the problem using number equations, and calculating the answer. In studying the introduction of self-regulation strategies to fifth and sixth graders with specific learning disabilities, Smith (2019) focused on the word-problem errors caused by choosing the wrong operation in instruction on solving problems. The students learned the following strategies:

- Read the problem out loud.
- Take note of important words.
- Explain what is happening with pictures.
- Put the math sentence into words.
- Take note of the answer.

Smith’s (2019) strategies included conferencing by discussing performance and instruction goals and charting to illustrate the strategy. The researcher also suggested modeling and self-instructing, mastering the steps, collaborating with others, performing independently, and maintaining the strategy over time. The students’ school provided individualized instruction. In addition to the strategy, Smith taught mathematics vocabulary by demonstrating words using manipulatives and teaching until the students achieved 100% accuracy. According to several studies, students’ problem-solving behaviors increase after instruction, suggesting a functional correlation between instruction and problem-solving behaviors. Therefore, practitioners could meet at-risk students’ needs by building a repertoire of supplemental instructional knowledge.

A strategic approach to ensuring teachers meet at-risk students' needs is professional development for supplemental instruction. Practitioners can implement supplemental interventions in professional development sessions to address student difficulties with problem-solving, computation, and number sense. Explicitly teaching educators strategies for self-regulation, cognitive flexibility, mnemonics, and schema training is essential. Computation intervention professionals could develop techniques to provide concrete-representational-abstract instruction, mnemonics exercises, computer manipulation drills, and multisensory methods for implementing interventions. Teachers could also learn supplemental intervention techniques for teaching number sense, including direct instruction, discovery learning methods, guided practice, and modeling.

Teachers could use these practices to engage students in discussions about their work and reasoning, creating student-centered classrooms rather than relying on teacher-centered approaches based on lectures and practices (National Council of Teachers of Mathematics, 2014; Seeley, 2016a). One way to create a student-centered classroom is You Do, We Do, I Do model (Seeley, 2016b), which comprises the following instructional process. First, students (you) explore a problem. Second, the students participate in a teacher-directed discussion (we) about what they did, their reasoning, and what they learned. Third, the teacher (I) helps students connect their work to the mathematical content and procedures in the lesson (Seeley, 2016b). Teachers who use the You Do, We Do, I Do model could enable students to engage in productive struggle, strengthen their reasoning skills, learn multiple strategies for problem-solving, and expand their problem-solving skills while teachers accommodate diverse learners (Lynch & Star, 2016; National Council of Teachers of Mathematics, 2014; Seeley, 2016b).

Mathematics interventions for students have been around for years but became more widespread in the 1990s. Mathematics interventions are still not as widely used as language or literacy interventions (Dowker, 2017). Interventions targeted to students' specific strengths and weaknesses are likely to have a positive impact in the short term. Most interventions have had limited long-term follow-ups on how they impact long-term educational success. Teachers can use intervention programs or steps focused on academic needs to help students and measure their progress. Interventionists should be more than extra help for students (Lee, 2022). Interventionists can assist teachers with customizing curricula to help students succeed in their core math class and develop their mathematical identity.

Teachers and other school staff members frequently use learning-based interventions to boost pupils' confidence in solving mathematical problems. Such interventions might include encouraging teachers and students to talk openly with one another, giving students frequent and constructive feedback, having them work in groups to solve math problems, employing non-traditional methods of instruction like visual aids, and providing incentives for success. Students could talk to each other and their teachers about the arithmetic they're struggling with and receive positive feedback. Targeted feedback highlighting strengths and opportunities for development might help students better grasp the topic. A student will likely acquire new abilities when there is open communication between the teacher and the learner. Collaborative learning activities are another learning-based intervention shown to increase students' confidence in their mathematical abilities (Grigg et al., 2018). When students work together, they are more likely to learn from one another's mistakes, ask for help, and try new approaches to mathematical problems. Students' social capital rises with this type of intervention, facilitating interactions with peers who may have more advanced knowledge of the course topic.

Engaging pedagogical approaches other than the traditional lecture can strengthen students' grasp of mathematical topics. Students may improve their reasoning and obtain a more holistic understanding of mathematics problem-solving by, for example, using diagrams or charts. Students could reframe their perceptions of their mathematical abilities through such tools, and they could learn to think more critically and procedurally. Finally, a reward system could help teachers boost students' confidence in their ability to succeed in mathematics. Students may be motivated and learn to value their progress when they receive positive reinforcement through verbal praise, acknowledgment of triumphs, and physical rewards such as certificates. Student engagement is essential for math self-efficacy interventions to be effective. Using learning-based interventions, such as open discussion, group work, non-traditional methods of instruction, and incentives, may bolster students' sense of competence.

Students' confidence in their abilities and motivation to succeed in mathematics may increase from interventions targeting these factors. Students with higher levels of mathematics self-efficacy are better equipped to handle difficulties they encounter while solving mathematical problems. Self-modeling and verbal persuasion are two of the most effective interventions for raising students' mathematical self-efficacy. Self-modeling occurs when learners are instructed to monitor and analyze their performance of a given task. An instructor or peer could verbally persuade students, encouraging them to set a goal and believe they can achieve it. Students' confidence in their mathematical abilities increases the most when they actively engage in self-modeling. Another way to boost confidence is by having students view recordings of themselves solving challenging arithmetic tasks and then reflect on the video. Students may benefit significantly from the intervention if taught to examine the videos critically and note what they could change. Self-modeling can give students a perspective on their progress and increase confidence as they tackle increasingly difficult tasks (Pinger et al., 2018).

Self-modeling is modifiable to meet the requirements of individual students. If students are having trouble, they could watch a video of a subject matter expert to compare their progress and think about what the expert did differently. Persuasive speech, using encouraging words such as “I believe in you” or “You can do this,” could also boost students’ confidence in their mathematical abilities. Students may benefit from having their instructors or peers help them create objectives and then offer positive reinforcement when they meet their goals. In this way, learners become confident they can succeed in their math courses. Students could also provide positive self-talk by focusing on their efforts, triumphs, and skills. Improved mathematics self-efficacy is one possible outcome of increased confidence in one’s mathematical skills and performance. Students’ confidence in their mathematical abilities may increase the most through self-modeling and verbal persuasion. Students benefit most from self-modeling when prompted to view the films critically and identify where they may improve. Through persuasive speech, teachers and others offer encouragement and support, empowering students to pursue their goals. These two strategies could help pupils develop competence and self-assurance in mathematics, laying a foundation for greater academic achievement.

The Emergence of Response to Intervention

Response to Intervention (RtI) as an educational framework that can reduce overclassification has continued to acquire popularity in recent years. According to Burns and Gibbons (2016), "Response to Intervention (RtI) has become an increasingly popular framework for providing support to struggling learners and reducing the number of students who are classified as having a disability" (p. 1). Response to Intervention (RtI), which has its origins in the Individuals with Disabilities Education Act (IDEA; 2004), has become a widely used framework for identifying and supporting struggling students. The RtI process involves universal screening of all students in general education classrooms and individualized, evidence-based interventions (Fuchs & Fuchs, 2017). The emergence of behavioral psychology in the middle of the 20th century led to a greater emphasis on data analysis and its applications for problem-solving in social contexts. Over time, this emphasis broadened using data to monitor and assess educational interventions (Gresham, 2018). Today, school-based intervention research frequently employs data-driven decision-making to evaluate the efficacy of various instructional approaches and student support systems.

The enactment of the Individuals with Disabilities Education Improvement Act (IDEA; 2004) built upon the accountability and scientifically based decision-making emphasized in the No Child Left Behind Act (NCLB; 2002). One of IDEA's primary goals was to address the overidentification and misdiagnosis of students with learning disabilities, and the legislation issued four key recommendations to guide this effort. These included using a variety of assessment tools and strategies to identify students, incorporating research-based instructional practices, documenting appropriate instruction relevant to students’ needs, and allocating 15% of IDEA funds to provide services to students not yet identified as having a disability (National C
Response to Intervention (RtI) is a multi-tiered framework that provides increasingly intensive interventions to students who struggle in academic or behavioral areas. The RtI process is composed of three tiers of intervention that are designed to meet the needs of all students, regardless of their level of ability. Tier 1 includes universal screening and progress monitoring for all students in the classroom. Students who do not succeed in Tier 1 move to Tier 2, where they receive supplementary instruction in small groups with frequent progress monitoring.

Students who do not succeed in Tiers 1 and 2 move to Tier 3, characterized by more intensive interventions and additional progress monitoring, either in small groups or individually (National Center on Intensive Intervention, 2018).

Universal screening is a critical component of Response to Intervention (RtI) and Multi-Tiered Systems of Support (MTSS) frameworks. Educators use universal screening to identify students who might be at risk in general education and to inform decision-making about appropriate interventions (Burns & Gibbons, 2015). Universal screenings typically occur three times yearly and assess skills critical for academic success, such as reading, math, and behavioral skills (VanDerHeyden et al., 2019). Educational leaders compare students' performance results to benchmark expectations, and students who fail to meet benchmarks will receive additional intervention support in Tier 2 or Tier 3 (Burns & Gibbons, 2015; VanDerHeyden et al., 2019).

Progress monitoring is essential to Response to Intervention (RtI), enabling educators to evaluate students' needs and responsiveness to interventions. By analyzing data on student progress, teachers and school leaders can determine whether to modify or intensify interventions to better meet students' needs (Denton et al., 2018; Fuchs & Fuchs, 2017).

Educational leaders play a critical role in successfully implementing Response to Intervention (RtI) practices (McIntosh, K., & Goodman, S; 2016). They are responsible for analyzing and documenting student progress data to make informed decisions about the placement, frequency, and intensity of interventions. Research has shown that leadership is a key factor in the effective implementation of RtI practices (González et al., 2017; Rinaldi et al., 2019). Educational leaders must be knowledgeable about RtI and be able to communicate its goals and rationale to staff. They should also be able to analyze data and make informed decisions about the placement, frequency, and intensity of interventions. Ongoing staff development and support are also essential, including training on RtI's rationale and implementation practices.

Educational leaders play a crucial role in the successful implementation of Response to Intervention (RTI) practices. Their responsibilities include documenting and analyzing student progress data to make informed decisions about intervention placement, frequency, and intensity (González et al., 2017; Rinaldi et al., 2019). Additionally, they are responsible for providing staff development and ongoing support which should involve training on the rationale and implementation practices of RTI (Burns & Gibbons, 2015; McIntosh & Goodman, 2016; Rinaldi et al., 2019).

Historical Implications of RTI for Special Education

RtI is a multi-tiered approach to help struggling learners. Student progress is closely monitored at each tier to determine the need for progressively intense instruction**.** RtI is an alternative to the IQ-discrepancy method for identifying learning disabilities, leading to the incorporation of special language into the 2004 revision of IDEA, allowing RtI as part of disability identification procedures. Many states have adopted Response to Intervention (RtI) models in their schools. According to a report by the National Center for Learning Disabilities (NCLD) (2019), 41 states and the District of Columbia have policies that support the implementation of RtI. The incorporation of RtI in schools is due in part to changes made in the 2004 Individuals with Disabilities Education Act (IDEA), which followed the 2002 recommendations of the President's Commission on Excellence in Special Education. The reauthorization eliminated the need for a discrepancy model to identify children with learning disabilities, instead suggesting evaluations of how well students responded to interventions based on research.

Historical Perspective on Math Education

Mathematics education reform has undergone several changes over time. In the 1960s, the mathematical focus was on the overemphasis on sets, abstractions, and rigid formalism. The 1970s saw a return to the basics with drills and algorithms. U.S. school leaders sought to remain competitive globally by producing more scholars, teacher educators, secondary mathematics teachers, engineers, and highly technical professionals. However, in recent years, there has been a continued emphasis on a conceptual understanding of mathematics and a focus on problem-solving and real-world applications (National Council of Teachers of Mathematics, 2020). Despite this shift, there are still concerns about the decline in the number of students enrolling in math classes and having little mathematical knowledge (National Center for Education Statistics, 2021).

The purpose of Kant's Copernican revolution in philosophy, which he introduced in his Critique of Pure Reason, was to explain how individuals and their cognitive structures influence the objects of experience, not vice versa. This critical perspective became the foundation for modern cognitive science and has influenced various fields, including psychology and neuroscience (Kirmayer, 2019). In Continental Europe, Kant's successors developed critical philosophy, which led to new developments and directions for philosophical thought. In line with the Anglo-American philosophical tradition, philosophers have identified limitations in language and formal logic in clarifying traditional philosophical issues. Despite Kant's influence on modern cognitive science, educational and pedagogical thought remains primarily based on philosophical theories and concepts.

The constructionist approach to learning emphasizes the active role of students in constructing their knowledge rather than passively receiving information. This approach acknowledges that theory may take a long time to manifest in historical contexts (Papert, 2019).

Jean Piaget's theory of cognitive development, which emphasizes the active role of learners in constructing their knowledge, has been widely recognized as an important basis for constructing knowledge (Lourenço & Machado, 2021). Piaget began studying children in school settings in the 1920s. As American psychologists rediscovered his early research in the 1960s and educators worked to understand its pedagogical implications, his theory became relevant to designing learning experiences in the United States. Over the past few decades, teacher preparation programs have incorporated Piaget's work on cognitive development and adaptation into their curriculum and used constructivist approaches in pedagogy (Hartshorne & Hutto, 2019). The translation and distribution of Lev Vygotsky's books in the 1970s led to refinements of Piaget's constructivist approach. Constructivist teaching strategies can engage students on sociocultural and developmental levels as they learn to apply models to conceptualize mathematical learning based on the theories of Piaget and Vygotsky (Nunes, Schliemann, & Carraher, 2018).

A multidimensional approach to engagement includes behavioral, affective, and cognitive dimensions that facilitate action, feeling, and thought. Students’ level of mathematics engagement involves their actual or intended enrollment and effort (Attard & Holmes, 2020). When students feel excited or enjoy school, they can have effective engagement. The academic engagement model is an approach to engage students’ self-regulatory strategies and investment. Despite debate about the distinction between behavioral, affective, and cognitive dimensions, a classification heuristic could help predict individuals' behavior and choices by the theories of motivation.

Challenges Faced by Students of Color in Math Education

In recent studies, it has been found that there are disparities in the availability of high-quality math curricula for Black students. Researchers Joseph and Cobb (2019) have argued that this restricted access to challenging mathematics courses could impede the progress of Black students and restrict their opportunities in the future. These disparities are often influenced by systemic factors such as school segregation, tracking practices, and resource allocation. Biases and stereotypes perpetuate assumptions about Black students' mathematical abilities. Jett (2019) highlighted how these assumptions lead to low expectations, limited opportunities, and a lack of support for Black students in mathematics. These biases could impact students' self-perception, engagement, and motivation in the subject. Recent research suggests that schools and educators should address these systemic inequities, develop more culturally responsive teaching practices, and provide targeted support for students of color to help them succeed (Ladson-Billings, 2020).

Recent studies have shown that Black students face multiple challenges in accessing high-quality math education. According to a report by the National Assessment of Educational Progress, only 15% of Black eighth-graders in the United States perform at or above the proficient level in math, compared to 45% of White students (NCES, 2019). This disparity can be attributed to several factors, including a lack of access to advanced math courses, underqualified teachers, and inadequate resources for schools in low-income neighborhoods (NCTM, 2018).

Research studies also suggested that stereotypes and biases about Black students' mathematical abilities can contribute to this inequality. A study conducted by Steele and

Aronson (1995) found that when Black students were primed to think about their race before taking a math test, they performed worse than when they were not. This suggests that negative stereotypes about Black students' intelligence in math can negatively impact their performance.

To address these challenges, experts have suggested several strategies that schools can implement. For instance, schools can work to recruit and retain highly qualified teachers who are culturally responsive to the needs of Black students (Ladson-Billings, 2020). Additionally, schools can offer more advanced math courses, provide targeted support to struggling students, and implement culturally responsive teaching practices that celebrate the contributions of Black mathematicians and scientists (NCTM, 2018). By taking these steps, schools can help to close the achievement gap in math education and provide all students with the tools they need to succeed in the subject.

Racial Inequalities of Standardized Assessments

Mathematics Persistence and Motivation Standardized examinations, such as the ACT, have been criticized for perpetuating inequalities and restricting opportunities for Black students. According to research, these assessments frequently reflect and reinforce dominant cultural norms, which can disadvantage students from diverse cultural backgrounds and experiences (Joseph & Cobb, 2019). Due to inherent cultural biases in standardized tests, Black students may encounter unique obstacles during standardized testing. For instance, standardized tests may contain questions or content that are foreign or irrelevant to the experiences and cultural knowledge of Black students. This can result in lower scores and fewer educational opportunities, as these tests are frequently used to determine college admission and scholarship eligibility.

One study found that Black students were more likely to experience anxiety and tension related to standardized testing, which can have a negative effect on their performance (Sulik, Blair, and Cooper, 2018). Educators and policymakers should address the biases and limitations of standardized assessments and create more inclusive and fair assessment practices that consider the diverse experiences and cultural backgrounds of all students. Researchers have explored the mathematics accomplishments of exceptional Black students to understand the factors contributing to their persistence in the subject. Jett (2019) explored the experiences of four Black male graduate students in mathematics. The study found the students faced challenges such as isolation, lack of representation, and stereotype threat. However, they also relied on resilience, mentorship, and a strong sense of identity to persist and excel in their mathematical pursuits.

Struggling students are more likely to experience and improve math achievement when motivated to understand and improve. Motivation partly derives from interest, which emerges from student, teacher, and content interactions (Bong et al., 2015; Matthews, 2018; Prendergast & Donoghue, 2014; Turner et al., 2015). Educators could design math instruction to promote interest and improve student engagement and achievement (Durik et al., 2015; Kim et al., 2015b; Prendergast & Donoghue, 2014). Interest in math is a stronger motivator than math utility; however, some students, particularly those with a perceived higher ability, are motivated by the utility of math (Durik et al., 2015; Kim et al., 2015b). Additionally, students with perceived higher math ability are the likeliest to have a high interest in math (Durik et al., 2015).

The expectancy-value theory (EVT) is an approach to explain high school mathematics enrolments. According to EVT, psychology is the means of predicting achievement-related choices and behaviors. The integrated model for childhood origins focuses on integrating expectations and perceived abilities with achievement goal, attribution, and decision theories.

The choice process centers around ability and values, particularly interest, importance, and an amalgam of attainment and utility values often combined; costs, such as psychological, financial, time, and energy; and the opportunity cost of giving up other options. The social environment influences ability and value perceptions. In a growing field of motivational psychology, EVT approaches are a powerful motivational framework for examining how young people make educated decisions based on their beliefs.

Impact of Self-Efficiency Interventions on Student's Mathematics Achievement

Within the realm of research on mathematics education, numerous constructs already exist that contribute to comprehending the emotional aspects of mathematics. These constructs include attitudes toward math, ideas about math, mathematics anxiety, mathematics emotions, mathematics hate, mathematics joy, and mathematics self-efficacy. A unified theoretical framework for these constructs is under development. Mathematical self-efficacy is particularly interesting because it is an emergent property derived from a system combining internal, external, and environmental factors. In particular, self-efficacy arose from research using Bandura's social cognitive theory, providing insight into how internal, external, and environmental factors may interact to influence one another (Cleary et al., 2017). Students who believe in their abilities are more likely to take proactive steps (such as adopting effective study methods) that increase their likelihood of achieving their goals. Therefore, students must receive positive reinforcement from their instructors or classmates. This dynamic interplay of individual, behavioral, and contextual variables characterize human functioning in and out of the classroom.

Self-efficacy is the conviction one holds concerning their aptitude to design and actualize the processes required to accomplish predetermined objectives. It is crucial to predict how much effort students put into their math homework. Working on assignments they know they can complete some students ignore the feeling they are beyond their skill set. Students' cognizance of their prowess in addressing mathematical problems has a vital bearing on the variety of predicaments they select to confront, the longevity of their struggle for resolutions, and their all-around composure. Learners' perspicacity of their aptitude concerning mathematical undertakings before becomes the foundation of their self-efficacy.

The expression "mathematics self-efficacy" alludes to an individual's presumption of sufficiency with respect to the completion of numerical exercises. Subsequently, the term "task specificity of mathematics self-efficacy" is appropriate to describe an individual's belief in their capability to complete a mathematical activity. Task-based assessments measure individuals' trust in their aptitudes concerning certain numerical undertakings, incorporating the culmination of assignments, problem-solving, comprehending new information, and acquiring respectable test scores. Instead of making broad assumptions, teachers could use these tools to focus on the individual's unique talents, abilities, and knowledge (Cleary & Kitsantas, 2017). Mathematical self-efficacy is task-specific, as shown in survey tools that gauge respondents' confidence in completing concrete or abstract mathematical activities. The 10 questions on a mathematics self-efficacy scale allow for probing subjects' comfort with activities, from calculating integrals to solving equations with many variables. Each question evaluates a candidate's proficiency in a narrow area of mathematics. Task specificity of mathematics self-efficacy could present as practical experience in the mathematics area in addition to survey instruments. A math self-efficacy intervention, for instance, could be participants completing a series of carefully crafted exercises designed to test their ability to solve mathematical problems. Individuals' skills and confidence to complete mathematical tasks may improve due to their participation in and performance of these activities.

To better understand how students' mathematical self-efficacy grows, social cognitive theory encompasses four distinct factors. Mastery experience, or how pupils see their triumphs and failures with math problems, is the initial source of self-efficacy. One's sense of competence and self-assurance in mathematics increases with success and decreases with failure. People's interpretations of the same academic performance may have varied effects on their sense of self-efficacy. The second type of influence, social persuasion, comes from the spoken word from authoritative figures like educators, parents, peers, and more experienced adults. Self-efficacy may increase from timely positive reinforcement from various sources and decrease from negative comments. Anxiety, burnout, exhaustion, and stress are examples of affective or physiological sources contributing to students' negative self-evaluations of their mathematical competence (Hajovsky et al., 2020). Students' self-perceptions as competent mathematicians will improve as a result of their increased sense of safety, calm, and emotional stability. Finally, students' interpretations of others' experiences constitute the fourth source. A student's sense of mathematical self-efficacy could benefit from exposure to the accomplishments of peers and people with similar backgrounds.

Role of School Leadership

As a school leader, one of the primary roles in determining interventions for students in math is to identify the students who are struggling and in need of support. This may involve analyzing data from assessments, classroom observations, and teacher feedback to identify areas where students struggle and the specific skills or concepts they need to master. Once the students in need of support have been identified, the school leader can work with teachers and other support staff to develop targeted interventions that address the specific needs of each student.

This may involve providing additional instructional resources, such as tutoring or small group instruction, or modifying the curriculum to better meet the needs of struggling students.

In recent years, there has been an ongoing emphasis on enhancing student achievement through educational reforms. According to a 2016 report by the National Center for Education Evaluation and Regional Assistance, recent reforms have emphasized teacher evaluation and support, adopted more rigorous academic standards, and increased school choice options for families. In addition, the significance of school leadership in driving school transformation efforts has been increasingly acknowledged. Effective school leaders are able to establish a positive school culture, establish high standards for student achievement, and provide instructors with the necessary support and resources to be successful.

The role of instructional leaders in education is constantly evolving, and the expectations placed on them are continually increasing. Effective leadership is critical to the success of educational organizations, and it involves creating a vision, providing direction, and empowering others to achieve goals (Amirteimoori & Malmir, 2021). According to research by Marzano et al. (2019), effective instructional leaders prioritize teaching and learning, build a positive school culture, and promote professional development among staff. They also use data to inform decision-making, provide instructional feedback, and support teacher growth.

According to a study conducted by Kim et al. (2021), transformational leadership is the ability to inspire and motivate followers to reach their maximum potential. On the other hand, transactional leadership is based on the exchange of rewards for performance. The study revealed that transformational leadership is positively correlated with employee job satisfaction, organizational commitment, and performance. Conversely, transactional leadership is associated with lower levels of employee job satisfaction and commitment.

Democratic leadership is a style of leadership that emphasizes collaboration, shared decision-making, and active member participation (Kaufman & Kaufman, 2019). According to Kaufman and Kaufman (2019), democratic leadership in education entails fostering respectful relationships and a culture of cooperation through the creation of conducive conditions. This leadership style places a significant emphasis on social justice, human rights, and the well-being of all organization members, including students, instructors, and administrators. Democratic education leaders work to foster a sense of community and empowerment among all stakeholders and to ensure that everyone's voice is heard.

The school leader has an essential responsibility in overseeing the progress of students who undergo interventions, regardless of their leadership style. They should utilize continuous assessments and data analysis to determine the effectiveness of the interventions and make necessary adjustments. Moreover, the school leader can collaborate with teachers and support staff to guarantee the faithful implementation of interventions and equal access to support for all students to excel in math.

Recommendations for Improving Mathematics Achievement

Various stakeholders could take specific actions to enhance the academic outcomes and achievement of Black males in mathematics. Dyce et al. (2021) provided recommendations for families, educators, policymakers, and researchers. The suggestions included creating culturally responsive classrooms, supporting positive racial identity development, promoting access to advanced mathematics courses, and researching the achievement gap. Individualized instruction has been shown to enhance student achievement in mathematics, according to research. This can include strategies such as one-on-one tutoring, small-group instruction, and individualized learning plans tailored to the requirements of each student (Borman, Benson, & Overman, 2019).

Using visual aids and manipulatives can aid in the comprehension of mathematical concepts by students. This can include, among other things, number lines, geometric shapes, and fraction bars. These tools, according to research (Van Garderen & Montague, 2020), can help students better their math performance. Encouraging mastery-oriented feedback, in which students are praised for their effort and progress instead of just their inherent abilities, can improve student achievement in mathematics. This form of feedback can help students develop a growth mindset and improve their math skills, according to research (Haimovitz, Dweck, & Walton, 2019).

Recent research by El Nokali et al. (2021) suggests that providing opportunities for Black male students to engage with math in real-world contexts can enhance their motivation and interest in the subject. Additionally, Dancy et al. (2021) found that incorporating culturally relevant and responsive teaching practices in mathematics classrooms can foster a sense of belonging and improve academic outcomes for Black male students. A study by Cavanagh et al. (2020) suggests that utilizing technology, such as online math games and simulations, can increase engagement and achievement in mathematics for Black male students.

Summary

In K-12 education, mathematics is crucial in preparing students for graduation, college, career readiness, and future opportunities. To achieve these goals, it is essential to use effective instructional strategies that align with State Standards and cater to diverse student populations. Unfortunately, students of color often face obstacles in math due to systemic factors, biases, and stereotypes that hinder their academic progress. Culturally responsive teaching practices and targeted support are necessary to address these disparities. Response to Intervention (RTI) is an educational framework that aids in screening and progress monitoring, allowing struggling students to receive the necessary support. School leaders must oversee the implementation of

RTI to ensure its success. To enhance mathematics outcomes, practical recommendations include incorporating individualized instruction, visual aids, and manipulatives, and providing mastery-oriented feedback. By implementing these strategies, a supportive and inclusive learning environment can be created, fostering student engagement and improving mathematics achievement.

CHAPTER THREE: METHODOLOGY

Introduction

School leaders explore best practices to improve student achievement, including implementing interventions. Often, those interventions utilized are aimed at improving student performance. The correlational study aimed to analyze the impact interventions have on student achievement as measured by the Algebra I EOC. Data collection occurred using a survey and open-ended questions. The survey and open-ended questions were analyzed using ANOVA, T-test and other simple statistical measures. The results provide an understanding of the impact interventions have on student achievement as measured by the Algebra 1 EOC.

Study Design

This study was conducted using quantitative methodology and a correlational design to determine the impact interventions have on student achievement as measured by the Algebra 1 EOC. As highlighted by Makowski et al. (2019), correlation studies provide insight into the strength and direction of the relationship between two variables, which can be positive or negative. Utilizing a correlational research approach facilitates a comprehensive understanding of the intricate connections among multiple factors. Such a design enables researchers to gain valuable insights into the functioning of the world by testing the identified variables in realistic scenarios. In the present study, a correlational research design was considered the most suitable approach to investigate the relationship between the school and the interventionist impact on student performance on the Algebra 1 End-of-Course (EOC) exams. The original design of this study sought to determine the number of students receiving intervention support 100%, 50% or 0% of the time. After compiling the data received, students were categorized as receiving interventionist support 100% or 0% of the time. The following questions were used to guide the research in this study:

1. Is there a difference in student performance between students receiving an intervention or not as measured by the Algebra 1 EOC?

   Null: There is no difference in student performance between students receiving an intervention or not as measured by the Algebra 1 EOC.

   ALT: There is a difference in student performance between students receiving an intervention or not as measured by the Algebra 1 EOC.

2. Is there a relationship between school and students receiving an intervention or not as measured by the Algebra 1 EOC?

   Null: There is no relationship between school and students receiving an intervention or not as measured by the Algebra 1 EOC.

   ALT: There is a relationship between school and students receiving an intervention or not as measured by the Algebra 1 EOC.

Population and Sample

The sampling technique used in this study was the convenience sampling technique. All the participants in this study were enrolled in Algebra 1. Some of the students had an interventionist in their Algebra I class, while other classes did not have interventionist. The participants were selected because they met the specific criteria for this study. Participants had to be enrolled in Algebra 1, which excludes students who were not enrolled in the course.

The Post Hoc data analyzed for this study consisted of analyzing Algebra 1 EOC scores for students enrolled in Algebra 1 during the 2021-2022 school year from the five selected high schools. The students enrolled in Algebra 1 were divided based on students in Algebra 1 with an Interventionist attached to the class and Algebra 1 classes without an Interventionist attached.

The population analyzed in the Post Hoc data consisted of five high schools from a large urban school district in Florida. Four high schools were Title I and one was non-Title I. School A is a non-Title I school with a student population of 3500 students. Forty-two percent of the students enrolled at school A are classified as economically disadvantaged, and 69% of the student population is classified as students of color. School B is a Title I school with a student population of 3400 students. Sixty-one percent of the student population is classified as economically disadvantaged, and 89% are classified as students of color. School C is a Title I school with 2400 students, Sixty-nine percent are classified as economically disadvantaged, and 97% are classified as students of color. School D is a Title I school with a student population of 1600 students, and 97% are classified as students of color. School E is a Title I school with 2400 students enrolled; Sixty-six percent are classified as economically disadvantaged, and 94% are classified as students of color.

Instrumentation

The purpose of this study was to determine the impact interventions have on student achievement as measured by the Algebra 1 EOC. To analyze this relationship, Post Hoc Algebra EOC scores served as the instrument that was used to measure student performance on the Algebra 1 EOC. The following sections detail the scoring system used for FSAs, the design of the FSAs relative to the Florida Standards, and the reliability and validity of the FSAs.

Scoring of Florida Standards Assessment

The Florida Standards Assessment (FSA) is a standardized test used in Florida to assess students reading, writing, math and science proficiency. The FSA is scored using a criterion-referenced approach, which means that students' scores are based on their performance relative to a set of pre-established standards or criteria. Each question on the FSA is aligned with a specific standard or skill that students are expected to master at a particular grade level. Students earn points for correctly answering questions demonstrating mastery of those standards.

The scoring process for the FSA involves several steps, including using computerized scoring algorithms and human scorers who review and verify the computerized scores. The process is designed to ensure accuracy and fairness in the scoring of student responses.

The FSA uses a five-level scoring system to report student performance. Each level corresponds to a range of scores and indicates the student's level of proficiency in the subject area assessed. The five levels are:

- Level 1: Inadequate
- Level 2: Below Satisfactory
- Level 3: Satisfactory
- Level 4: Proficient
- Level 5: Mastery

Table 1 *Florida Standards Assessment Scale Scores by Achievement Level*

Florida Standards Assessment	Level 1	Level 2	Level 3	Level 4	Level 5
Algebra I EOC	425-486	487-496	497-517	518-531	532-575

Note. Adapted from FLDOE (2022).

The Florida Standards Assessments

The suite of Florida Standards Assessments employs a scoring method that allows students to receive more points for more complex questions and fewer points for easier questions to evaluate student knowledge of standards by grade level or course. This scoring model, which combines the number of correct responses with the difficulty of the questions, generates the scale scores and sub scores for each strand of standards (FLDOE, 2018).

The Algebra I End-of-Course Assessment consists of three clusters of standards: (a) Algebra and Modeling, (b) Functions and Modeling, and (c) Statistics and the Number System (FLDOE, 2020d).

Reliability

The State of Florida implemented a new assessment program for the 2014–2015 school year to align with the ratification of the Florida Standards. The Florida Comprehensive Assessment Tests were superseded with the Florida Standards Assessments (FSA). The FSA assessment battery was deemed reliable based on internal consistency and marginal reliability evaluations. Cronbach's alpha, stratified Cronbach's alpha, and Feldt-Raju were employed to ascertain internal consistency (Florida Department of Education, 2021b). The FSA ELA, Mathematics, and EOC assessments were all administered at the same time; therefore, internal consistency was examined to assure the reliability of the test scores. The reliability coefficients were computed utilizing Cronbach's alpha, stratified alpha, and Feldt-Raju coefficients, with the mixed item types regarded as separate strands. Cronbach's alpha was deemed suitable because it underestimates the reliability of test scores on examinations with mixed item types (FLDOE, 2017b). There were both multiple-choice and non-multiple-choice items on all FSA examinations. A Cronbach alpha level between 0.70 and 0.95 is considered acceptable (Tavakol

& Dennick, 2011), and based on this criterion, the FSA assessments have a high level of internal consistency.

Table 2 *Measures of Reliability: Florida Standards Assessment End-of-Course Assessments*

Course	Test Form	Cronbach's Alpha	Stratified Alpha	Feldt-Raju
Algebra	Online – Core 24	0.93	0.93	0.93
	Accommodated	0.91	0.91	0.92

Note. Adapted from *Annual Technical Report: Evidence of Reliability and Validity*, by Florida Department of Education, 2021, p. 10.

Measure of Reliability

The Florida Standards Assessment demonstrated high reliability as indicated by the coefficients for operational items, which ranged from 0.85 and 0.92. These coefficients were calculated by measuring the average conditional standard errors at various points on the achievement scale for all students. According to the Florida Department of Education 2021 report (p.13), these high reliability coefficients indicate a reasonable level of internal consistency for the FSA.

Table 3 *Measures of Reliability: Florida Standards Assessment*s

Course	Grade	Marginal reliability
Algebra I		0.86

Note. Adapted from *Annual Technical Report: Evidence of Reliability and Validity*, by Florida Department of Education, 2021, p. 13.

Validity

The validity of the FSAs was evaluated by an independent third party, Alpine Testing Solutions, in the summer of 2015 (Wiley, Hembry, & Buckendahl, 2015). The study found that the items on the FSA were generally consistent with the student learning expectations in the

Florida Standards. According to Wiley et al. (2015), on the initial FSA, 65% to 76% of the items on the ELA assessment were an exact match for the intent of a Florida Standard, and of the items that did not match exactly, 64% were closely related. Similarly, Wiley et al. (2015) found that 79% to 94% of the items of the FSA Mathematics and Algebra I EOC were an exact match for a Florida Standard, while 81% of the items that were not an exact match were closely related to a standard. Overall, Wiley et al. (2015) found, “no evidence to question the validity of the FSA scores for the intended purpose” (p. 46).

Data Collection

The Algebra EOC assessment was administered in a single administration. Data files were obtained from the Large Urban School District (LUSD) containing the assessment data for the single cohort of students who were in Algebra I during the 2020-2021 school year. Requested and received assessment data consisted of (a) Algebra I EOC scale scores and achievement levels.

University Protocol

This study was carried out adhering to guidelines and protocols established by the University of Central Florida (UCF) Instructional Review Board (IRB), which required training in research ethics by the Collaborative Institutional Training Initiative (CITI). The proposed study was reviewed and approved by a committee of faculty members of the University of Central Florida on July 25, 2022. The University of Central Florida IRB approved the study on January 6, 2023, and a copy of the approval letter can be found in Appendix A

Once University of Central Florida IRB granted approval, an application was submitted to the Large Urban School District (LUSD) IRB to conduct the research. The application consisted of an overview of the research and potential impact, proof of the completion of the research ethics course as conducted through CITI, the research instruments, and a letter of proposal from the UCF faculty committee chair. The LUSD approved the research on May1, 2023 and the data to complete the researched were received in full on May 15, 2023. A copy of the approval letter from the LUSD can be found in Appendix B.

Analysis

To analyze the relationships described in the research questions, correlational design was used. Each question is detailed below with a description of the analysis performed on the data. Table 4 provides a summary of each research question, the variables used in the analysis. To answer research question one, a T-test was used to determine whether there was a difference in student performance between students receiving an intervention or not as measured by the Algebra 1 EOC. To answer research question 2 an ANOVA was used to determine between school and the students receiving an intervention or not as measured by the Algebra I EOC.

Table 4 *Research Questions with Variables and Statistical Analysis*

Research Question	Predictor Variable(s)	Dependent Variable(s)	Method of Analysis
1. Is there a difference in student performance between students receiving an intervention or not as measured by the Algebra 1 EOC?	Students receiving Intervention or not receiving an intervention	Student performance on Algebra 1 EOC. Continuous	T-test Levene's test of Equality Variance Participants Representative Between Subject Factors
2. Is there a relationship between school and students receiving an intervention or not as measured by the Algebra 1 EOC?	School Type- Title I or non-Title I	Student performance on Algebra 1 EOC. Continuous	One way ANOVA Test of Homegenity Variances Homogeneous Subsets- Tukey HSD, Tukey B and Scheffe Simple Box Plot Test of Independence

Summary

This chapter reviewed the methodology deployed to determine the impact interventions have on student achievement as measured by the Algebra I End-of-Course Assessment. Data was collected through cooperation with the Large Urban School District. Post Hoc assessment data obtained were produced by students through the administration of the Algebra 1 EOC which has been proven to be a valid and reliable instrument. Multiple correlational analyses including an ANOVA and T-test were used to test the research questions and determine the relationship that exists between the variables in questions. The results of this data analysis are presented in the following chapter.

CHAPTER FOUR: ANALYSIS AND RESULTS

Introduction

The correlational design aimed to examine the impact interventions had on student achievement as measured by Algebra 1 EOC, and to determine whether a relationship existed between schools and students who received interventions as measured by the Algebra 1 EOC. Post HOC data from Algebra 1 EOC was used for this study, and participants were selected based on their use of interventionists to support Algebra 1 students. Time spent with students was recorded by collecting data on interventionists' time spent with students, ranging from 0% to 100%. The survey was completed by the school administrator and included data on students in Algebra 1 without interventionists.

The data collected can help identify disparities or unique characteristics among schools or interventionist support programs. The results highlight clear differences between the groups, analyzing mean scores, standard deviations, and sample sizes to illustrate performance disparities between students with and without interventionists across different schools. This study also examines the equality of error variance using Levene's test, indicating significant variations in the dependent variable across the groups. Finally, between-subjects effects are explored to provide insights into the impact of various factors on the study outcomes.

Testing the Research Questions

Research Question 1: Is there a difference in student performance between students receiving an intervention or not as measured by the Algebra 1 EOC?

To answer Research Question 1, we rely on the assumption of homogeneity of variance, which helps us determine if the variance of the dependent variable, Algebra 1 EOC scores, is equal across various groups, namely intervention and non-intervention. The violation of this assumption can indicate that there are differences in the dispersion of scores between the groups, which in turn might suggest a potential difference in student performance.

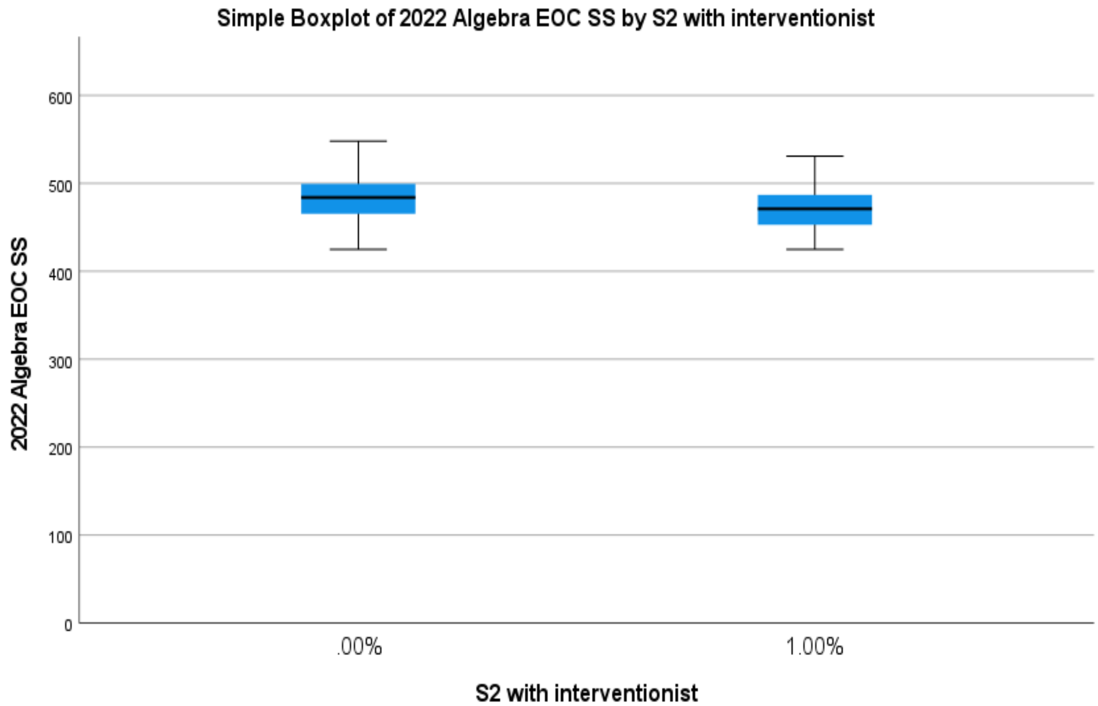
Research Question 2: Is there a relationship between school and students receiving an intervention or not as measured by the Algebra 1 EOC?

To determine if the relationship between school and intervention status affects the variability of the Algebra 1 EOC scores, it's important to consider the assumption of homogeneity of variance. If this assumption is violated, it suggests that the impact of intervention status on students' performance may vary between schools, indicating a potential relationship between school and intervention. This information is crucial in understanding the effectiveness of interventions and making informed decisions to improve academic outcomes.

Statistical Assumptions

For Research Question 1, a T-Test was used with four assumptions that must be met before running the analysis. According to Field (2018), these four assumptions are (1) data are continuous, (2) the sample is randomly selected from the population, (3) there are no significant outliers in the data set, (4) the data are distributed approximately normally, and (5) the data sets have approximately equal variance. All assumptions for the tested data set are met to run the T-Test for this analysis. The Algebra I EOC scale scores are set on a continuous scale of whole numbers and as such, are continuous. The subjects were randomly selected from the population, meeting the second assumption. A boxplot displaying the data below in figure 5 shows that there are no outliers in the data and reveals a roughly symmetrical shape, indicating the normality of the data.

Table 5 *Simple Box Plot by Interventionist*



Homogeneity was tested with Levene’s Test, as shown in figure 6 below. The Levene's Test for Equality of Variances offers insights into the variance comparison between groups. In this context, it suggests that the variance in Algebra EOC scores of the students who received intervention is not significantly different from students not receiving an intervention.

Table 6 *Levene's Test of Equality Variance's*

Group Statistics

	S2 with interventionist	N	Mean	Std. Deviation	Std. Error Mean
2022 Algebra EOC SS	0.00%	576	480.09	25.999	1.083
	1.00%	833	468.95	25.125	.871

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means							
						Significance				95% Confidence Interval of the Difference	
		F	Sig.	t	df	One-Sided p	Two-Sided p	Mean Difference	Std. Error Difference	Lower	Upper
2022 Algebra EOC SS	Equal variances assumed	.281	.596	8.068	1407	<.001	<.001	11.142	1.381	8.433	13.851
	Equal variances not assumed			8.017	1208.974	<.001	<.001	11.142	1.390	8.415	13.868

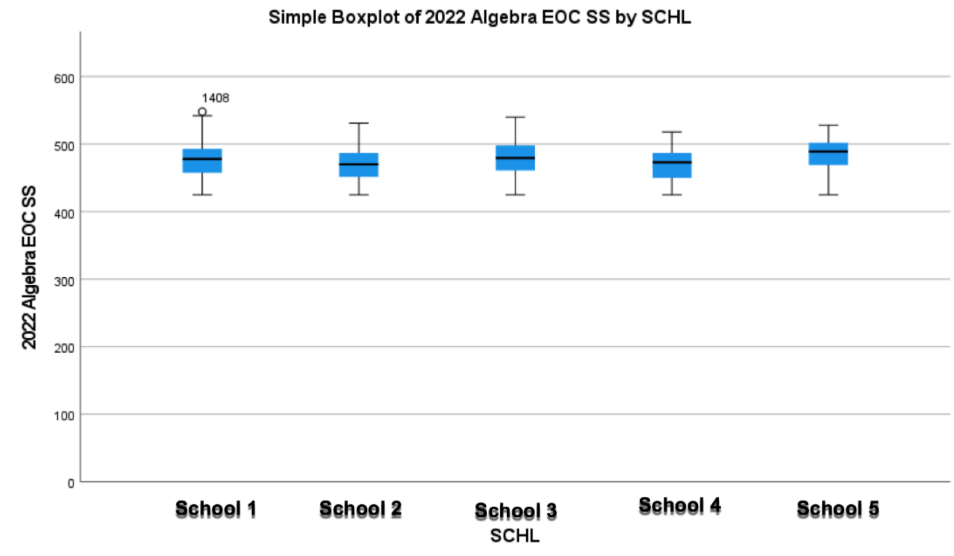
Independent Samples Effect Sizes

				95% Confidence Interval	
		Standardizer[a]	Point Estimate	Lower	Upper
2022 Algebra EOC SS	Cohen's d	25.485	.437	.330	.545
	Hedges' correction	25.499	.437	.329	.544
	Glass's delta	25.125	.443	.335	.552

a. The denominator used in estimating the effect sizes.
Cohen's d uses the pooled standard deviation.
Hedges' correction uses the pooled standard deviation, plus a correction factor.
Glass's delta uses the sample standard deviation of the control group.

Before conducting the ANOVA analysis for Research Question 2, several assumptions were tested to ensure the accuracy of the results. As per the guidelines provided by Field (2018), several assumptions were tested, including normality, homogeneity of variance, test of independence, test for outliers and validity and reliability. The data collected from different schools and students are considered independent of each other, implying that each student's performance is not affected by other students' performance. Moreover, the distribution of student achievement scores appears to be approximately normal within each group, as shown in the series of boxplots below. Additionally, the five boxplots shown below appear to have approximately similar spread, indicating that the variances are similar. There is one outlier in the data for School 1 which was removed for the analysis.

Table 7 *Simple Box Plot by School*



In order to test the independence of the data from the five schools, Kolmogorov-Smirnov and Shapiro-Wilk tests were run and determined that the data sets are independent.

Table 8 *Tests of Normality*

Tests of Normality

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	SCHL	Statistic	df	Sig.	Statistic	df	Sig.
2022 Algebra EOC SS	1	.082	335	<.001	.952	335	<.001
	2	.085	399	<.001	.964	399	<.001
	3	.059	314	.010	.973	314	<.001
	4	.099	208	<.001	.938	208	<.001
	5	.090	152	.004	.971	152	.003

a. Lilliefors Significance Correction

<u>Demographic Variables of the Sample</u>

Table 9 provides a detailed analysis of the demographic variables, which helps to understand the composition of the sample participants. Although it does not directly align with a specific research question, it provides important information about the participants' background and context, which can contribute to the interpretation of the study outcomes for both research questions.

Table 9 *Participants' Representative Between-Subjects Factors*

School	*N*
With Interventionist	
1	335
2	399
3	314
4	208
5	152
Interventionist Type	
No Intervention	560
With Intervention	848

Note. Demographic information provided by LUSD.

Table 9 aligns with Research Question 1. The data reveals that students who received intervention from an interventionist had higher mean scores on the Algebra EOC test than those who did not receive any intervention. This finding indicates that the presence of interventionists, who provided additional support and guidance, positively impacted on the students' performance in Algebra. It suggests that targeted interventions can contribute significantly to improved academic outcomes.

Table 10 *Participants' Representative Between-Subjects Factors*

SCHL	Intervention Type	Mean	*SD*	*N*
School 1	No Intervention	477.08	27.027	199
	With Intervention	468.74	24.329	136
	Total	473.70	26.253	335
School 2	No Intervention	471.70	27.877	66
	With Intervention	468.51	25.660	333
	Total	469.04	26.030	399
School 3	No Intervention	481.65	27.528	162
	With Intervention	472.35	24.154	152
	Total	477.15	26.323	314
School 4	No Intervention	455.50	43.134	2
	With Intervention	467.70	25.174	206
	Total	467.58	25.259	208
School 5	No Intervention	487.15	20.887	131
	With Intervention	474.43	17.443	21
	Total	485.39	20.863	152
Total	No Intervention	480.04	26.425	561
	With Intervention	469.19	24.904	848
	Total	473.51	26.059	1408

Table 11 provides descriptive statistics related to the relationship between school and students. receiving an intervention or not as measured by the Algebra 1 EOC.

Table 11 *Descriptive Statistics*

SCHL	Intervention Type	Mean	Std. deviation	*n*
School 1	No Intervention	477.08	27.027	199
	With Intervention	468.74	24.329	136
	Total	473.70	26.253	335
School 2	No Intervention	471.70	27.877	66
	With Intervention	468.51	25.660	333
	Total	469.04	26.030	399
School 3	No Intervention	481.65	27.528	162
	With Intervention	472.35	24.154	152
	Total	477.15	26.323	314
School 4	No Intervention	455.50	43.134	2
	With Intervention	467.70	25.174	206
	Total	467.58	25.259	208
School 5	No Intervention	487.15	20.887	131
	With Intervention	474.43	17.443	21
	Total	485.39	20.863	152
Total	No Intervention	480.04	26.425	561
	With Intervention	469.19	24.904	848
	Total	473.51	26.059	1408

Levene's test (Table 11), aligns with Research Question 1 and plays a significant role in assessing the equality of error variance among different groups. The test results indicate that the error variance of the dependent variable (Algebra EOC) differs significantly between the groups. This finding suggests that the groups, categorized by school and interventionist status, exhibit variations in the dispersion of their scores. Such differences in error variance may be indicative of underlying factors that affect the students' performance, such as variations in instructional quality, resources, or other unaccounted variables. Levene’s test of equality of error variance showed that the dependent variable’s error variance is not consistent between groups. The null hypothesis can be rejected because the test’s *p* value is less than 0.05. Therefore, the error variance of the dependent variable differs significantly between groups.

Table 12 *Levene's Test of Equality of Error Variance*[a,b]

		Levene statistic	*df*1	*df*2	Sig.
2022 Algebra EOC	Based on mean	2.364	9	1399	.012
	Based on median	2.211	9	1399	.019
	Based on median and with adjusted *df*	2.211	9	1364.034	.019
	Based on trimmed mean	2.399	9	1399	.011

Note. Tests the null hypothesis that the error variance of the dependent variable is equal across groups.
a. Dependent variable: 2022 Algebra EOC
b. Design: Intercept + SCHL + With Intereventionist + SCHL * No Interventionist

The test of between-subjects effects showed that the school (SCHL) had a substantial impact on the 2022 Algebra 1 EOC. The intercept had a large impact as well, $F(1, 1408) = 57572.434$, $p = .000$. The WithIntereventionist variable, $F(1, 1408) = 1.174$, $p = .279$, and its interaction with the school, $F(4, 1399) = 1.009$, $p = .401$, had no statistically significant effects.

The test of between-subjects effects (Table 12) provides additional insights into the impact of various factors on the study outcomes. Table 12 aligns with Research Questions 1 and 2. It provides a between-subjects effects test, which helps to analyze the impact of different factors on the study outcomes. By analyzing the results, researchers can identify significant effects associated with specific variables or combinations thereof. This analysis helps determine the extent to which demographic variables and interventionist status influence the observed differences in academic performance.

Table 13 *Test of Between-Subjects Effect*

Source	Type III sum of squares	*df*	Mean square	*F*	Sig.
Corrected model	57074.499[a]	9	6341.611	9.868	.000
Intercept	36998609.640	1	36998609.640	57572.434	.000
SCHL	11084.927	4	2771.232	4.312	.002
No Interventionist	754.243	1	754.243	1.174	.279
SCHL* WithIntereventionist	2594.571	4	648.643	1.009	.401
Error	899059.687	1399	642.645		
Total	316866101.000	1409			
Corrected total	956134.186	1408			

Note. Dependent variable: 2022 Algebra EOC
a. R^2 = .060 (Adjusted $R^{2`}$ = .054)

According to the findings of the between-subjects effects test, the school (SCHL) had a statistically significant impact on the 2022 Algebra EOC , $F(4, 1399) = 4.312$, $p = .002$, and partial eta squared = .012. The WithIntereventionist variable had a statistically significant effect, $F(1, 1399) = 1.174$, $p = .279$, partial eta squared = .001, and the school and WithIntereventionist variable's interaction had a statistically significant effect, $F(4, 1399) = 1.009$, $p = .401$, partial eta squared = .003.

Table 13 Test of Between Subject Effects presents the results of a statistical analysis of the effects of different factors on the 2022 Algebra End-of-Course (EOC) Sum of Squares (SS) scores. The analysis focuses on between-subjects effects using a Type III sum of squares approach. This study includes several sources of variation, including a corrected model, intercept, SCHL, WithIntereventionist, and the interaction effect between SCHL and No Interventions.

The corrected model, with a Type III sum of squares of 57074.499 and 9 degrees of freedom, shows a significant effect. The overall analysis reveals a significant intercept with a

Type III sum of squares of 36998609.640 and a high partial eta squared value of .976. This indicates that the intercept plays a significant role in explaining the variation in the EOC scores.

Among the other factors, SCHL demonstrates a significant effect on the EOC scores, with a Type III sum of squares of 11084.927 and a p-value of .002. The interaction effect between SCHL and WithIntereventionist is not significant (p-value = .401). The analysis also includes information on the error term, with a Type III sum of squares of 899059.687 and 1399 degrees of freedom. The total variation in the data is represented by the total sum of squares of 316866101.000.

The dependent variable of the analysis is the 2022 Algebra EOC. The computed R-square value is .060, suggesting that the factors included in the model explain approximately 6% of the variance in the EOC scores. Additionally, an adjusted R-square value of .054 accounts for the degrees of freedom used in the analysis.

The statistical analysis was conducted on the 2022 Algebra EOC scores. Key factors, including the intercept and SCHL, are found to have significant effects on the scores. However, the interaction effect between SCHL and WithIntereventionist is not significant. The analysis contributes to the understanding of the factors influencing the Algebra EOC scores in this study

Table 14 presents "Multiple Comparisons" that compare different schools (labeled 1, 2, 3, 4, and 5) based on their mean differences in terms of the 2022 Algebra EOC (dependent variable). The table provides information such as the mean difference, standard error, significance level, and 95% confidence interval for each comparison. Upon analyzing the data, several observations can be made. School 1 shows statistically significant mean differences with School 4 and School 5 HS, indicating notable distinctions in their Algebra EOC scores. School 2 also exhibits significant mean differences with School 3 and School 5 HS. The remaining schools (3, 4, and 5) follow a similar pattern, showing significant differences with various other schools. The document concludes that there is a statistically significant difference in mean scores between the schools on the Algebra 1 EOC. The error term is provided as mean square(error) = 642.645. Overall, this information sheds light on the variations in Algebra EOC scores among the different schools, contributing to a comprehensive understanding of their relative performance.

Table 14 *Multiple Comparisons*

(I) SCHL	(J) SCHL	Mean difference (I-J)	Std. error	Sig.	95% confidence interval	
					Lower bound	Upper bound
School 1	2 HS	4.66	1.877	.095	-.46	9.79
	3 HS	-3.44	1.990	.415	-8.88	1.99
	4 HS	6.12*	2.237	.049	.01	12.23
	5 HS	-11.69*	2.478	.000	-18.45	-4.92
School 2	1 HS	-4.66	1.877	.095	-9.79	.46
	3 HS	-8.11*	1.912	.000	-13.33	-2.88
	4 HS	1.46	2.168	.962	-4.46	7.38
	5 HS	-16.35*	2.416	.000	-22.95	-9.75
School 3	1 HS	3.44	1.990	.415	-1.99	8.88
	2 HS	8.11*	1.912	.000	2.88	13.33
	4 HS	9.56*	2.266	.000	3.37	15.75
	5 HS	-8.24*	2.505	.009	-15.08	-1.40
School 4	1 HS	-6.12*	2.237	.049	-12.23	-.01
	2 HS	-1.46	2.168	.962	-7.38	4.46
	3 HS	-9.56*	2.266	.000	-15.75	-3.37
	5 HS	-17.81*	2.705	.000	-25.19	-10.42
School 5	1 HS	11.69*	2.478	.000	4.92	18.45
	2 HS	16.35*	2.416	.000	9.75	22.95
	3 HS	8.24*	2.505	.009	1.40	15.08
	4 HS	17.81*	2.705	.000	10.42	25.19

Dependent variable: 2022 Algebra EOC
Based on observed means
The error term is mean square(error) = 642.645
* The mean difference is significant at the .05 level.

For the Algebra 1 achievement test 1 EOC, $F(1,1408) = 9.868$, $p < .001$, the effect size (eta squared) was .060, which is considered small. The means of the two groups were significantly different, according to post hoc analysis using Tukey's test. Compared to students who did not receive an intervention, those who did had a higher mean score.

A univariate ANOVA, $F(4, 1399) = 4.312$, p - .001, 2 = .060, occurred to determine the impact of the school (SCHL) and interventionist (WithInterventionist) on the 2022 Algebra EOCscores. The results showed a statistically significant effect of school on the scores, $t(1735) = -3.945$, $p = .001$, $d = 0.37$. Post hoc testing showed that School A ($M = 5.45$, $SD = 1.14$) had considerably higher scores than School 2 ($M = 4.90$, $SD = 1.17$). $F(1, 1399) = 1.174$, $p = .279$, $d = .001$ showed no statistically significant impact of the interventionist on the scores. The profile plot's findings in all five schools revealed no difference in scores between the interventionist and noninterventionist groups. The homogeneity test showed uniform score variance across the five schools, $F(4, 1399) = 0.845$, $p = .500$. The results of the descriptive statistics showed that the mean score of the interventionist group ($M = 5.17$, $SD = 1.17$) was just a little bit higher than the mean score of the noninterventionist group ($M = 5.09$, $SD = 1.17$) in the descriptive statistics. Based on the power analysis, it was found that the test power is 0.845, a power test of 0.845 suggests a strong probability of correctly detecting a significant impact of the interventionist on students' scores on the Algebra 1 EOC.

Summary

This study offers a comprehensive and detailed analysis of the collected data, with a focus on several key aspects. It investigates student scores on the Algebra EOC, school relationship and interventionist status, shedding light on the performance disparities between students with and without interventionists across different schools. The study provides insights into the impact of various factors on study outcomes, exploring the equality of error variance using Levene's test.

The results of the analysis reveal clear differences in the relationship between school and students receiving an intervention or not. Mean scores, standard deviations, and sample sizes are analyzed, highlighting the performance disparities between students with and without interventionists. The study also examines the between-subjects effects, contributing to a better understanding of the relationship between interventionist status, and academic performance.

It should be noted that the results did not show a statistically significant difference in the Algebra EOC scores of students receiving an intervention or not, as measured by the Algebra I EOC. However, there are other factors to consider that may contribute to these results, such as student motivation, parental involvement, teaching methods, and student attendance.

Overall, this study provides valuable insights into the relationship between school, interventionist status, and academic performance, and can serve as a useful resource for further research in this area.

CHAPTER FIVE: SUMMARY, DISCUSSION, AND CONCLUSIONS

Introduction

Chapter 5 consists of a summary of the study, discussion of the findings, implications for practice, recommendations for further research and conclusions. The summary of the study will provide a brief overview of the literature reviewed, the problem statement, the purpose of the study, the two research questions, the significance of the study and a review of the methodology. The discussion of the findings summarizes the findings from the previous chapter and references the literature presented in chapter 2, followed by implications for practice. The last section of this chapter contains suggestions for further research and general conclusions of the study. As shown by the Algebra 1 EOC, there is a statistically significant difference between school performance and students who received interventions and those who did not. Post hoc analysis using Tukey's test indicated that although the effect size was small, the means of the schools performance were statistically different. However, the interventionist's effect on the scores was not statistically significant. The interventionist effect on the scores did not reach statistical significance, meaning that there was no clear evidence to support a difference in student performance between those who received interventions and those who did not. As the results of this study did not indicate a significant effect, additional research is required to ascertain the effect of the interventionist on student performance.

Summary of the Study

The research documents on math interventions and their impact on student achievement were compiled and analyzed. The gathered data was then examined to investigate the relationship between interventions and student achievement on the Algebra EOC, as well as the correlation between school relationships and student performance. The study utilized POST HOC data obtained from an LUSD.

The purpose of this study was to determine if there was a relationship between students receiving an intervention or not, as measured by the Algebra I EOC. Additionally, the study aimed to investigate if there was a relationship between schools and students receiving an intervention or not, as measured by the Algebra I EOC. The data analyzed in this study was obtained from a single cohort of students enrolled in Algebra 1, and the study was driven by two research questions.

Research Question 1: Is there a difference in student performance between students receiving an intervention or not as measured by the Algebra 1 EOC?

Research Question 2: Is there a relationship between school and students receiving an intervention or not as measured by the Algebra 1 EOC?

.

Methodology

Quantitative methodology and a correlational design were used to determine the impact interventions had on student achievement as measured by the Algebra 1 EOC. As highlighted by Makowski et al. (2019), correlation studies provide insight into the strength and direction of the relationship between two variables, which can be positive or negative. Utilizing a correlational research approach facilitates a comprehensive understanding of the intricate connections among multiple factors. Such a design enables researchers to gain valuable insights into the functioning of the world by testing the identified variables in realistic scenarios. A correlational research design was considered the most suitable approach to investigate the relationship between the school and the interventionist impact on student performance on the Algebra 1 End-of-Course (EOC) exams.

Population

The population analyzed in the Post Hoc data consisted of five high schools from a large urban school district in Florida. Four high schools were Title I and one was non-Title I. School 1 was a non-Title I school with a student population of 3500 students. Forty-two percent of the students enrolled at school 1 were classified as economically disadvantaged, and 69% of the student population was classified as students of color. School 2 was a Title I school with a student population of 3400 students. Sixty-one percent of the student population was classified as economically disadvantaged, and 89% were classified as students of color. School 3 was a Title I school with 2400 students, Sixty-nine percent were classified as economically disadvantaged, and 97% were classified as students of color. School 4 was a Title I school with a student population of 1600 students, and 97% were classified as students of color. School 5 is a Title I school with 2400 students enrolled; Sixty-six percent were classified as economically disadvantaged, and 94% were classified as students of color.

Instrumentation

The instrument used in this study was the Florida Standards Assessment Algebra EOC. Post Hoc Algebra EOC scores served as the instrument that was used to measure student performance on the Algebra 1 EOC. The Algebra EOC was used to analyze the relationship between students who received intervention and those who did not.

Data Collection

Assessment data from the single cohort of students enrolled in Algebra I during the 2021-2022 school year were obtained from LUSD through the procedures for the LUSD and the University of Central Florida. The Post Hoc data analyzed for this study consisted of analyzing Algebra 1 EOC scores for students enrolled in Algebra 1 during the 2021-2022 school year.

Discussion of Findings

The results of this study highlight the critical need for math interventions to enhance student performance. This research was initiated due to growing concerns about how best to assist students facing challenges in mathematics. While interventions have been around for many years, there is still little research on the impact interventions have on student achievement. It is important to note that the study revealed a significant difference in the relationship of school and student performance for students receiving an intervention or not as measured by the Algebra 1EOC but there was no significant difference in the performance outcomes between students who received interventions and those who did not as measured by the Algebra 1 EOC. This suggests that the school played a significant role in student performance for students receiving an intervention or not as measured by the Algebra 1 EOC. Interventions should encompass more than just providing additional assistance; they should involve close collaboration with teachers to tailor curricula and provide comprehensive support to help students excel in their primary math classes while fostering a strong mathematical identity (Lee, 2022).

Implications for Practice

Mathematics interventions for students have been around for years but became more widespread in the 1990s. Mathematics interventions are still not as widely used as language or literacy interventions (Dowker, 2017). Interventions targeted to student's specific strengths and weaknesses are likely to have a positive impact in the short term. Most interventions have had limited long-term follow-ups on how they impact long-term educational success.

Research has shown that targeted interventions, such as providing additional support and guidance from interventionists, can significantly improve students' academic performance. Educators must tailor interventions to the specific needs of students to enhance their outcomes. They should prioritize the quality of instruction provided to students and work towards ensuring consistency and equity across different schools and interventionist groups. By implementing these measures, educators can help students overcome academic challenges and achieve their full potential.

Recent studies have shown that incorporating culturally responsive teaching practices and utilizing technology in mathematics classrooms can increase engagement and improve academic outcomes for Black male students. For instance, El Nokali et al. (2021) found that providing opportunities for Black male students to engage with math in real-world contexts can enhance their motivation and interest in the subject, whereas Dancy et al. (2021) discovered that culturally relevant teaching practices can foster a sense of belonging and improve academic outcomes. Cavanagh et al. (2020) suggest that utilizing technology such as online math games and simulations can also play a significant role in increasing engagement and achievement in mathematics for Black male students.

The National Council of Teachers of Mathematics (NCTM; 2014) recommends evidence-based instructional practices for teaching mathematics to all students. These practices include establishing mathematics goals, implementing tasks that promote reasoning and problem-solving, using mathematical representations, facilitating meaningful discourse, building procedural fluency from conceptual understanding, supporting productive struggle, and eliciting evidence of student thinking. By adopting these practices, educators can create a more conducive learning environment for all students. This study also highlights the potential influence of disparities in resources on academic performance. Therefore, educators should work towards minimizing resource gaps across schools and interventionist groups, ensuring that all students have equal access to necessary resources and support systems.

Effective instructional leaders prioritize teaching and learning, build a positive school culture, and promote professional development among staff, according to research by Marzano et al. (2019). They also use data to inform decision-making, provide instructional feedback, and support teacher growth. By utilizing data-driven decision-making processes, educators can identify significant impacts associated with demographic variables and interventionist status and develop effective interventions to improve overall educational outcomes.

School leaders need to acknowledge the diverse backgrounds and needs of our students while interpreting study outcomes and designing interventions. By doing so, we can create equitable learning environments while enhancing student performance and addressing disparities. It is crucial to consider the implications for practice and strive towards providing tailored and inclusive education to all students.

Recommendations for Further Research

The study found that there are correlations between schools and student scores on the Algebra I EOC, but it did not observe any statistically significant connections between students who received intervention or not as measured by the Algebra I EOC. However, the study had several limitations in its design: (a) it was quantitative and did not consider variables such as fluctuations in intrinsic student motivation, quality of instruction, experience levels of teachers, level of content (standard or honors), or tutoring received, (b) the sample was representative of a single cohort of students in one district in a state, and (c) the study focused mainly on overall scale scores and did not include sub-scale scores. Considering these limitations, the study recommends future research to cover these areas:

1. A qualitative study to include variables such as quality of teacher instruction and experience level of teacher.
2. The design of an Algebra instruction intervention focusing on review units of key standards in the algebra content and delivered through a one-to-one or small group

intervention followed by a subsequent study to determine the effects of the intervention.

3. Further research through replication in other school districts of varying sizes, and possibly in other states would help with the ability to generalize findings to the broader population of U.S. students.
4. An additional study with a broad selection of variables related to low socioeconomic background, such as income level, educational attainment of parents, socioeconomic level of the school, and academic diversity of pupil assignment to classes to isolate the significant predictors.
5. A qualitative study to include additional variables of the study, such as student motivation in Algebra I to determine if motivation impacts achievement scores.

Despite these limitations, addressing these areas of concern and conducting future studies will contribute to a deeper understanding of the factors influencing student performance. It will also inform evidence-based practices in education, and help educators develop effective intervention programs that can lead to better student outcomes.

Conclusion

This study aimed to examine the effectiveness of interventions on student achievement, as assessed by the Algebra 1 EOC. The results of the study revealed there was little to no difference in the academic performance of students who received interventions compared to those who did not. However, there was a significant difference in the school and student performance as measured by the Algebra 1 EOC. Future research could delve deeper into establishing a cause-and-effect relationship and explore the specific types of interventions that yield the most significant improvements in student achievement. Additionally, investigating the long-term effects of these interventions on students' overall academic success would provide valuable insights for educators and policymakers.

APPENDIX A: INSTITUTIONAL REVIEW BOARD APPROVAL LETTER

UNIVERSITY OF CENTRAL FLORIDA

Institutional Review Board
FWA00000351
IRB00001138, IRB00012110
Office of Research
12201 Research Parkway
Orlando, FL 32826-3246

EXEMPTION DETERMINATION

January 6, 2023

Dear Jennifer Bellinger:

On 1/6/2023, the IRB determined the following submission to be human subjects research that is exempt from regulation:

Type of Review:	Initial Study, Initial Study
Title:	Examining the Impact Interventionist has on Math Achievement in an Urban School Setting
Investigator:	Jennifer Bellinger
IRB ID:	STUDY00004976
Funding:	None
Grant ID:	None
Documents Reviewed:	• Bellinger HRP-251-Form, Category: Faculty Research Approval; • Data Points, Category: Other; • HRP 255-SR, Category: IRB Protocol

This determination applies only to the activities described in the IRB submission and does not apply should any changes be made. If changes are made, and there are questions about whether these changes affect the exempt status of the human research, please submit a modification request to the IRB. Guidance on submitting Modifications and Administrative Check-in are detailed in the Investigator Manual (HRP-103), which can be found by navigating to the IRB Library within the IRB system. When you have completed your research, please submit a Study Closure request so that IRB records will be accurate.

If you have any questions, please contact the UCF IRB at 407-823-2901 or irb@ucf.edu. Please include your project title and IRB number in all correspondence with this office.

Sincerely,

Jonathan Coker
Designated Reviewer

APPENDIX B: LARGE URBAN SCHOOL DISTRICT RESEARCH APPROVAL LETTER

[redacted] Public Schools
Research and Evaluation

[redacted] Application to Conduct Research
Research Notice of Approval

Approval Date: 5/1/2023 **Study ID Number: 712**
Expiration Date: 4/30/2024
Project Title: ***Examining the Impact Interventionist has on Math Achievement in an Urban School Setting***

Requester: Jennifer Bellinger
Sponsoring Agency/Organization/Institutional Affiliation: University of Central Florida

Thank you for your request to conduct research in [redacted]. We have reviewed and approved your application. This *Research Notice of Approval (R-NOA)* expires one year after issue date, 4/30/2024.

If you are interacting with OCPS staff, students or families, you may email the school-based or district-based administrators who have indicated interest in participating, including this notice as an attachment. After initial contact with applicable administrators, you may email any necessary staff included in your application. This approval notice does not obligate administrators, teachers, students, or families of students to participate in your research; participation is entirely voluntary.

Our department is in the process of pulling records for your data request. Time needed will vary according to the complexity of the data request. We will contact you should further clarification be needed. Depending on the availability, extent of data or years identified in the data requested, this process takes a minimum of 2 business weeks. Data requested within the current fiscal year may require more time for processing due to static release dates by the State.

For any data not listed in our "Available Data Elements" document found on the R&E webpage, the department will need to involve other departments, requiring additional resources and time. There may be data that we are unable to provide. In this case, you will be notified.

You are responsible for submitting a Change/Renewal Request Form to this department prior to implementing any changes to the currently approved protocol. If any problems or unexpected adverse reactions occur as a result of this study, you must notify this department immediately. Allow 45 days prior to the expiration date, if you intend to submit a Change/Renewal Request Form to extend your R-NOA date. Otherwise, submit the Executive Summary (along with the provided Cover Page) to conclude your research with OCPS within 45 calendar days of the R-NOA expiration. Email the form/summary to research@[redacted]. All forms may be found at this link.

Should you have questions, need assistance or wish to report an adverse event, please contact us at research@[redacted] or by phone at [redacted].

Sincerely,

REFERENCES

Abuzahra, N., Farrah, M. A. H., & Zalloum, S. (2016). Using cartoon in language classroom from a constructivist point of view. *Arab World English Journal (AWEJ)*, 229–245. https://doi.org/10.2139/ssrn.2822995

Allsopp, D. H., Faggella-Luby, M. N., Lovin, L. A., & Barnhardt, J. (2016). Addressing the needs of struggling learners in the era of the Common Core State Standards. *Learning Disabilities Research & Practice*, *31*(1), 15–26.

Allsopp, D. H., van Ingen, S., Simsek, O., & Haley, K. C. (2016). Building to Algebra: Big ideas, barriers, and effective practices. In B. S. Witzel (Ed.), *Bridging the gap between arithmetic & algebra* (pp. 7–20). Sheridan Books.

Almaleki, S. (2021). Psychometric properties of Florida's B.E.S.T. aligned mathematics assessments. *Educational Assessment, Evaluation and Accountability*. Advance online publication. https://doi.org/10.1007/s11092-021-09362-0

Attard, C., & Holmes, K. (2020). "It gives you that sense of hope": An exploration of technology use to mediate student engagement with mathematics. *Heliyon*, *6*(1), Article e02945. https://doi.org/10.1016/j.heliyon.2019.e02945

Beyerlein, S., & Harris, K. R. (2021). Implementing the BEST standards: A systematic approach to developing critical thinking skills. *Journal of Educational Research and Practice*, *11*(1), 1–10. https://doi.org/10.1080/19407882.2021.1869052

Bhowmik, M. (2015). Constructivism approach in mathematics teaching and assessment of mathematical understanding. *Basic Research Journal of Education Research and Review*, *4*(1), 8–12.

Bong, M., Lee, S. K., & Woo, Y. K. (2015). The roles of interest and self-efficacy in the decision to pursue mathematics and science. In K. A. Renniger, M. Nieswandt, & S. Hidi (Eds.), *Interest in mathematics and science learning* (pp. 33–48). AERA Books.

Bostic, J. Q., Hodge, A. M., & Best, J. R. (2021). Examining teacher alignment of the B.E.S.T. math standards and instructional practices in Florida classrooms. *Journal of Education and Practice*, *12*(1), 121–131.

Bryk, A. S., Gomez, L. M., Grunow, A., & LeMahieu, P. G. (2015). *Learning to improve: How America's schools can get better at getting better*. Harvard Education Press

Burns, M. K., & Gibbons, K. A. (2015). *Implementing response to intervention in elementary and secondary schools: A guide to effective practice*. Routledge.

Burns, M. K., & Gibbons, K. A. (2016). Introduction to response to intervention: What, why, and how valid is it? In M. K. Burns, & K. A. Gibbons (Eds.), Implementing response-to-intervention in elementary and secondary schools: Procedures to assure scientific-based practices (2nd ed., pp. 1–24). Routledge.

Cai, J., & Knuth, E. J. (2018). The importance of reasoning and sense-making in enhancing the mathematical learning of algebra. *Journal for Research in Mathematics Education*, *49*(3), 281–287. https://doi.org/10.1080/0025570X.2018.1476544

Cavanagh, M. F., Arbaugh, J. B., & Sridharan, V. (2020). Increasing engagement and performance in online mathematics courses through technology-enhanced active learning. *Online Learning*, *24*(3), 69–87.

Cavas, P. (2019). The impact of opportunity to learn on student achievement: Evidence from a sample of middle school students. *Journal of Educational Research*, *112*(3), 291–300.

Clarke, M. (2021). The impact of small-group and whole-class interventions in mathematics on student achievement: A meta-analysis. *Educational Research Review*, *34*, Article 100358. https://doi.org/10.1016/j.edurev.2021.100358

Cleary, T. J., & Kitsantas, A. (2017). Motivation and self-regulated learning influences on middle school mathematics achievement. *School Psychology Review*, *46*(1), 88–107.

Cleary, T. J., Velardi, B., & Schnaidman, B. (2017). Effects of the Self-Regulation Empowerment Program (SREP) on middle school students' strategic skills, self-efficacy, and mathematics achievement. *Journal of School Psychology*, *64*, 28–42.

CPalms. (2019). *B.E.S.T. standards*. https://www.cpalms.org/Standards/BEST_Standards.aspx

Dancy, T. E., Edwards, M. T., & Escontrias, S., Jr. (2021). Culturally relevant and responsive teaching in mathematics: A critical review of the literature. *Journal of Urban Mathematics Education*, *14*(1), 7–29.

Darch, C., Carnell, E., & Rolfe, H. (2017). Mathematical ability and labour market outcomes: Evidence from the British Cohort Study. *Journal of Education and Work*, *30*(4), 429–442.

Denton, C. A., Fletcher, J. M., Taylor, W. P., Barth, A. E., & Vaughn, S. (2018). An evaluation of intensive intervention for students with persistent reading difficulties. *Journal of Learning Disabilities*, *51*(2), 130–143. https://doi.org/10.1177/00222194060390050601

Dowker, A. (2017). Interventions for primary school children with difficulties in mathematics. *Advances in Child Development and Behavior*, *53*, 255–287. https://doi.org/10.1016/bs.acdb.2017.04.004

Dowker, A., Bennett, K., & Smith, L. (2019). Attitudes to mathematics interventions: A systematic review. *Review of Education*, *7*(2), 267–322. https://doi.org/10.1002/rev3.3153

Durik, A. M., Hulleman, C. S., & Harackiewicz, J. M. (2015). One size fits some: Instructional enhancements to promote interest. In K. A. Renniger, M. Nieswandt, & S. Hidi (Eds.), *Interest in mathematics and science learning* (pp. 49–62). American Educational Research Association.

Dyce, C. M., Davis, J., & Gunn, S. (2021). *Black males matter: A blueprint for creating school and classroom environments to support their academic and social development: A sourcebook*. Information Age Press.

El Nokali, N. E., Sadler, T. D., & Sonnert, G. (2021). The impact of real-world contexts on Black male students' mathematics motivation and interest. *Journal of African American Studies*, *25*(1), 1–16.

English, L. D. (2016). STEM education K–12: Perspectives on integration. *International Journal of STEM Education*, *3*, Article 3. https://doi.org/10.1186/s40594-016-0036-1

Every Student Succeeds Act, 20 U.S.C. § 6301 (2015).

Field, A. (2018). Discovering statistics using IBM SPSS Statistics. SAGE Publications Limited

Fielding, J., Geiger, V., Miller, J., Bruder, R., Towara, U., & Ratnayake, I. (2022). Using situated expectancy value theory to explore initial teacher education students' motivation to engage with challenging mathematical tasks. *Teaching and Teacher Education*, *113*, Article 103663. https://doi.org/10.1016/j.tate.2022.103663

Florida Department of Education. (2014). *Algebra 1 end-of-course assessment test item specifications*. http://www.fldoe.org/core/fileparse.php/5665/urlt/0072141-algebra.pdf

Florida Department of Education. (2014). *Florida standards assessments: Test design summary and blueprints*. http://www.fldoe.org/core/fileparse.php/7768/urlt/FSATestDesignSummary.pdf

Florida Department of Education. (n.d.). *Algebra 1 end-of-course assessment*. http://www.fldoe.org/accountability/assessments/k-12-student-assessment/algebra-1/

Frykholm, J. A., & Johnson, A. H. (2021). Supporting teachers to make adaptations inclusive for learners in mathematics instruction. *Intervention in School and Clinic*, *56*(4), 235–240. https://doi.org/10.1177/105345122098630

Fuchs, D. & Fuchs, L. S. (2017). Introduction to response to intervention: What, why, and how valid is it? In D. L. Compton, D. Fuchs, & L. S. Fuchs (Eds.), *The Routledge handbook of reading research* (pp. 319–334). Routledge.

Fuchs, D., & Fuchs, L. S. (2017). The promise and the challenges of Response to Intervention. *Reading Research Quarterly*, *52*(1), 1-6.

Gash, H. (2017). Maths and neurophenomenology. *Constructivist Foundations*, *13*(1), 182–183.

Gersten, R., & Dimino, J. (2021). Progress monitoring in the era of evidence-based interventions: Challenges and opportunities. *Learning Disabilities Research & Practice*, *36*(1), 3–10.

Gersten, R., Beckmann, S., Clarke, B., Foegen, A., Marsh, L., Star, J. R., & Witzel, B. (2017). *Assisting students struggling with mathematics: Response to intervention (RtI) for elementary and middle schools* (NCEE 2017-4010). National Center for Education Evaluation and Regional Assistance (NCEE), Institute of Education Sciences.

Gersten, R., Chard, D. J., Jayanthi, M., Baker, S. K., Morphy, P., & Flojo, J. R. (2021). Effective implementation of evidence-based practices in schools: Recommendations and resources. *School Psychology Review*, *50*(1), 105–126. https://doi.org/10.17105/SPR50-1.105-126

Gresham, F. M. (2018). Historical and conceptual foundations of school-based intervention research. *Journal of School Psychology*, *68*, 5–14.

Grigg, S., Perera, H. N., McIlveen, P., & Svetleff, Z. (2018). Relations among math self efficacy, interest, intentions, and achievement: A social cognitive perspective. *Contemporary Educational Psychology*, *53*, 73–86. https://doi.org/10.1016/j.cedpsych.2018.01.007

Hajovsky, D. B., Oyen, K. A., Chesnut, S. R., & Curtin, S. J. (2020). Teacher–student relationship quality and math achievement: The mediating role of teacher self-efficacy. *Psychology in the Schools*, *57*(1), 111–134. https://doi.org/10.1002/pits.22322

Hedges, L. V., & Rhoads, C. L. (2019). Statistical power for randomized experiments with noncompliance and missing data: Design and analysis strategies. *Journal of Research on Educational Effectiveness*, *12*(2), 310–338. https://doi.org/10.1080/19345747.2018.1553132

Hill, H. C., & Correnti, R. (2019). Algebra in eighth grade and later STEM outcomes. *Journal of Educational Psychology*, *111*(6), 1015–1030. https://doi.org/10.1037/edu0000333

Hill, H. C., & Correnti, R. (2019). What we know, what we need to know: Improving mathematics instruction and student learning in the United States. *Educational Researcher*, *48*(8), 501–514.

Hines, S. J., & Schaper, A. (2019). Implementing response to intervention: Team member roles and responsibilities. *Journal of Educational and Psychological Consultation*, *29*(3), 315–333. https://doi.org/10.1080/10474412.2018.1479743

Howell, C. R., Su, W., Nassel, A. F., Agne, A. A., & Cherrington, A. L. (2020). Area based stratified random sampling using geospatial technology in a community-based survey. *BMC Public Health*, *20*, Article 1678. https://doi.org/10.1186/s12889-020-09793-0

Jazim, A. A., Sulaiman, H., & Mohd, M. (2017). The use of information processing theory in mathematics problem solving. *Journal of Education and Learning*, *6*(1), 103–114. https://doi.org/10.5539/jel.v6n1p103

Jett, C. C. (2019). Fostering Black students' excellence in mathematics: Unpacking the impact of racial biases and mathematics identity. *Journal of Urban Mathematics Education*, *12*(2), 5–23.

Jett, C. C. (2021). The role of internal factors in promoting mathematical persistence among Black students. *Journal of African American Males in Education*, *12*(1), 1–15.

Joseph, N. M., & Cobb, C. D. (2019). "I'm just trying to get to the next level": Finding solutions for advancement in mathematics for Black students. *Journal of African American Males in Education*, *10*(2), 82–97.

Kant, I. (1901). *Critique of pure reason* (Trans. J. M. D. Meiklejohn). George Bell and Sons. Original work published 1781.

Katranci, Y., & Bolat, O. (2018). The effects of a constructivist approach on student achievement in algebra: A meta-analysis. *International Journal of Science and Mathematics Education*, *16*(6), 1079–1096.

Kim, S., Jiang, Y., & Song, J. (2015). The effects of interest and utility value on mathematics engagement and achievement. In K. A. Renniger, M. Nieswandt, & S. Hidi (Eds.), *Interest in mathematics and science learning* (pp. 63–78). American Educational Research Association.

Kirmayer, L. J. (2019). Kant's revolution in philosophy and its relevance to psychiatry. *Canadian Journal of Psychiatry*, *64*(5), 292–296. https://doi.org/10.1177/0706743719831569

Ladson-Billings, G. (2020). Culturally relevant pedagogy 2.0: a.k.a. the remix. *Harvard Educational Review*, *90*(2), 147-164. https://doi.org/10.17763/haer.84.1.p2rj131485484751

Ladson-Billings, G. (2020). From the achievement gap to the education debt: Understanding achievement in U.S. schools. *Educational Researcher*, *49*(2), 153–166. https://doi.org/10.3102/0013189X209035

Lee, D., & Kearns, J. (2020). Progress monitoring in special education: A systematic review of evidence-based practices. *Journal of Special Education*, *54*(1), 3–14.

Lee, J. (2022). Interventionists as curriculum designers: Developing mathematical identity. *Teaching Children Mathematics*, *28*(4), 222–229.

Lee, J. C. K., & Wong, A. K. Y. (2021). Democratic leadership in education: A review of the literature and future research agenda. *Educational Research Review*, *32*, Article 100364. https://doi.org/10.1016/j.edurev.2020.100364

Love, N., Heinecke, W.F., & Heinecke, L.G. (2018). Implementing the BEST standards: A case study of a successful middle school. *Journal of Educational Research and Practice*, *8*(2), 51-–64. https://doi.org/10.5590/JERAP.2018.08.2.05

Makowski, D., Ben-Shachar, M. S., Chen, S. A., & Lüdecke, D. (2019). Indices of effect existence and significance in the Bayesian framework. *Frontiers in Psychology*, *10*, Article 2767. https://doi.org/10.3389/fpsyg.2019.02767

Martin, A. J., Kaur, B., O'Dowd, K., & Ginns, P. (2022). The impact of whole-class interventions in mathematics: A meta-analysis. *Journal of Educational Psychology*, *114*(1), 23–43. https://doi.org/10.1037/edu0000514

Matthews, J. S. (2018). When am I ever going to use this in the real world? Cognitive flexibility and urban adolescents' negotiation of the value of mathematics. *Journal of Educational Psychology*, *110*(5), 726–746. https://doi.org/10.1037/edu0000242

McIntosh, K., & Goodman, S. (2016). *Integrated multi-tiered systems of support: Blending RTI and PBIS*. Guilford Publications

McLeod, D. B., & Reynolds, R. E. (2017). Enhancing mathematics education: Resources and teacher professional development. *Journal for Research in Mathematics Education*, *48*(3), 256–259. https://doi.org/10.5951/jresematheduc.48.3.0256

Mercer, D. (2016). Who is the building leader? Commentary on educational leadership preparation programs for the future. *Educational Considerations. 43*(4), 6–10. https://files.eric.ed.gov/fulltext/EJ1116627.pdf

Merkley, R., & Ansari, D. (2016). Why numerical symbols count in the development of mathematical skills: Evidence from brain and behavior. *Current Opinion in Behavioral Sciences*, *10*, 14–20. https://doi.org/10.1016/j.cobeha.2016.04.006

Miciak, J., Williams, J. L., & Taylor, J. H. (2019). Teacher perceptions of professional development and their implementation of Response to Intervention. *Journal of Education and Learning*, *8*(1), 1–13.

Mullis, I. V. S., Martin, M. O., Foy, P., & Arora, A. (2016). *TIMSS 2015 international results in mathematics*. https://timss2015.org/timss-2015/mathematics/

National Assessment of Educational Progress. (2021). *Mathematics 2019: National and state results*. https://www.nationsreportcard.gov/mathematics-2019-naep/

National Center for Education Evaluation and Regional Assistance. (2016). *Characteristics of public and private elementary and secondary school principals in the United States: Results from the 2015-16 National Teacher and Principal Survey first look*. U.S. Department of Education. https://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2017016

National Center for Education Statistics. (2019). *Mathematics performance of Black students*. https://nces.ed.gov/programs/coe/indicator_cgf.asp

National Center for Learning Disabilities. (2017). *The Individuals with Disabilities Education* Act (IDEA). https://www.ncld.org/wp-content/uploads/2014/11/IDEA-Guide-FINAL_508.pdf

National Center for Learning Disabilities. (2019). *State of learning disabilities: Understanding the 1 in 5*. https://www.ncld.org/stateofld/

National Center on Intensive Intervention. (2018). *What is RtI?* https://intensiveintervention.org/what-rti

National Council of Teachers of Mathematics. (2014). *Principles to actions: Ensuring mathematical success for all*.

National Council of Teachers of Mathematics. (2018). *Catalyzing change in high school mathematics: Initiating critical conversations*.

National Council of Teachers of Mathematics. (2018). Catalyzing change in high school mathematics: Initiating critical conversations. https://www.nctm.org/News-and-Calendar/Messages-from-the-President/Archive/2018/Catalyzing-Change-in-High-School-Mathematics--Initiating-Critical-Conversations/

National Education Association. (2019). *The Every Student Succeeds Act: What it means for students and schools*. https://www.nea.org/advocating-for-change/new-from-nea/every-student-succeeds-act-what-it-means-students-and-schools

No Child Left Behind (NCLB) Act of 2001, Pub. L. No. 107-110, § 101, Stat. 1425 (2002).

Organisation for Economic Co-operation and Development. (2021). *The economic benefits of improving math skills*. https://www.oecd.org/education/the-economic-benefits-of-improving-math-skills-9789264279353-en.htm

Pinger, P., Rakoczy, K., Besser, M., & Klieme, E. (2018). Implementation of formative assessment–effects of quality of programme delivery on students' mathematics achievement and interest. *Assessment in Education: Principles, Policy & Practice*, *25*(2), 160–182.

Powell, S. R., Fuchs, L. S., & Fuchs, D. (2021). Response to Intervention in mathematics: What is the state of the science? *Journal of Learning Disabilities*, *54*(2), 88–101. https://doi.org/10.1177/

Prendergast, M., & Donoghue, J. (2014). 'Students enjoyed and talked about the classes in the corridors': Pedagogical framework promoting interest in algebra. *International Journal of Mathematical Education in Science and Technology*, *46*(6), 795–812. https://doi.org/10.1080/0020739X.2013.877603

Public Law No. 114-95, Every Student Succeeds Act, December 10, 2015.

Rinaldi, C., Jiban, C. L., & DeLeon, J. C. (2019). Examining the role of educational leaders in Response to Intervention implementation. *Journal of Education and Learning*, *8*(4), 1–11.

Rittle-Johnson, B., Fyfe, E. R., Hofer, K. G., & Farran, D. C. (2017). Early math trajectories: Low-income children's mathematics knowledge from ages 4 to 11. *Child Development, 88*(5), 1727–1742. https://doi.org/10.1111/cdev.12798

Rivera, C., & Park, Y. (2020). The impact of progress monitoring on student academic achievement: A meta-analysis. *Journal of School Psychology*, *79*, 53–70.

Seeley, C. L. (2016a). *Building a math-positive culture: How to support great math teaching in your school*. ASCD.

Seeley, C. L. (2016b). *Making sense of math: How to help every student become a mathematical thinker and problem solver*. ASCD.

Sileyew, K. J. (2019). *Research design and methodology*. IntechOpen.

Smith, M. J. (2019). *Investigating the impact of Response to Intervention on middle school students* (Publication No. 27740520) [Doctoral dissertation, Tennessee State University]. ProQuest Dissertations and Theses Global.

Turner, J. C., Kackar-Cam, H. Z., & Trucano, M. (2015). Teachers learning how to support student interest in mathematics and science. In K.A. Renniger, M. Nieswandt, & S. Hidi (Eds.), *Interest in mathematics and science learning* (pp. 243–257). American Educational Research Association.

U.S. Department of Education. (2018). *Response to Intervention (RTI)*. https://www.ed.gov/rti

VanDerHeyden, A. M., & Allsopp, D. (2014, September). *Innovation configuration for mathematics* (Document No. IC-6). University of Florida, Collaboration for Effective Educator, Development, Accountability, and Reform Center. https://ceedar.education.ufl.edu/wp-content/uploads/2014/09/IC-6_FINAL_09-25-14.pdf

VanDerHeyden, A. M., & Witt, J. C. (2018). Establishing a progress-monitoring baseline: Recommendations for practitioners. *Assessment for Effective Intervention*, *43*(1), 3–12.

VanDerHeyden, A. M., Witt, J. C., & Barnett, D. W. (2019). Universal screening within an RTI framework: Applications at the secondary level. In *Best practices in universal screening and progress monitoring* (pp. 189–204). The Guilford Press.

Wang, M. T., Chen, Q., & Yan, W. (2020). Opportunity to learn and student achievement: A meta-analysis. *Review of Educational Research*, *90*(3), 293–329.

Wang, M. T., Zhang, Y., Zhang, T., & Zhang, X. (2017). The role of opportunity to learn in predicting academic achievement in mathematics, science, and reading among middle school students. *Journal of Educational Psychology*, *109*(3), 381–397.

Wardrop, J. L., Bullock, L. M., & Shurden, M. S. (2020). Building a successful response to intervention (RtI) framework in schools: Key considerations for planning and implementation. *Preventing School Failure: Alternative Education for Children and Youth*, *64*(1), 1–12.

Werts, M. G., Lambert, M. C., & Carpenter, D. D. (2014). Response to Intervention in rural settings: Considerations and implications. *Rural Special Education Quarterly*, *33*(1), 19–27. https://doi.org/10.1177/875687051403300103

World Economic Forum. (2020). *The Future of Jobs report 2020*. http://www3.weforum.org/docs/WEF_Future_of_Jobs_2020.pdf

Xu, J., Yuan, R., Xu, Y., & Xu, G. (2017). The effectiveness of peer tutoring intervention in enhancing secondary school students' knowledge and skills in mathematics: A meta-analysis. *Educational Psychology Review*, *29*(3), 521–548. https://doi.org/10.1007/s10648-016-9381-6

Yelland, N., & Masters, J. (2019). Leading professional development for mathematics. In J. Boaler, C. Humphreys, S. L. Morgan, & B. Peyser (Eds.), *Mathematics for equity: A framework for successful practice* (pp. 165–181). Jossey-Bass.

Yoon, K. S., Duncan, T., Lee, S. W.-Y., Scarloss, B., & Shapley, K. L. (2016). *Reviewing the evidence on how teacher professional development affects student achievement* (Issues & Answers Report, REL 2017–No. 180). Washington, DC: U.S. Department of Education, Institute of Education Sciences, National Center for Education Evaluation and Regional Assistance, Regional Educational Laboratory Southwest.