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The Effect of Prekindergarten Participation on Third-Grade Reading and Math

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This is to certify that the doctoral study by

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has been found to be complete and satisfactory in all respects,
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Walden University
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Abstract

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by

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MA, Capella University 2012

BS, Barry University 2006

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

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Abstract

Student reading and math achievement in the U.S. is not only low but also is decreasing. The purpose of this study was to determine the differences in third-grade reading and math scores between students who attended prekindergarten programs and students who did not attend prekindergarten programs. The theoretical framework was Bruner's constructivist learning theory. A quantitative, causal-comparative ex post facto study was conducted. The third-grade reading and math scores of students who completed the Georgia Milestones in 2016-2017 and 2017-2018 were analyzed using MANOVA (N = 16,533). There was a statistically significant difference between the combined math and reading scores of students who participated in prekindergarten and those who did not, $F(2, 16303) = 12.25$, $p < .0005$, Wilk's $\Lambda = .998$, partial $\eta^2 = .002$. This result supported rejection of the null hypothesis. Each dependent variable was examined separately. The results for prekindergarten participation and reading $F(1, 16304) = 21.40$, $p < .0005$, partial $\eta 2 = .001$, and prekindergarten program participation and math, $F(1, 16304) = 22.42$, $p < .001$, partial $\eta 2 = .001$) were below Cohen's d effect size threshold for medium effect sizes for reading ($d = .08$) or math ($d = .08$). The results of this study have insufficient effect size to attribute the higher mean scores of reading and math scores to prekindergarten program participation. The findings from this study may promote positive social change by informing policy initiatives that improve the pre-K math and reading instruction and curricula to achieve a better long term positive effect on student reading and math achievement in elementary grades.

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Dedication

I dedicate this dissertation to my caring and supportive family. I am eternally grateful for the unconditional love, understanding, and words of encouragement. First, I would like to acknowledge my wonderful husband, Teslilimi Olukoya Jr., for pushing me to keep writing when I wanted to give up. I thank you for stepping up with the children and ensuring I had a quiet space to work. You have always been my support system, and for that, I thank you. I also thank my daughters, Mikaiyah and Laila. You two were my motivation to keep pushing and keep writing. To my oldest, thank you for asking me, "How much more do you have to do?" This was a weekly reminder to persevere. To my youngest daughter, I am in awe of your patience as I worked through this process. To my parents, Nycula and Jessie Randle, thank you for telling the world that soon I would be a doctor. This was a gentle kick that failure was not an option. To my father, David McNickles, thank you for telling me as a child that I could accomplish anything that I put my mind to. These words gave me the confidence to dream big and see beyond my limitations. I wouldn't be where I am without the unwavering support of my committee. Thank you to Dr. Karyn Hawkins-Scott. You were a willing thought partner to help me organize my thoughts and visualize myself as a graduate. You were with me since I began this writing process, and your support never wavered. Thank you to Dr. Christine Winterbottom for providing constructive feedback. A final thank you to Salina Shrofel for giving me your "deal breakers" and helping me become a stronger writer. My success is directly a result of all that each of you invested in me. For that, I thank you.

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Chapter 1: Introduction to the Study

I examined the long-term effects of prekindergarten participation on third-grade student achievement in reading and math in an urban U.S. school district. I measured achievement using the reading and math test scores of third-grade students on the Georgia Milestones End of Grade reading and math tests. Student achievement, as measured by Georgia Milestones, refers to the performance of students in Grades 3, 4, 6, and 7 in the areas of reading and math (Georgia Department of Education, 2017). In fifth and eighth grade, students are assessed in the areas of reading, math, science, and social studies.

The Georgia Milestones Assessment assesses student reading and math through selected, constructed, and extended responses as mandated by the Every Student Succeeds Act (ESSA) of 2015, thereby increasing the rigor and cognitive demand required by students (Alvermann & Jackson, 2016). ESSA (Institute of Education Sciences, n.d.) is the current federal legislation governing U.S. education. Lawmakers passed the act to improve school support from the state level, implement state reporting systems to measure student growth and inform instruction, increase retention of teachers and building leaders, turn around low-performing students, increase opportunities for charter school development, and adopt standards and assessments to ensure students were college and career ready. As such, a priority for educators and policy makers is closing the achievement gap and providing support for students (Alvermann & Jackson, 2016).

I analyzed reading and math scores of students who participated and did not participate in prekindergarten programs in the local district. The results of this study have the potential to effect positive social change by providing educators and policy makers with information on whether third-grade students who attended prekindergarten programs in the district of study

achieve higher scores in reading and mathematics than do third grade students who did not attend prekindergarten programs in the district. The results may be useful to improve the education of third-grade students and the quality of teachers' practices.

The major sections of Chapter 1 include a summary of background literature related to the study, a description of the gap in practice regarding the lack of research of prekindergarten participation and its influence on third-grade reading and math achievement, and the rationale that explains why the study was needed. I provide details regarding the gap in practice, supported by current literature. I then state the study purpose and present the research question and hypotheses. Chapter 1 also includes an explanation of the study's theoretical framework and a description of the assumptions, scope and delimitations, and limitations. Chapter 1 concludes with a discussion of the significance of the study and a transition to Chapter 2.

Background

The background and scope of this study centered on current knowledge and awareness of the role of prekindergarten programs in positively influencing the reading and math achievement of third-grade students. The No Child Left Behind Act (NCLB) of 2001 instituted standardized tests as key to improving the educational outcomes and career opportunities for students (Deming et al., 2016). NCLB required the assessment of students throughout the United States in the areas of reading and math, publication of the results, and the sanctioning of schools with persistently low performance (Deming et al., 2016). Recent reform in 2010, led by the National Governor's Association and members of the Council of Chief State School officers, resulted in the development of a set of universal educational standards in the areas of English Language Arts and math for students in K-12 schools throughout the United States. These standards are known as the Common Core State Standards (Anderson-Levitt, 2020).

Frank et al. (2020) found that Common Core State Standards provided standards-based educational reform through accountability measures that included redefined teacher evaluation linked to student performance on state assessments, revised state standards related to curriculum and professional development, and implementation of rigorous assessment measures of student performance on state standards. High-stakes testing has also been found to have a detrimental impact on schools with a high population of students considered at risk for poor educational outcomes. Zhang et al. (2017) found schools with low-performing students were at higher risk of failure to meet the new academic demands of Common Core and high-stakes testing as well as sanctioning by educational agencies.

Siraj et al. (2019), however, found that enrollment in kindergarten readiness programs had positive impacts on entering kindergarten students, increasing students' acquisition of curriculum outcomes. In addition, Siraj et al. found that prekindergarten programs can prevent academic deficiencies and decrease behavioral problems through greater support and early identification of support services. Furthermore, Valentino (2018) found that access to pre-kindergarten programs has the potential to close achievement gaps. Bratsch-Hines et al. (2019) found that prekindergarten and early education programs were closely associated with phonological awareness and letter knowledge. Both skills were closely linked to word reading precursors and oral language ability.

In spite of these findings, there remains a gap in the literature on the role of prekindergarten programs in positively influencing later reading and math achievement. The lack of research on prekindergarten participation and its influence on third-grade reading and math achievement further indicates a gap in practice. Addressing the lack of information about prekindergarten participation and its influence on third-grade reading and math achievement is

necessary to support schools (Fram et al., 2011). The study is needed to provide policy makers and school administrators with information to inform the improvement of early elementary reading and mathematics teaching.

Problem Statement

The problem I addressed in this study was the lack of information about whether students who attend prekindergarten programs demonstrate higher achievement on state assessments when compared to students who do not complete prekindergarten programs. Researchers have analyzed the influence of prekindergarten participation and student readiness for later learning. Students in the United States continue to demonstrate lower performance on standardized tests as compared to other nations in terms of reading and math (Harvey, 2018). The poor performance of students in reading and math on U.S. and international, standardized tests has a detrimental impact on the U.S. gross domestic product growth rate (Harvey, 2018). The significant lack of research of prekindergarten participation and its influence on third-grade reading and math achievement indicates a gap in practice.

Nguyen et al. (2015) found that prekindergarten participation provided students with opportunities to close achievement gaps. Similarly, Hustedt et al. (2021) found gains in vocabulary, mathematics, and print awareness among students who attended prekindergarten which were also linked to achievement in kindergarten and later grades. However, Hustedt et al. did not analyze long-term effects, as the study was limited to kindergarten entry data. Manigo and Allison (2017) found that participation in preschool promoted later academic success through the implementation of prereading strategies such as oral language, phonological awareness, and prewriting skills. However, Manigo and Allison's study was limited due to the small sample size. Also, the results are not generalizable to other populations. Bai et al. (2020)

found positive outcomes for students who attended prekindergarten that persisted through eighth grade.

Gormley et al. (2017) conducted a study using data from Oklahoma public schools to examine the effects of Tulsa's universal, prekindergarten programs on identified achievement indicators of middle school students. Their results indicated lasting effects on math achievement scores, enrollment in honors classes, and grade retention but did not yield statistical significance on reading test scores, letter grades, nor special education designation. Sample attrition was a limitation in their study, which may impact their results as participants were no longer included in subsequent years.

The results of the long-term effects of prekindergarten participation and later student achievement is mixed (Abenavoli, 2019), with some studies indicating a benefit of increased math performance in middle grades, enrollment in honors classes, and increased graduation rates (DeAngelis et al., 2018; Williams, 2019) and other studies reporting no impact or diminished efforts by completion of elementary school (Alsobaie, 2015; Hofer & Society for Research on Educational Effectiveness, 2014; Han et al., 2020). The mixed results of reading and math outcomes for students who attend prekindergarten indicates a gap in practice and lack of knowledge on prekindergarten participation and its effect on third-grade reading and math achievement. This study is needed to provide quantitative information regarding whether there is a significant difference between third-grade reading and math scores for students who attended prekindergarten and students who did not attend prekindergarten programs.

Purpose of the Study

The purpose of this quantitative study was to address the gap in practice regarding the lack of research on prekindergarten participation and its effect on third-grade reading and math

achievement. To address the gap in practice, I examined the differences between third-grade reading and math state assessment scores of students who attended prekindergarten programs and students who did not attend pre-kindergarten programs in the district of study. I examined the independent variable of prekindergarten participation and the dependent variables of third-grade reading and math scores as measured by the Georgia Milestones. I sought to examine whether there was a significant difference between third-grade math and reading assessment scores of students who attended prekindergarten programs and those who did not attend prekindergarten programs.

Research Question and Hypotheses

I used a quantitative, causal-comparative ex post facto design using a one-way multivariate analysis of variance (MANOVA) to answer the following research question: What is the statistical difference in third-grade math and reading assessment scores between students who attended pre-kindergarten programs and students who did not attend pre-kindergarten programs? To answer this research question, the following hypotheses were tested:

H_0: There is no statistical difference in third-grade math and reading assessment scores between the students who attended prekindergarten programs and students who did not attend pre-kindergarten programs.

H_1: There is a statistical difference in third-grade math and in reading assessment scores between students who attended prekindergarten programs and students who did not attend pre-kindergarten programs.

Theoretical Foundation

I sought to determine the effects of prekindergarten participation on third-grade reading and math achievement in the district of study. This study drew from constructivism, as developed

by Bruner (1977). According to Bruner, learning is a process of discovery in which the learner rearranges or transforms information to lead to new insights and new inquiry (see also Page, 1990). According to Bruner, when learners use background knowledge to learn new information, students are more likely to remember concepts and knowledge because the learner discovered the information on his or her own. In this theory, learning for students is a result of interaction with the world through exploration and manipulation of objects, active participation, problem-solving, and autonomy.

Bruner referred to three systems of processing information as enactive, iconic, and symbolic representation (Bruner, 1977). According to Bruner, the enactive stage is the first stage of development. The enactive stage is a concrete stage that is heavily dependent on hands-on learning (Bruner, 1977). The enactive stage is action-based and involves physical objects, followed by bodily or gestural actions (Bruner, 1977).

Following enactive is the iconic stage. The iconic stage is an image-based stage in which information is represented by the categorization of spatial, temporal, and qualitative structures (Bruner, 1977). Specifically, the iconic stage represents a change in the learner's cognitive functioning in which the learner can make an image from a concrete situation (Bruner, 1977). The images in the learner's mind during the iconic stage can be made more explicit, such as drawn on a sheet of paper a visualization in the learner's mind to represent the concrete situation.

The final stage of development in Bruner's constructivism is symbolic. The symbolic stage represents design features that are remote and arbitrary (Bruner, 1977). The symbolic stage is interactive, in which students interact with their environment while learning new information (Bruner, 1977). In this stage, learners use the symbolic language-based mode of representation

during the interaction, which may include words or symbols (Bruner, 1977). This final stage also represents students' transition from concrete to abstract understanding.

Bruner focused his work on participants under the age of 5 (Sylva, 2014). Bruner found that variance in adult intellectual achievement is already accounted for by the time children become school-age. According to Bruner, educators should understand the cognitive level of their students and provide opportunities for students to learn new, unfamiliar things through discovery. Bruner's theory of constructivism explains how experiential learning opportunities that are found in prekindergarten programs impact student learning (Braswell, 2017).

Nature of the Study

I used a quantitative, causal-comparative ex post facto research design to determine the effect of prekindergarten participation on third-grade reading and math achievement. This research design allowed me to look for a relationship between the independent variable and dependent variables after the research event had occurred. I compared the Georgia Milestones reading and math scores of students who attended prekindergarten and students did not attend prekindergarten to determine if there were any statistically significant differences in math and reading achievement between the two groups.

In this study, the independent variable was participation in the prekindergarten program. The independent variable also determined the grouping of the participants. One group comprised students who attended the district's prekindergarten program. The other group consisted of students who did not attend a prekindergarten program. The dependent variables were third-grade students' Georgia Milestones reading and math assessment scores. The purpose of this study was to examine the statistical difference, if any, in third-grade reading and math assessment scores between students who attended prekindergarten programs and students who

did not attend prekindergarten programs. For this quantitative, causal-comparative ex post facto research, I used existing archival data of Georgia Milestones results to examine students' reading and math skills of students in third grade.

Definitions

Beginning learners: Learners who do not yet demonstrate proficiency in the knowledge and skills necessary at this grade level/course of learning, as specified in Georgia's content standards. The students need substantial academic support to be prepared for the next grade level or course and to be on track for college and career readiness (Georgia Department of Education, 2017).

Developing learners: Learners who demonstrate partial proficiency in the knowledge and skills necessary at this grade level/course of learning, as specified in Georgia's content standards. The students need additional academic support to ensure success in the next grade level or course and to be o track for college and career readiness (Georgia Department of Education, 2017).

Distinguished learners: Learners who demonstrate advanced proficiency in the knowledge and skills necessary at this grade level/course of learning, as specified in Georgia's content standards. The students are well prepared for the next grade level or course and are well prepared for college and career readiness (Georgia Department of Education, 2017).

Every Student Succeeds Act (ESSA): Legislation signed by former President Obama in 2015, which reauthorized the Elementary and Secondary Education Act (ESEA) of 1965 and required that high academic standards in classrooms; statewide assessments; the publication of assessment results; access to high-quality, prekindergarten programs; and accountability measures to improve low-performing schools (The Congressional Digest, 2020).

Georgia Milestones End-of-Grade Assessment: An assessment given to students in Grades 3-8 that replaced the Criterion-Referenced Competency Tests in 2014 to assess students' acquisition of knowledge and skills in reading and math for students in third-, fourth-, sixth-, and seventh-grade, and reading, math, science, and social studies for students in Grades 5 and 8 (Georgia Department of Education, 2017). The assessment used open-ended, written responses and norm-referenced items as a component of ESSA's mandated state assessments (Georgia Department of Education, 2017).

National Assessment of Educational Progress (NAEP): A nationally representative assessment given to students in Grades 4, 8, and 12 in the areas of reading and math (in Georgia) that provides the data for the *Nation's Report Card* (Dogan et al., 2015).

Prekindergarten programs: Center-based programs for students 4- to 5- years of age that are located within a public school, receive funding from state agencies, and are under the direction of local and state agencies (Clifford et al., 2005).

Proficient learners: Learners who demonstrate proficiency in the knowledge and skills necessary at this grade level/course of learning, as specified in Georgia's content standards. The students are prepared for the next grade level or course and are on track for college and career readiness (Georgia Department of Education, 2017).

Assumptions

I had six assumptions in conducting the study. The first assumption for this study was that the Georgia Milestones End-of-Grade Assessment was implemented in accordance with the administration manual, thereby rendering the results valid, accurate, and reliable. The second assumption was that each student in the prekindergarten classes received instruction in the subject school district that was comparable and met the requirements of Bright From the Start.

Bright From the Start, Georgia's Department of Early Care and Learning. Bright From the Start is chiefly responsible for ensuring the child care and early education needs of students and families in Georgia and administers the prekindergarten program. Another assumption was that students in Grades 1 through 3 received instruction on the Georgia Standards of Excellence state standards. The subject school district uses a district-wide curriculum. Therefore, it was also assumed that each of the participants received instruction that adheres to the prescribed district curriculum. I also assumed that the results of the Georgia Milestones End-of-Grade Assessment data accurately represent each student's skills and knowledge attainment. It was also assumed there was no difference between the groups of the independent variable such as socioeconomic status that could explain any differences in reading and math achievement as measured in third grade. The assumptions were necessary in the study to ensure that any conclusions drawn from the reading and math data were appropriate.

Scope and Delimitations

The scope of this study was the effect of prekindergarten participation on third-grade reading and math scores; I focused my efforts on determining whether there were differences in third-grade reading and math scores between students who attended prekindergarten and students who did not attend prekindergarten. Based on the scope of this study, I selected only students whose data contained prekindergarten participation data. Therefore, students whose records did not contain prekindergarten enrollment data were excluded from this study. Their inclusion in the study could have skewed the data and resulted in the miscoding of students' prekindergarten enrollment, which could have impacted the overall analysis of the study and affected the generalizability of the study.

Limitations

A study featuring a causal-comparative ex post facto research design has inherent limitations. The ex post facto aspect of the study meant that I had no control over the outcome. This differs from an experimental research design in which the researcher has the opportunity to manipulate variables (Levy & J. Ellis, 2011). A second limitation was the assignment of groups. The prekindergarten and no prekindergarten groups were assigned prior to the implementation of this study. In a study with a control and experimental group, the researcher is able to establish causal relationships by isolating the effect of the independent group. In this study, there was no control or experimental group. The results from this study may be influenced by confounding variables, which created a limitation in the study.

Further limitations existed in the variation of prekindergarten and subsequent quality of instruction. I did not know whether students in the study received additional instructional support beyond the school day, which may have influenced student assessment data. Student demographic information, including race/ethnicity and socioeconomic status, was also unknown.

In this study, parental involvement could be a factor that impacts internal validity. The variation in scores between students who participated in prekindergarten programs and students who did not participate in prekindergarten programs could be attributed to parental involvement as opposed to the independent variable of prekindergarten participation. Limitations related to the test construct were also present in this study. A limitation with construct validity is it is unknown whether any testing irregularities occurred during Georgia Milestones administration for the participants.

Significance

Reading and math skills are an educational concern for the subject school district, as well as other schools within the United States (Prizovskaya, 2017). Educational leaders have used prekindergarten programs as a resource to prepare students for kindergarten and later school years (Siraj et al., 2019). Additionally, prekindergarten programs have been used to decrease the achievement gap between students at risk of poor educational outcomes and their peers. I compared the early reading and math skills as measured by the Georgia Milestones data of students who attended a prekindergarten program and students who did not participate in a prekindergarten program.

Reading is a critical life skill that empowers individuals to participate in the democratic process, pursue higher education, and garner employment opportunities, which impacts their economic stability, health and wellness, recreation, and self-confidence (Copeland et al., 2016). However, the 2003 National Assessment of Adult Literacy results indicate that 14% of adults living in the United States lack basic reading skills (Talwar et al., 2014). The results from the Programme for the International Assessment of Adult Competencies also indicate that in the United States, adult literacy is significantly below average, as compared to other nations (Talwar et al., 2014). Researchers, however, continue to study reading research to gain insight into contributing factors that positively impact reading achievement. Ortlieb and Young (2016) found that students who read with adult-like prosody by second grade demonstrate higher levels of comprehension in third grade when compared to peers who were not reading with adult-like prosody.

Prins et al. (2015) found that proficiency in reading and math are closely linked to adult health and higher socioeconomic status. The Programme of the International Assessment of

Adult Competencies, which assesses adult literacy and proficiency in math in adult situations, found that roughly 50% of unemployed adults in the United States between the ages of 16-64 perform below proficiency in math (Institute of Education Sciences et al., 2016). Harvey (2018) further found that in math, the United States scored lower than 26 nations, which may, over time, impact the United States' economic stability. As evidenced in the research, for students to compete in a global society, proficiency in reading and math are prerequisites.

This study contributes to the body of knowledge needed to address the long-term effects of prekindergarten participation on reading and math achievement. Improvement of students' reading and math skills impacts the quality of early educational settings in the subject school district and enables students to compete in a global society. The results of this study provide data for educators and policy makers regarding the impact of pre-kindergarten participation and reading and math achievement of third-grade students. That is, the study may increase the awareness of the impact of prekindergarten programs have on early reading and math achievement. As early as kindergarten, significant gaps in achievement exist among students of different racial, socioeconomic, and language backgrounds (Valentino, 2018). In addition, minority preschoolers in the United States are less likely to enroll in a high-quality prekindergarten program when compared to their White peers (Valentino, 2018). The findings from this study may inform administrators and policy makers about the need for prekindergarten programs to improve student achievement on later reading and math state tests.

Summary

In this chapter, I introduced the purpose of the study and stated the problem. I also provided an overview of Bruner's constructivism, the theoretical foundation of the study, and described the nature of the study. I examined the relationship between program participation in

prekindergarten and third-grade reading and math scores on the Georgia Milestones standardized assessment. Archival data from the Georgia Department of Education for the local school district were used to determine whether differences in Georgia Milestones reading and math scores of third-grade students in the district of study were significant based on prekindergarten participation.

In Chapter 2, I review literature focused on the gap in practice as presented in the problem statement. Chapter 2 includes a description of the theoretical foundation of the study and how the theory has been applied in previous research as related to the purpose of this study. In Chapter 2, I define emergent literacy and numeracy as it relates to constructivism. A review of current and past studies that focus on prekindergarten participation and its impact on reading and numeracy is also discussed. The past studies substantiated the gaps in research concerning the long-term impact on reading and math, as it relates to prekindergarten participation.

Chapter 2: Literature Review

The lack of research on prekindergarten participation and its influence on third-grade reading and math achievement indicates a gap in practice. The findings from a review of the literature indicate mixed results. The purpose of this study was to examine the statistical difference, if any, in third-grade reading and math scores between students who attended prekindergarten programs and students who did not attend prekindergarten programs. My broader aim was to determine the effect of pre-kindergarten participation.

National assessment of students in the United States reveals that students continue to struggle in reading and math acquisition, as measured in fourth, eighth, and 12th grades (Rebarber & Pioneer Institute for Public Policy Research, 2020). In 2018, researchers found that 15 year olds in the United States ranked 13th in national reading achievement compared to students in other countries (Rebarber & Pioneer Institute for Public Policy Research, 2020). During the same assessment year, 15 year olds in the United States ranked 31st in math. In addition, students in the United States performed significantly below the international Organisation for Economic Co-operation and Development average (Rebarber & Pioneer Institute for Public Policy Research, 2020).

In this climate, enrollment in early learning programs has shown increased enrollment. Education Commission of the States et al. (2020) found increased enrollment in prekindergarten programs since 2018 among 4- and 5-year-old children. The rise in enrollment in prekindergarten programs is due to state adoption and expansion of state-funded prekindergarten programs to address the academic gaps of students in the United States (Education Commission of the States et al., 2020). Researchers support the emphasis on prekindergarten programs as an opportunity to

provide students with early learning programs that ensure later reading and math proficiency (Ansari et al., 2021, p. 61).

Chapter 2 includes overviews of the literature search strategy and theoretical foundation and the literature review. As I conducted the literature review, I investigated compared, contrasted, and synthesized various themes within the research. Major themes were categorized into different sections, starting with analysis of research on prekindergarten programs, reading and math proficiency, achievement, and long-term studies on the effectiveness of prekindergarten. The literature review concludes with discussion of research on high stakes testing. The chapter concludes with a summary and transition to Chapter 3.

Literature Search Strategy

For the literature review, I used databases such as ERIC, Academic Search Complete, Education Source, and Google Scholar via the Walden University website. The search resulted in classic and current research articles from peer-reviewed journals, books, and governmental websites. To find literature, I used the following key terms: *achievement*, *pre-kindergarten*, *emergent reading*, *numeracy*, *early childhood education*, *fade out*, *constructivism*, *Bruner*, and *high-stakes testing.*

The literature review includes studies of preschool programs and their effect on students' reading and math proficiency. I also obtained information from websites and copies of studies from the National Institute for Literacy and the National Center for Education. I examined studies of early reading and math skills, reading achievement, and long-term impact on reading and math proficiency. The review also focuses on studies related to the research question, hypotheses, theoretical framework, and state initiatives such as the ESSA and Common Core standards. I also review research related to the long-term impact of prekindergarten program

participation on reading and math proficiency. Many researchers have examined the effects of prekindergarten program participation and subsequent reading and math skills proficiency. Additionally, I examined research about Bruner's theoretical model of constructivism. The background information within this chapter provides understanding and support for this research study.

Theoretical Foundation

Constructivism is a theory of learning associated with Piaget, Vygotsky, and Bruner in which students actively construct their understanding rooted in cognitive or social constructivism (Pande & Bharathi, 2020). Cognitive constructivism emphasizes the role of cognitive functioning, whereas social constructivism emphasizes the role of the environment in which the learner constructs their knowledge (Powell & Kalina, 2009). Social constructivism posits that knowledge acquisition occurs through interaction by the learner and communication and collaboration with others (Whaley et al., 2019). Social constructivism emphasizes the cultural and social environment in which learning occurs (Jain, 2019). This study was grounded on the theoretical foundation of social constructivism, as posited by Bruner.

Izmirli (2020) discussed the implications of social constructivism in the classroom. Izmirli further stated social interactions provide learners with opportunities to construct knowledge. Jane et al. (2020) found that students needed an opportunity to reflect on their learning and ownership of their learning experiences; they also observed that learning should occur from the students' perspectives to account for differences in the background experiences of students. In another study, Hằng et al. (2020) studied the impact of social constructivism on primary education in Vietnam. Hằng et al. found that the implementation of social constructivism internationally has been the theoretical basis of curriculum reform. In one science

education course, Hằng et al. found social constructivism present in classroom-fostered social and emotional support that enabled student risk-taking and ownership of learning.

Other researchers have found that social constructivism influences student achievement. Social constructivism was found to be critical in creating and sustaining motivation and engagement during the learning process (Ardiansyah & Ujihanti, 2018). Amponsah et al. (2018) found that social constructivism supported cooperative learning opportunities and social contexts facilitated meaning and learning. In addition, students are able to test the validity of their ideas and develop meaning at a higher complexity when engaged in classroom discourse (Amponsah et al., 2018). Papworth (2016, as cited in Bawack & Kala Kamdjoug, 2020) conducted a study on English language acquisition using a social constructivist approach. The study aimed to improve student engagement while increasing student achievement. Participants who were guided using a social constructivist approach self-reported increased engagement with learning materials, increased retention of information, and greater student achievement (Papworth, 2016, as cited in Bawack & Kala Kamdjoug, 2020). Social constructivist classes fostered collaborative learning and an opportunity for students to construct meaning through peer interaction and social participation (Papworth, 2016, as cited in Bawack & Kala Kamdjoug, 2020). Social constructivism posits that social interaction during learning not only fosters collaboration but increases cognition and student achievement. Due to social constructivism's potential to positively impact student achievement, the theory has been heavily researched.

Social constructivism also provides an understanding of teachers' paradigms regarding student learning. Yurekli et al. (2020) found that teachers held a social constructivist view toward student learning. Dladla and Ogina (2018) examined teachers' beliefs regarding street children. In this study, social constructivism was used as the theoretical framework to examine

how teachers perceive street children in South Africa and how their perception of these students impacted learning outcomes for these students. The researchers found that teachers' beliefs regarding teaching and learning profoundly influenced teacher practices, specifically instructional delivery, content mastery, and instructional planning. Therefore, teachers' predisposition toward social constructivism provides further insight into teachers' beliefs regarding student learning.

Ardiansyah and Ujihanti (2018) found that social constructivism has important implications for teachers. In this study, Ardiansyah and Ujihanti viewed teachers as a guide whose purpose is to provide students with an opportunity to test their understandings. In this view, students take an active role in the process of knowledge construction and meaning-making. Ugwuozor (2020) found that students in Nigeria who were taught in constructivist classrooms had higher achievement than those taught in transmission classrooms. Therefore, social constructivism provides support on the impact of the learning environment, early learning experiences, and later achievement.

Stefan (2017) studied e-learning using constructivist methodology. In the study of 143 participants, Stefan found that constructivism emphasized active participation during knowledge acquisition, improved teachers' organization of learning experiences, and improved students' independent and divergent thinking. Constructivism involves the student and teacher by emphasizing the learning environment as central in the learning process. Therefore, constructivism impacts the learning process of students and the instructional practices of educators.

Social constructivism is the theory most identified in research on literacy instruction and support (Yang et al., 2019). The environment, not just the learner's understanding, is important

in the development of student's language capacities. Mcleod (2019) found that seven primary characteristics of social constructivist learning environments were

- student voice and ownership
- realistic contexts
- experiencing knowledge
- appreciation of multiple perspectives
- social interaction
- multiple modes of representation
- self-awareness of knowledge

Bruner's theory of social constructivism provides a theoretical framework for how children learn and the impact of the learning environment. Bruner stated that learning was the result of students constructing new knowledge based on current or past learning, and the key to a student's understanding was the organization of information (Bruner, 1977).

Bruner's theory of social constructivism provides intentional actions that teachers can do to support student learning. Wood et al., (1976) described scaffolding as providing intentional student support on challenging tasks. Social constructivism posits that temporary support from teachers fosters deeper student understanding (Such, 2019). Fernández et al. (2015) found that learning environments that exhibited social constructivism consistently ensured the following:

- orientation of the student's attention to the task
- simplification of the task by reducing the number of steps allows the student to handle the task
- scaffolding, which allowed the educator to motivate the student toward a specific goal by directing the actions of the student

- scaffolding that highlighted critical features of the task for the student
- scaffolding, which reduced student frustration through purposeful support
- scaffolding that provided the student with an exemplar model and key steps for completion.

Social constructivism is highly researched in educational settings and found to impact teacher ideology and student learning greatly. Social constructivism significantly impacts education due to Bruner's seminal work, *The Process of Education* (Carey, 2016). Bruner's theory of social constructivism was significantly impacted by his work with pre-kindergarten programs. Bruner's experience at the Woods Hole conference helped develop the federal Head Start program in 1965 to provide support for early learners (Carey, 2016). Head Start programs are public pre-kindergarten programs designed to provide equitable opportunities for young children to ensure students would not lag behind their peers (Hustedt et al., 2021). Pre-kindergarten programs are designed for students that are at risk for academic failure and provide students with opportunities to reach academic proficiency (Hustedt et al., 2021) Pre-kindergarten programs are important in that they provide learning environments that promote academic achievement and student learning. Consistent with Bruner's theory of students' learning and knowledge acquisition, this study will examine the long-term effects of pre-kindergarten participation on reading and math achievement of students.

Literature Review Related to Key Concepts and Variables

The U.S. federal government has invested in educational reform. The reform has led to funding and accountability contingent upon the reading and math achievement of students (Dupre, 2018). Prekindergarten programs were developed to provide positive learning outcomes

for students at risk for academic failure (Greenburg et al., 2020). The current study addresses the influence of pre-kindergarten program participation on student reading and math achievement.

The first key concept of the study is the issue of school reform. One of the first efforts of legislative reform was ESEA. ESEA, which was enacted in 1965, authorized the government to distribute funding, known as Title I, to schools that enroll students from low-income households to close the reading, writing, and math gaps of students at risk for poor educational outcomes. Title II provided funding for textbooks and preschool programs. Title III provided funding for special education services and bilingual education. Title IV provided $100 million of funding over five years for research and training opportunities. However, the legislation did not provide the intended results to increase educational opportunities for all students, as initially intended (Paul, 2016). As a result, ESEA was reauthorized as NCLB.

The NCLB implemented high-stakes accountability to reform education. High stakes testing was monitored as Adequate Yearly Progress (AYP) to monitor student proficiency to determine if schools made progress in closing achievement gaps. As with ESEA, however, there were issues with the implementation of NCLB. Schools that failed to meet AYP were sanctioned. After two consecutive years of not meeting AYP, school districts were required to offere parents school choice, an opportunity to transfer students to a more successful school. After the third consecutive year, students were offered free supplemental services or tutoring through their school district. After the fourth consecutive year, schools were subject to restructuring.

Another key concept is state assessments. Smulkaitis and Tweddle (2020) found many state assessments were not used solely for the purpose of measuring student achievement but also to gauge teacher and school performance. Also, little progress was made nationally to decrease racial achievement gaps. Schools with limited black students reported the students' data

separately, and the data was not calculated as part of the AYP scores (Harman et al., 2016). After a decade of implementation of NCLB, more than half of the nation's schools failed to meet the demands of AYP (Lavery, 2015).

ESEA was reauthorized as ESSA in 2015. As with prior federal legislation, ESSA requires high stakes testing in grades third through eighth in the areas of reading, math, and science. ESSA also requires accountability at the state level, with support provided to low performing schools (Richerme, 2020). Changes initiated with ESSA included the preparation of students for college and career, Common Core Standards, which aimed at reducing the amount of student dropout rates while increasing college enrollment or preparation for the workforce, and a focus on early learning programs. ESSA authorized pre-kindergarten development grant programs to foster collaboration to ensure access to high-quality early learning programs to improve outcomes for students considered at risk for poor educational outcomes (Paige & DeMitchell, 2017).

Pre-kindergarten is a key concept in this study, as pre-kindergarten program participation is the independent variable examined in this study. Pre-kindergarten programs in Georgia are state-funded educational programs for eligible four-year-old children to prepare students for success in kindergarten and later school years (Bright from the Start: Georgia Department of Early Care and Learning, 2021). The pre-kindergarten program in Georgia seeks to prepare students for later academic success by employing developmentally appropriate curriculum for students by:

1. Identifying health barriers that block learning
2. Addressing physical or mental disabilities that impact learning
3. Facilitating enthusiasm, curiosity, and persistence toward learning

4. Encouraging an understanding of self and others
5. Developing social and interpersonal skills of students
6. Developing communication skills of students
7. Facilitating early reading skills
8. Developing general knowledge about the world, things, places, and events

The Georgia Early Learning and Development Standards were implemented as a result of a two-year study and revision project to address student learning. The researchers sought to promote quality learning experiences for students and to create a set of developmentally appropriate, attainable standards that meet the individual and cultural needs of students (Bright from the Start: Georgia Department of Early Care and Learning, 2021). The standards were designed as a continuum of skills, behaviors, and concepts that addressed the early learning of students that aligned with the Head Start Child Outcomes Framework.

The purpose, outcomes, and curriculum objectives are vital components of the Bright from the Start's, Georgia's Department of Early Care and Learning, commitment to program quality. Therefore, the sites in the study are rated as quality programs, and discussion on program quality as a variable will not be considered during this study.

Early Reading Skills

Pre-kindergarten programs that promote early reading skills such as oral language, phonological awareness, print and word awareness, and alphabet knowledge better prepare students for early education, and their students are more effective readers (Knoche & Davis, 2017). Early reading skills are the skills, knowledge, and beliefs that are the developmental precursors to conventional forms of reading and considerable research indicates that before school entry, significant differences in reading ability are already present and require explicit

instruction to support students' reading skills acquisition (Kardaleska & Karovska-Ristovska, 2018).

Baroody and Diamond (2016) examined the relationship between pre-kindergarten reading environments, children's interest and engagement during reading, and reading skills of 167 students. They found pre-kindergarten environments are structured to support and promote early reading skills. Pre-kindergarten environments also impacted early reading skills, children's interest and engagement in reading, and student performance on early reading measures. Pre-kindergarten environments implement reading as a significant component of instructional time, potentially resulting in increased reading skills and opportunities to engage in reading activities.

Reading is defined as the ability to decode and comprehend written text (Squires, 2018). Solari et al., (2018) defines reading comprehension as the ability to make meaning from written and connected texts. Reading comprehension is an intentional and interactive process that requires the precise performance of several underlying subcomponent skills (Solari et al., 2018). Decoding occurs at the sound and word level, which requires phonological skills; whereas, reading comprehension occurs at the sentence level, requiring syntax, semantics, pragmatics, and morphology (Squires, 2018). For students with that struggle in reading, their decoding skills are more impaired than their comprehension skills (Choi et al., 2017). Researchers found that that early weakness in reading proficiency may potentially impact later school achievement (Jiang & Farquharson, 2018). Suggate et al., (2018) found that reading and language development remain stable through childhood, and language skills during infancy were predictive of reading comprehension at age 12. The researchers identified early reading skills, sometimes referred to as emergent reading skills, as alphabetic principle, phonological awareness, phonemic awareness, and concepts of print (Suggate et al., 2018). These early reading skills lead to the

development of vocabulary and reading comprehension, skills that are considered that criteria for proficiency on state assessment measures (Georgia Department of Education, 2017). Zhang et al. (2017) found opportunities such as preschool, provide exposure to early reading skills that have a lasting impact on student achievement.

The alphabetic principle, phonological awareness, phonemic awareness, and concepts of print are identified as early reading skills (Pinto et al., 2019). The alphabetic principle is the knowledge that letters have a specific sound (Schmidt-Naylor et al., 2017). The alphabetic principle includes letter naming knowledge and awareness of letter sounds. Letter naming knowledge is identified as a critical component of reading, which requires the computation of the size, shape, location, and orientation of the visual features of the letter to differentiate between similarly shaped letters (Wong et al., 2018). Letting naming knowledge further requires students to discriminate between lower and uppercase letters, resulting in the identification of 52 distinct letters, which leads to later development of phonemic awareness (Paige et al., 2018). However, students who struggle with letter naming knowledge upon entry in early grades are at risk for reading difficulties and require explicit instruction in early reading skills (Paige et al., 2018). Therefore, early, explicit instruction on the alphabetic principle has the potential to impact letter recognition fluency and early coding abilities.

Letter Sound Awareness

Letter sound awareness is also a critical early reading skill that is essential for a strong reading foundation (Sigmundsson et al., 2017) Letter sound awareness represents the building block of coding unfamiliar words in reading and impacts students' lexical vocabulary (Clemens et al., 2017). The ability to connect symbols with sounds is essential for the development of reading (Burns et al., 2018). For early readers, letter-sound awareness is a critical skill that

allows retrieval from memory, the sounds associated with printed alphabetic letters to combine with other letters-sounds that comprise a written word (Saez et al., 2016). Letter-sound awareness is defined as the ability to identify capital and lowercase letters and apply the corresponding sound (Sigmundsson et al., 2017).

A student's letter-sound awareness is learned over time, and the extent to which letter-sound retrieval becomes fluent is integral in the student's emerging decoding skills and possibly the first indicator of individual differences in early reading ability (Reutzel, 2015). In the United States, there are 26 capital letters and 26 corresponding lowercase letters. However, there are 44 sounds in the English language, including sound patterns such as long and short sounds, blends, diphthongs, and digraphs, which may present a challenge with decoding skills for struggling readers (Le Roux et al., 2017). Researchers have found that students that fail to develop basic skills by first grade are predictive of life-long poor reading skills (Wolf, 2016). The first step in teaching decoding skills is teaching students about individual letters and the sounds they represent (Wolf, 2016).

Ten years of reading data indicate gender differences in the reading ability of boys and girls (Sigmundsson et al., 2017). The gender gap in letter-sound knowledge observed in five to six-year-old children accumulates and may be one of the factors that account for the gender differences found on PISA, 2015 (Sigmundsson et al., 2018). The gender difference in reading skills, however, is present even in the early academic careers of students (Sigmundsson et al., 2017). Torppa et al. (2018) further found that as early as the first day of attendance in early education settings, gender differences in letter-sound knowledge is already present. Sigmundsson et al. (2017) found significant gender differences in letter-sound knowledge of five and six-year-old students, indicating an early emerging gap between boys and girls in letter-sound awareness.

Letter-sound awareness has a significant impact on reading and is a stronger predictor than a student's IQ and cognitive functioning (Foorman et al., 2017). The areas of the brain that process letters and corresponding sounds are very specific, such as line orientation (Nelson et al., 2017). Researchers have named this area of the brain, visual word form area (VWFA), and it processes words before semantics and phonology is attached to the symbol, which allows individuals to access parts of the brain that are reserved for recognizing certain symbols, shapes, and faces (Nelson et al., 2017). At a neurobiological level, researchers have suggested that boys are slower at developing phonological and visual information integration than girls (Price-Mohr & Price, 2017). At an environmental level, researchers suggest these gaps may be due to environmental differences that occur in early childhood between the girl and boy children (Pansu et al., 2016). Early identification and intervention, however, positively impacts later oral reading fluency and reading comprehension skills (Kingdon et al., 2016). Therefore, pre-kindergarten provides an opportunity to assess students' early alphabetic principle skills and provide early intervention.

Phonological Awareness

Phonological awareness is a foundational skill for learning to read (Adlof et al., 2018). Phonological awareness is the ability to identify and manipulate units of sound (Pinto et al., 2016). Phonological awareness includes the ability to identify rhyming words, segmentation, syllabication, deletion and addition of sounds, and manipulation of sounds (Sermier Dessemontet et al., 2017). Phonological awareness has been identified as a key predictor in future reading ability (Kardaleska & Karovska-Ristovska, 2018). Of early readers, students who demonstrated proficiency in phonological awareness were predicted to be proficient readers (Kardaleska & Karovska-Ristovska, 2018). In a study conducted by Einarsdottir et al. (2016), researchers found

students with strong phonological skills before grade, typically learned to read with greater proficiency than students with weaker phonological awareness skills. Furthermore, phonological awareness and letter-sound proficiency were predictive of reading comprehension (Petrová et al., 2020), which is demonstrative of reading proficiency and one of the reading skills assessed on state assessments. Students with strong phonological skills are better able to attend to word meaning and context. However, students that are weak in phonological skills must use their cognitive and attentive skills at the word level and, therefore, struggle with retaining meaning at the sentence level (Pinto et al., 2016). Therefore, phonological awareness instruction in early childhood settings can potentially improve later reading comprehension skills for students.

Phonemic Awareness

Phonemic awareness is a critical skill that later predicts word reading proficiency in early elementary grades (De Groot et al., 2017). Phonemic awareness is a skill that develops in the preschool years during the beginning stages of learning to read (Chen et al., 2018). Phonemic awareness is the ability to manipulate sounds within words (Pinto et al., 2016). Students access phonemic awareness through auditory processes, where students segment, identify initial sounds, delete sounds, and orally segment (Pinto et al., 2016). Phonemic awareness requires students to understand that words are created by blending phonemes and the ability of students' understanding of a difference in word meaning when phonemes are substituted or deleted (Le Roux et al., 2017). Furthermore, phonemic awareness helps beginning readers understand the alphabetic principle and prepares readers for print reading (Wade-Woolley, 2016).

De Groot et al. (2017) found that explicit instruction in phonemic awareness positively impacted students' reading skills. Phonemic awareness is a subset of phonological awareness that encompasses blending and segmenting skills (Edward & Taub, 2016). Blending is a measure

of phonological synthesis, which is the ability to form words by combining parts of words, which may aid in fluency and rapid automatic naming skills, which are skills that strong readers demonstrate (Edward & Taub, 2016). Students are typically taught three components of decoding with consonant-vowel-consonant, consonant-vowel-consonant silent e, and consonant-vowel-consonant-consonant pattern (Gellert & Elbro, 2018). Under phonemic awareness, segmentation is a skill that requires analysis. Therefore, early childhood teachers have a vital role in ensuring students acquire phonemic awareness, the bridge between letter recognition and early reading (Alhumsi, 2020).

Concept of Print

The concept of print is defined as the understanding of the organizational properties of print, which includes distinguishing print from pictures, distinguishing letters from words, the directionality of print, and that print has meaning (Dobbs-Oates et al., 2015). The concept of print was found to have a moderate relationship on later decoding and spelling and was a strong predictor of later reading comprehension (Dobbs-Oates et al., 2015). Students' understanding of the concept of print may be positively impacted through read alouds that explicitly embed print characteristics within the instructional activity (Terrell & Watson, 2018). Justice et al. (2017) found that early childhood educational settings can support the early literacy development of students. The researchers further found that early childhood educators that provide early and ongoing print-related support had lasting, positive impacts on students' later reading ability (Justice et al., 2017). Therefore, pre-kindergarten potentially provides an opportunity to provide early and ongoing support to students' reading skills and positively impacts later reading achievement.

Due to the attention placed on the reading proficiency of students in elementary grades, reading is used as a variable in the current study. I assumed the reading achievement of students who attended pre-kindergarten programs would differ from students who did not attend pre-kindergarten programs. Due to Georgia's use of reading achievement as a determinant of passing the third-grade Georgia Milestones state assessment, reading achievement data of third-grade students is used in this study.

Early Math Skills

Reading and math skills are considered the foundation for early learning (Koponen et al., 2018). Özcan and Dogan (2018) found that early math skills have a direct effect on reading comprehension and mathematical problem-solving. Early math skills proficiency of students has been determined to be a critical factor in high school graduation, attending college (Mattera & Morris, 2017) and later student achievement (Cirino et al., 2016; Doctoroff et al., 2016). Early math skills are identified as number sense, number representation, spatial sense, measurement, patterns, and problem-solving (Özcan & Dogan, 2018). Therefore, these skills are discussed in greater detail as factors impacting later math proficiency.

Number Sense

Number sense is defined as understanding the basic concept of numbers, which is demonstrated by the precise representation of small and estimation of large numbers, counting skills, and numerical operations (Siemann & Petermann, 2018). Woods et al. (2017) found that before entering kindergarten, some students develop an informal sense of number sense through play. Early school experiences, however, shape students' formal mathematics with the informal representations learned at earlier ages (Woods et al., 2017). It is during the formal instruction in early childhood settings that students learn to associate quantity and verbal representations of

numbers with symbolic representations of numbers in numeric and word form (Woods et al., 2017).

Number sense was found to also positively impact students' language use and mathematical development (Arias de Sanchez et al., 2018). Arias de Sanchez et al. (2018) found teacher's use of math talks facilitated children's development of mathematical principles and pre-kindergarten and early childhood educators used code-switching during math instruction for their students to bridge students' prior knowledge and student's language experiences to deepen students' number sense. Therefore, it is crucial to assess students' understanding of number sense to ensure a strong foundation in math and reading skills that are identified as indicators of student achievement.

Number Representation

Number representation is defined as a symbolic system used to represent numbers by linking a quantity with its associated number, which is then linked to a pre-existing, non-symbolic number system (Fanari et al., 2017). The ability to link concrete representations of numerals to its written numeral or symbol is a foundational skill that later impacts cardinality and foundational math skills (Sasanguie et al., 2016). Number representation is a component of early math skills that is an indicator of math proficiency in early elementary (Fischer et al., 2020). Therefore, student number representation provides a precursor to potential math achievement in later grades.

Spatial Awareness

Spatial awareness in math is defined as the understanding of object orientation (Lombardi et al., 2017). Characteristics of spatial awareness include mental rotations of an object, visualizing objects from different perspectives, object space substitution, and understanding how

objects are arranged in space in relation to other objects (Lombardi et al., 2017). Spatial ability has been linked to performance on math assessments. It was found that the spatial ability of pre-kindergarten children, irrespective of socioeconomic status, was associated with achievement in numbers and operations (Rutherford et al., 2018). Researchers further found that spatial awareness proficiency was predictive of performance on math tasks three years later (Rutherford et al., 2018). Lombardi et al. (2017) found that spatial awareness proficiency was a foundational mathematical skill, and its link to math achievement was evident as early as pre-kindergarten and early elementary grades. Therefore, early instructional in spatial awareness presents an additional opportunity to identify students early for possible math deficits that can potentially negatively impact later math achievement.

Measurement

Mathematical thinking is rooted in identifying, extending, and describing predictable sequences (Rittle-Johnson et al., 2019). Counting and arithmetic principles are examples of predictable patterns, such as counting by 1s, where each numerals' value increases by one, and the ability to use patterns is a foundational skill that supports later math development (Rittle-Johnson et al., 2019). Patterns focus on students' ability to notice and use predictable sequences (Clements & Sarama, 2018). Students' pattern skills start with simple AB patterns where items repeat in a sequence alternating between two objects, colors, or sizes (Rittle-Johnson et al., 2019). As students' pattern skills develop, students can grasp more challenging patterns such as ABB, ABBA, or AABB patterns that involve patterns consisting of three or more items within the pattern. By the completion of preschool, students can complete, duplicate, and extend patterns (Knaus, 2017). Students' repeating patterning skills at the end of pre-kindergarten was found to be predictive of fifth and sixth-grade math achievement in numeration, algebra, and

geometry (Rittle-Johnson et al., 2019). Therefore, students' access to pre-kindergarten opportunities provides students with fundamental math skills that have long-term implications.

The National Council of Teachers of Mathematics found that math problem-solving is a fundamental math skill that students have difficulty acquiring (Morin et al., 2017). Problem-solving is a higher-order thinking skill that is not easily acquired due to the cognitive demand placed on students (Demitra & Sarjoko, 2018). Furthermore, math problem-solving requires significant cognitive demand and reading and comprehension skills that students with math difficulties lack (Özcan & Dogan, 2018). However, researchers have found a correlation between number sense and later math achievement. Morin et al. (2017) found that number sense in pre-kindergarten was strongly correlated to problem-solving in later grades. Therefore, pre-kindergarten opportunities may lead to stronger achievement in math for some students.

Long-Term Impact of Prekindergarten

The research in this study examines the statistical difference in third-grade math and reading assessment scores between students who attended pre-kindergarten programs and students who did not attend pre-kindergarten programs. Literature related to studies that explicitly compared later reading and math proficiency of pre-kindergarten program participates and students who did not participate in pre-kindergarten programs were examined. In one study, Woodson (2017) found learning and knowledge acquisition of children is heavily dependent upon their early learning environments. Thomas et al. (2020) found students from lower socioeconomic status begin their school career with cognitive deficits that impact emergent reading skills, vocabulary, phonological awareness, and print knowledge. Also, students from lower socioeconomic status have vocabulary sizes that are roughly half of their counterparts with higher socioeconomic status (Pollard-Durodola et al., 2018). Students of low socioeconomic

backgrounds also have a 30% chance of grade retention, a 12% chance of out of school suspension, and a 21% chance of dropping out of school (Hines, 2017). Woodson (2017) also found the reading and math skills of entering kindergartners decreased as socioeconomic status decreased, with students of lower socioeconomic status having an average reading score in the bottom thirty-fourth percentile and students in higher socioeconomic status scoring in the top sixty-seventh percentile. With glaring disparities and achievement gaps that exist long before students enter formal school, there is a push for access to pre-kindergarten opportunities to positively impact students and decrease the achievement gap.

Pre-kindergarten was created with the sole purpose of addressing inequities and disparities in educational opportunities caused by poverty (Kotzin, 2017). President Johnson's "War on Poverty" led to federal legislation known as *The Economic Opportunity Act*, which helped create early learning opportunities. Numerous findings indicated that children born into poverty faced an enormous amount of failure before entering formal school, which negatively impacted their ability to learn (Evans et al., 2016). Additional research findings indicated that children born of lower socioeconomic status would be better prepared for formal school if opportunities were provided earlier to address their needs (Duncan et al., 2016). From these initiatives, pre-kindergarten was established in 1965 as a community-based summer program (Hines, 2017).

Bright from the Start: Georgia Department of Early Care and Learning connects Georgia families with childcare learning centers (Bright from the Start: Georgia Department of Early Care and Learning, 2021). One of the services, administering their Georgia Pre-K program, is vital to this study. Students that are four years of age by September 1 of the school year are eligible for enrollment in the pre-kindergarten program (Bright from the Start: Georgia

Department of Early Care and Learning, 2021). Participation in Georgia's pre-kindergarten program is voluntary for the public and private schools, which may lead to a shortage of availability of pre-kindergarten programs in some areas (Bright from the Start: Georgia Department of Early Care and Learning, 2021). In the pre-kindergarten class, students receive standards-based instruction related to the Georgia Early Learning and Development Standards that focus on five domains. Two of those domains: Communication, Language, and Literacy and Cognitive Development and General Knowledge provide context for understanding the long-term reading and math development of students and areas assessed on the National Assessment of Educational Progress (NAEP) and the high-stakes test, the Georgia Milestones End of Grade, which is discussed in greater detail later in the literature review.

Enrollment in pre-kindergarten programs has garnered much (Gong et al., 2016). During the last ten years, enrollment in pre-kindergarten programs in the United States has doubled, with over a million four-year-old children being served in state-funded pre-kindergarten programs (Johnson et al., 2016). With the increase in pre-kindergarten enrollment, there has also been an increase in funding for the program. Pre-kindergarten funding is comprised of state, local, and federal contributions, with 87% derived from state funding, 7 percent local funding, and five percent federal funding (Poppe et al., 2021). On average, states spent 2.8 billion dollars on preschool programs in 2005; however, a decade later, states spent roughly 6.3 billion dollars to serve pre-kindergarten programs (Poppe et al., 2021). Pre-kindergarten enrollment impacts financial and educational resources at the state, local, and federal levels. With significant resource allocation towards pre-kindergarten programs as a means of educational reform, there is a need to examine the differences between reading and math state assessment scores of students

who attended pre-kindergarten programs and students that did not attend pre-kindergarten programs.

Pre-kindergarten access has been long debated as an educational reform opportunity to support students by reducing inequality and increasing student achievement (McWalters, 2019). Access to pre-kindergarten opportunities has been lauded with closing opportunity gaps and provided short and long-term benefits (Valentino, 2018). Johnson et al. (2016) examined Tulsa's high-quality pre-kindergarten program and found variation in the letter recognition, spelling, and problem-solving skills of students who attended the pre-kindergarten program, with some students performing better than students who did not attend pre-kindergarten programs, while other students performed with less proficiency than students who did not attend pre-kindergarten programs. Hustedt et al. (2021) found positive, statistically significant impact on literacy and math skills for participants in New Mexico's pre-k program. Ansari et al. (2020) found pre-k graduates academically outperformed students who did not attend pre-kindergarten. Johanson et al. (2016) found interventions that targeted vocabulary, decoding, and reading comprehension in pre-kindergarten had a greater effect on students with high levels of language skills in preschools than students who entered preschool with lower levels of pre-kindergarten.

McCoy et al. (2017) found positive correlations between pre-kindergarten participation and language, literacy, and math skills. The researcher conducted a meta-analysis of 22 high-quality experimental and quasi-experimental studies conducted over the last fifty years, with the last study being conducted in 2016 and found that on average, participation in pre-kindergarten participation decreased student referrals to special education placement, retention, increased high school graduation rates, and pre-kindergarten participation also positively impacted language development, reading, and math skills, in addition to, self-regulation, motivation and

engagement, and persistence in learning which are precursors to positive academic trajectories (McCoy et al., 2017). Pre-kindergarten was also found to provide an opportunity to intervene and support struggling students. Mashburn et al. (2016) found that interventions used in pre-kindergarten programs have the potential to moderately impact children's literacy and language skills if pre-kindergarten programs are willing to make the substantial financial investment. In addition to the impact on language development, reading, and math schools, one longitudinal study found participants that were randomly selected to receive comprehensive pre-kindergarten had a 77% graduation rate, almost 20% higher than the control group, were less likely to be arrested for violent crimes, had increased employment rates, and were more likely to earn higher wages than the control group (Beekman & Ober, 2016).

Artz and Welsch (2016) found mixed results of pre-kindergarten participation and standardized test scores. Artz and Welsch (2016) found a significant impact on students' fourth-grade math standardized test scores, mainly for students at risk of poor educational outcomes, but found a limited impact on fourth-grade reading standardized test scores. Lipsey et al. (2018) found academic achievement attained in pre-kindergarten showed regression by third grade for students who attended pre-kindergarten when compared to participants who did not participate in the pre-kindergarten program. Abenavoli (2019) found that the cognitive abilities, academic knowledge, and social-emotional skills of pre-kindergarten participants faded-out as participants progressed through school. Han et al. (2020) found pre-kindergarten program participation was not a predictor of sustained academic achievement. The researchers found when students experienced high levels of pre-kindergarten quality and lower quality home learning environments the positive effects of pre-kindergarten were less likely to be sustained.

High-Stakes Testing

Educational reform measures have sought to decrease the achievement gap and ensure that each student had the same educational proficiency, irrespective of race, or socioeconomic status (Saultz et al., 2017). The NCLB Act of 2001 is a federal education reform aimed at decreasing the achievement gap (Myers, 2018). NCLB Act required the assessment of students in reading and math in grades 3 – 8 and once in high school to measure student proficiency and determine the effectiveness of teachers and school leaders and established adequate progress of public schools (Myers, 2018). Schools that fail to meet adequate progress face severe consequences (Myers, 2018). One such consequence is a loss of federal funding if schools fail to demonstrate proficiency of progress across racial and social-economic status, which is based on student achievement on high-stakes tests (Myers, 2018).

The ESSA replaced NCLB as the federal government educational policy (Saultz et al., 2017). Under the new legislation, the mandate of 100% student proficiency on high-stakes tests was removed, and more power was returned to the states for educational decisions (Saultz et al., 2017). However, the requirement of school accountability based on student performance on state tests remained intact (Saultz et al., 2017). In doing so, the practice of tracking students' performance in math and reading and holding schools responsible for students' low performance on state assessments ensures that high-stakes testing will remain as a vital component of school effectiveness measures, and therefore, a critical component of school reform efforts.

The 10th Amendment of the Constitution ensured that education was a state responsibility. However, states vary in their policies and practices governing education. Such policies govern pre-kindergarten access and enrollment, compulsory attendance, instructional standards, school funding, and student outcomes (Owings et al., 2017). The 2012 results of the

Program for International Student Assessment (PISA), which assesses the proficiency of tenth-grade students, placed the United States below the middle of the 65 nations assessed (Owings et al., 2017). However, students from Massachusetts ranked ninth in math and fourth in reading, with District of Columbia, Alabama, and Mississippi scoring below the national average of the countries assessed (Owings et al., 2017). The differences in policies and practices governing education at the state level may contribute to the differences in achievement in reading and math. Therefore, it is essential to understand the policies governing high-stakes testing and how high-stakes testing impacts student outcomes.

A test or assessment attempts to gain information regarding a sample of people or programs to make inferences about the participant's knowledge, characteristics, or propensities through the use of a systematic method (Baker et al., 2016). In elementary school settings, testing is an essential component of school accountability measures (Bae, 2018). As such, there are many safeguards and procedural tasks that are implemented to ensure the integrity of the assessment (Rutkowski & Wild, 2015). On state assessments, a sample of an assessment reflects the representation of a small portion of content and tasks that can be administered from the vast amount of content (Georgia Department of Education, 2017). Therefore, assessments used in schools generally reflect the content-specific goals found at each grade level. Of these assessments, reading and math have represented the most examined topics for school-aged students (Baker et al., 2016). In addition to content assessed, test composition, task or item design, and sample content and skills are dependent upon the test purpose and time constraints.

The reading test consists of 43 items, with a possibility of 55 points (Georgia Department of Education, 2017). Some items, such as constructed responses, which are short answer questions, have a possibility of earning two points. Selected responses, or multiple-choice items,

have a possibility of one point. Embedded within the reading test is a writing assessment that consists of a possible seven points, often on the narrative genre. Within the reading tests, five standards are assessed, although there are 42 standards that are taught within the school year (Georgia Department of Education, 2017). Many researchers have argued that high-stakes testing has led to an increase in teaching to the test (Gill et al., 2016). Braaten et al. (2017) found that due to the narrow scope of assessment items and broad curriculum objectives, some teachers teach specific objectives and topics that are directly tested. Braaten et al. (2017) also found that teachers also altered their instructional practices, such as eliminating differentiation, in favor of instructional practices that expose a higher number of students to tested items.

Research indicates that high-stakes reading and math assessments result in a narrow focus of state curriculum, specifically those that are high-impact for testing, teacher-centered instructions, and a decrease in student and teacher motivation (Ferguson-Patrick, 2018). Student performance on high-stakes tests is viewed as the sole indicator of school success, which, unfortunately, has negatively impacted students from culturally and linguistically diverse backgrounds (Zoch, 2017). Ferguson-Patrick (2018) also found that increased focus on high-stakes testing resulted in scripted pedagogies and curriculum offerings in schools in the United States and internationally, which detrimentally impacts the students that pre-kindergarten programs were designed to impact. In addition, a focus on high-stakes testing results in students lacking the necessary reading skills to function in society (Ferguson-Patrick, 2018).

High-stakes testing has also been shown to impact student achievement due to accountability measures, teacher self-efficacy, and curriculum influence (Gonzalez et al., 2017). High-stakes testing is a critical component of state educational accountability measures designed to hold teachers and schools accountable for student learning (Gonzalez et al., 2017). High stakes

testing accountability measures also extend to student outcomes in the form of student promotion, retention, and high school graduation policies. (González-Betancor & López-Puig, 2016). Students who fail to demonstrate proficiency on state-mandated tests are subjected to retesting and grade retention.

Student achievement, as measured by Georgia Milestones, assesses students in grades third, fourth, sixth, and seventh, in the areas of reading and math (Georgia Department of Education, 2017). The assessment in Georgia, the Georgia Milestones, consists of two assessments: The End of Grade and the End of Course. The Georgia Milestones End of Course assessment tests high school students in reading, math, history, and science content at the completion of a course such as Ninth Grade Literature. The assessment represents 20% of the student's final grade and may potentially impact a student's graduation from high school (Georgia Department of Education, 2017). In fifth and eighth grades, students are assessed in the areas of reading, math, science, and social studies. For fifth grade students, promotion to the sixth grade is contingent upon a passing score for reading and math (Georgia Department of Education, 2017). Students who fail either section must retest during a summer administration. For a student who does not pass the summer administration, they are ineligible for promotion to the next grade. Depending upon the district's policy, the student may be retained in the current grade or placed in the next grade level. While the implications of high stakes testing impact students across many grade levels, this study examines the long-term effects of pre-kindergarten participation on achievement of third-grade students in reading and math. For the purposes of this study, achievement is limited to the areas of reading and math of third-grade students, which include the Georgia Milestones End of Grade reading and math data for third-grade students in the subject school district.

Vandecandelaere et al. (2016) found that students who were retained in early grades would have benefitted from being continuously promoted. In addition, when confronting new subject material, students that repeated a grade scored lower than same-age students who were one grade higher on math assessments (Vandecandelaere, 2016). However, research has indicated an association between grade retention and increased dropout rates in secondary education (González-Betancor & López-Puig, 2016). Although high-stakes testing and accountability have increased the number of students retained in the elementary grades, there is no clear data that indicates grade retention benefits students in the long-term (Battistin & Schizzerotto, 2018). Therefore, the use of data from high-stakes testing may conflict with the aims of pre-kindergarten as an educational reform.

Results from high stakes testing are used as a component of teacher evaluation systems, thereby impacting instructional decisions and practices (Gonzalez et al., 2017). High-stakes testing impacts a teacher's self-efficacy due to increased time spent on test-taking skills, opposed to teaching, limited support for student remediation, and increased pressure to increase student test scores, which impact students' reading and math achievement (Gonzalez et al., 2017). Reading and math achievement is also impacted due to school shutdowns during test preparation and testing days (Gonzalez et al., 2017). Student schedules are also impacted by testing to allow for time spent on testing (Gonzalez et al., 2017). Besides, time spent on remediating student learning for achievement on high-stakes testing, there are increases in teacher workload and burnout, impacting student learning (Gonzalez et al., 2017). Therefore, any learning gains created from pre-kindergarten opportunities may be negated by testing practices in preparation for high-stakes testing.

Summary and Conclusions

This chapter provided an overview of historical and current research studies of early reading and math skills, the long-term impact of pre-kindergarten, and high stakes testing. The literature review also included a review of topics that are relevant to the study, such as pre-kindergarten funding and legislation. This chapter also discussed the impact of high-stakes testing, which is used as an accountability measure for schools and teachers. I also discussed research on pre-kindergarten participation and that long-term impact had yielded mixed results. One finding within the literature review indicates short term reading and math achievement gains for students who attend pre-kindergarten. However, an unknown finding is the long-term achievement of students who attend pre-kindergarten programs. Due to the mixed results of studies conducted on the long-term impact of pre-kindergarten, there is a need to investigate further if there is a long-term benefit of pre-kindergarten participation on reading and math scores of third-grade students.

In Chapter 3, the research design of the study is described and discussed. The topics covered include the sample population, data collection, and the data analysis plan. The threats to validity and ethical considerations are also described and discussed.

Chapter 3: Research Method

The literature review indicated that research about prekindergarten participation had yielded mixed results concerning its effect on the math and reading achievement of U.S. students. The purpose of this study was to examine the statistical difference, if any, in third-grade reading and math scores between students who attended prekindergarten programs and students who did not attend pre-kindergarten programs. In this chapter, I will justify the research design and approach and describe the population of interest, sample selection procedures, data collection, instrumentation operationalization of variables, and data analysis procedures. The chapter will conclude with a discussion of threats to validity and ethical considerations.

Setting

The setting for the study was in an urban district in Georgia. The district has 74 public elementary schools. The sample contained data for third-grade students who completed the Georgia Milestones reading and math assessments for the years 2016-2017 and 2017-2018. The sample contained of 3,867 students who attended a prekindergarten program and 12,439 students who did not attend a prekindergarten program.

Research Design and Rationale

For this study, I used a quantitative, causal-comparative ex post facto research design to address the following research question: What is the statistical difference in third-grade math and reading assessment scores between students who attended prekindergarten programs and students who did not attend prekindergarten programs? To answer this research question, the following hypotheses were tested:

H_0: There is no statistical difference in third-grade math and reading assessment scores between the students who attended prekindergarten programs and students who did not attend prekindergarten programs.

H_1: There is a statistical difference in third-grade math and in reading assessment scores between students who attended prekindergarten programs and students who did not attend prekindergarten programs.

In this study, the independent variable was students' participation in a prekindergarten program. Program participation was an independent variable that was not manipulated in this study. I examined the relationship between program participation in prekindergarten and third-grade reading and math scores on the Georgia Milestones standardized assessment. Participants were grouped into two categories: students who attended prekindergarten and students who did not attend prekindergarten. The dependent variables were Grade 3 students' Georgia Milestones reading and math scores. I chose a quantitative approach over qualitative or mixed-methods approaches because it is the most effective for for answering research questions that require measurement of variables (Creswell & Creswell, 2018).

Methodology

Participant Selection

The population for this study was third-grade students from the school years of 2016-2017 and 2017-2018 who were enrolled in 74 elementary schools in an urban district in Georgia. The sample contained data for third-grade students who completed the Georgia Milestones reading and math assessments for the years 2016-2017 and 2017-2018 (N = 16,533). The target population was comprised of 3,867 students who attended a prekindergarten program and 12,439 students who did not attend a prekindergarten program.

I included third-grade students who completed the Georgia Milestones reading and math assessments for the years 2016-2017 and 2017-2018 in the study. I included all students who took the Georgia Milestones reading and math assessment. SPSS Version 25 match files were run to merge data from reading and math variables based on student ID numbers resulting in 227 cases being removed for the data set (N = 16,306). Based on prekindergarten enrollment, the final sample size for students who attended a prekindergarten program was 3,867 and 12,439 for students who did not attend a prekindergarten program. Students who attended prekindergarten were grouped as the comparison group of prekindergarten participation. Students who did not attend a prekindergarten program were grouped as the comparison group of non-pre-kindergarten participation.

The calculation of the sample size for this study was contingent upon three factors. The first factor was power. The power of a statistical test measures the probability of a false rejection of the null hypothesis (Meyvis & Van Osselaer, 2018). For this study, I used a power of 80% to adequately reject a false null hypothesis. A power of 80% ensures that any conclusion from the statistical analysis is valid (Meyvis & Van Osselaer, 2018). The second factor was the effect size. Effect size measures estimate of the expected statistical difference between the variables in the study (Lachowicz et al., 2018). Effect sizes have three distinct categories: small effect, moderate effect, and large effect (Cohen, 1988). For this study, I used a medium effect size, partial eta-squared *(η2* = 0.06*)*, to provide evidence of a relationship between the independent and dependent variables without over restriction or leniency (Cohen, 1988). The significance of this study was set to .05 to ensure a 95% confidence level that any conclusions drawn from the statistical tests would be true. I used Slovin's (Sells, 2019) formula to calculate the minimum

sample size needed, where N = 16,306 with a confidence level of 95%. As a result, a minimum sample size of 376 was needed to have a confidence level of 95%.

Procedures for Recruitment, Participation, and Data Collection

The data set provided by the Georgia Department of Education included data regarding students' prekindergarten participation information and Georgia Milestones reading and math scores for third grade students during the 2016-2017 and 2017-2018 school years. The Georgia Department of Education maintains student records for audit and research and evaluation purposes. I contacted the Georgia Department of Education's Research Department and completed the data access form. I obtained permission from the Georgia Department of Education to access the data. The data set was emailed to me. The data were deidentified; each student was assigned a nonidentifiable numerical code by the Georgia Department of Education for matching purposes. I used the archival data to answer the research question, which centered on determining whether there were significant differences in third-grade reading and math scores between students who attended prekindergarten and students who did not attend prekindergarten in the district of study.

Archival Data

For this study, I did not collect primary source data. The Georgia Department of Education maintains the data for Georgia Milestones Assessment scores for all students in the state of Georgia. I obtained the reading and math data for third grade students from the 2016-2017 and 2017-2018 school years.

Instrumentation and Operationalization of Constructs

I collected archived data for the independent variable of third-grade reading and math scores from the Georgia Department of Education. The instrument was published in 2014 by the

Data Recognition Corporation and overseen by the Georgia Department of Education. The Georgia Milestones Assessment System development adheres to the for Educational and Psychological Testing protocol as established by the American Educational Research Association, the American Psychological Association, and the National Council on Measurement in Education (Georgia Department of Education, 2017). The standards have the purpose of promoting the sound and ethical use of tests and providing a basis for evaluation of the quality of testing practices and assurance of validity and reliability (Georgia Department of Education, 2017). According to the standards, validity is the degree to which evidence and theory support the interpretations of test scores based on the proposed use of the test. The Georgia Milestones Assessment has the purpose of measuring how well students mastered the state's content standards in reading, math, science, and social studies in Grades 3 through 8 as defined by the state legislature O.C.G.A. § 20-2-281 (Georgia Department of Education, 2017). The Georgia Milestones reading assessment measures students' reading and vocabulary and writing and language proficiency on key ideas and details, craft structure, integration of knowledge and ideas, vocabulary acquisition and use, writing, and conventions. For math, the Georgia Milestones measures student proficiency on operations and algebraic thinking, numbers and operations, measurement and data, and geometry. The assessment provides information on student academic achievement at the student, class, system, and state levels.

Committees of Georgia educators review alignment to the curriculum, suitability, and potential bias or sensitivity issues (Georgia Department of Education, 2017). Test items that do not meet the purpose of the test are reviewed or rejected based on the authority of the committee of Georgia Educators (Georgia Department of Education, 2017). Items that are accepted are field-tested to ensure that the test item functions as intended. The committee analyzes the field-

test items to detect potential biases (Georgia Department of Education, 2017). Accepted test items are banked for future test administrations (Georgia Department of Education, 2017). The test items are then developed into an actual test form for student assessments, with each test form using content and statistical data to ensure the same range of content, as well as the same statistical attributes (Georgia Department of Education, 2017). Multiple forms are used for the Georgia Milestones Assessment. The forms are equated, using statistical procedures, to ensure that all forms are of equal levels of difficulty (Georgia Department of Education, 2017), which addresses the validity of the assessment.

The Georgia Milestones Assessment System is considered a reliable assessment. Reliability refers to the stability and consistency of student test scores over time (Georgia Department of Education, 2017). The Georgia Milestones Assessment System uses the Cronbach's alpha reliability coefficient, which expresses the consistency of test scores as the ratio of true score variance to observed total score variance (Morera & Stokes, 2016). Based on Cronbach's alpha, the reliability indicators obtained from the Georgia Milestones assessment indicate that the scores reported to students provide a reliable measure of student performance (Georgia Department of Education, 2017). There are 10 third-grade reading assessment forms. Each form has 45 operational items and a possible 55 raw score points per form. The median reliability is .89. There is .88 minimum reliability and .91 maximum reliability. For math, there are 10 forms. Each form has 53 operational items and a possible 58 raw score points per form. The median reliability is .92. There is a minimum reliability of .91 and a .93 maximum reliability.

For this study, I calculated the operational variables as single item scores. The third-grade reading and math scores were measured as continuous variables. Third-grade reading scores have

a minimum score of 180 and a maximum value of 830 (Georgia Department of Education, 2017). The math scores have a minimum score of 290 and a maximum value of 705 for third grade (Georgia Department of Education, 2017), with students' scores having a value of anywhere between the minimum and maximum values. A reading score of 180 to 474 signifies a beginner learner, who is roughly two grade levels below proficiency. A reading score of 475 to 524 signifies a developing learner, who is roughly one grade level below proficiency. A reading score of 525 to 580 signifies a proficient learner. A score of 581 to 830 signifies a distinguished learner, who is performing above grade level.

In math, a score of 290 to 474 signifies a beginner learner, who is roughly two grade levels below proficiency. A score of 475 to 524 signifies a developing learner, who is roughly one grade level below proficiency. A score of 525 to 579 signifies a proficient learner and a score of 580 to 705 signifies a distinguished learner, who is performing above grade level.

Data Analysis Plan

I used the software program IBM SPSS version 25 for Windows for data analysis. SPSS version 25 match files was run to merge data from reading and math variables based on student ID numbers resulting in 227 cases being removed from the data set (n = 16,306) due to missing reading or math scores. Based on pre-kindergarten enrollment, the final sample size for students who attended a pre-kindergarten program was 3,867 and 12,439 for students who did not attend a pre-kindergarten program. I examined the research question: What is the statistical difference in third-grade math and reading assessment scores between students who attended pre-kindergarten programs and students who did not attend pre-kindergarten programs? To answer this research question, the following hypothesis was tested:

H_0: There is no statistical difference in third-grade math and reading assessment scores between the students who attended prekindergarten programs and students who did not attend prekindergarten programs.

H_1: There is a statistical difference in third-grade math and in reading assessment scores between students who attended prekindergarten programs and students who did not attend prekindergarten programs.

I used one-way MANOVA to determine any differences in the third-grade reading and math scores of students who participated the district's pre-kindergarten program and students who did not participate in the district's pre-kindergarten program. A one-way MANOVA is an appropriate statistical analysis when the objective of the study is to assess whether significant differences exist between two or more continuous dependent variables and one categorical independent variable. The study included two independent variables, which were categorical variables of students who participated in the pre-kindergarten program and students who did not participate in the pre-kindergarten program, measured at the continuous level.

I used a two-tailed test to identify whether there was a relationship between the variables in either direction (Scott-Baumann, 2008). A value of .05 is typically used to determine if the null hypothesis can be rejected. The confidence interval was set to 95% during data analysis to indicate strength of mean scores if a statistically significant difference was found between the variables.

Threats to Validity

Threats to validity refer to the statistical and research design issues that threaten the research and could lead the researcher to draw false conclusions regarding the data (Scott-Baumann, 2008). In any study, it is imperative that researchers consider threats to all forms of

validity to ensure meaningful results. Quantitative research, however, has been found to produce more validity and reliability when compared to other research methods (Creswell & Creswell, 2018).

External validity can be established when the results of the study are generalizable (Creswell & Creswell, 2018). Pre-kindergarten programs, teacher quality, and socioeconomic status may differ between schools. As a result, it makes it difficult to generalize the results to the population of third-grade students in the U.S. because there may be confounding variables that could influence the reading and math scores.

Internal validity is established when it is determined that the independent variable is the cause of the outcome. The study should be clear about alternative explanations for the results. In this study, parental involvement could be a factor that impacts internal validity. The participants in this study were assessed at the end of third grade on the Georgia reading and math assessment. The variation in scores between students who participated in pre-kindergarten programs and students who did not participate in pre-kindergarten programs could be attributed to parental involvement and the independent variable of pre-kindergarten participation. An additional limitation was that it was unknown whether students received additional instructional support beyond the school day, which may impact student assessment data. Variation in pre-kindergarten models and the quality of instruction was additional limitations within the study. It is unknown whether students attended private pre-kindergarten programs or pre-kindergarten programs not reported during enrollment. Student demographic information, including race/ethnicity and socio-economic status, is also unknown.

Construct validity allows a researcher to confirm the appropriateness of inferences made within a study (Creswell & Creswell, 2018). Construct validity refers to appropriate rationale

applied to the use of tests and interpretations of data (Strauss & Smith, 2009). The Georgia Milestones Assessment System development adheres to *for Educational and Psychological Testing* as established by the American Educational Research Association, the American Psychological Association, and the National Council on Measurement in Education (Georgia Department of Education, 2016). The standards have the purpose of promoting the sound and ethical use of tests and providing a basis for evaluating the quality of testing practices and ensuring validity and reliability (Georgia Department of Education, 2016). According to the standards, validity is the degree to which evidence and theory support the interpretations of test scores based on the proposed use of the test. To ensure validity, the Georgia Milestones Assessment has the purpose of measuring how well students mastered the state's content standards in reading, math, science, and social studies in grades three through eight as defined by the state legislature O.C.G.A. § 20-2-281 (Georgia Department of Education, 2017). The Georgia Milestones reading assessment measures students' reading, vocabulary, writing and language proficiency on key ideas and details, craft structure, integration of knowledge and ideas, vocabulary acquisition and use, writing, and conventions. For math, the Georgia Milestones measures student proficiency on operations and algebraic thinking, numbers and operations, measurement and data, and geometry. The assessment provides information on student academic achievement at the student, class, system, and state levels.

Ethical Procedures

Researchers using analysis of archival data have a responsibility to safeguard data (Artal & Rubenfeld, 2017). My study adhered to the ethical requirements of Walden University's Institutional Review Board (IRB). Permission to access archival data for Georgia Milestones third-grade reading and math scores was obtained from the Georgia Department of Education.

Walden University's IRB granted approval of my proposal (04-30-19-0672588) and then I was allowed to proceed with data collection. I was provided a data request form from the Georgia Department of Education and was provided access to the Georgia Milestones third-grade reading and math scores for the district of study. The data set contains information on student reading and math scores from the 2016-2017 and 2017-2018 school years. The Georgia Department of Education de-identified the participants. Participant names were replaced with numerical codes to protect the participants. The data will remain on file for five years, after which the data will be permanently deleted from the flash drive.

Summary

The nature of the study, research design, methodology, and data analysis plan was discussed in Chapter 3. In this quantitative study, I analyzed archival data to determine whether a statistical difference exists in third-grade math and reading assessment scores between students who attended pre-kindergarten programs and students who did not attend pre-kindergarten programs. This chapter included justification for using one-way MANOVA. This chapter also discussed the sampling strategy and instrumentation used to measure key variables. Threats to internal and external validity, as well as ethical considerations, were also discussed. The analysis and results of the study are presented in Chapter 4.

Chapter 4: Results

I designed this quantitative study to address the gap in practice regarding the lack of research on prekindergarten participation and its influence on third-grade reading and math achievement. I sought to answer the following research question: What is the statistical difference in third-grade math and reading assessment scores between students who attended pre-kindergarten programs and students who did not attend pre-kindergarten programs? The following hypotheses were tested:

H_0: There is no statistical difference in third-grade math and reading assessment scores between the students who attended prekindergarten programs and students who did not attend prekindergarten programs.

H_1: There is a statistical difference in third-grade math and in reading assessment scores between students who attended prekindergarten programs and students who did not attend prekindergarten programs.

The major sections of Chapter 4 will include a detailed description of the data collection, results, and summary. I describe the approval process and sampling method for collecting data. The results section will include descriptive statistics and statistical findings. The results will be illustrated through tables, when appropriate. This chapter will conclude with a summary of the research question and a transition to Chapter 5.

Data Collection

On April 19, 2019, I submitted the application for IRB approval. I received notification on July 16, 2019, from Walden University's IRB that I was approved to advance to the data collection stage. On July 16, 2019, I completed the data request form for the Georgia Department of Education seeking permission to use Georgia Milestones third-grade reading and math scores

for the district of study. The request indicated that data would be used for the purpose of my doctoral study. I received an electronic copy of the deidentified data set on July 19, 2019. I saved the data set to my personal computer and saved backup files on two flash drives, which are locked in a filing cabinet. I have sole access to the filing cabinet where the data are stored. The data were then deleted from my personal computer. After five years, the flash drives will be permanently destroyed.

The data set contained students' scores from the 2016–2017 and 2017–2018 Georgia Milestones reading and math assessments. The data set included data for 3,867 third-grade students who participated in prekindergarten and 12,439 third-grade students who did not participate in prekindergarten. The sampling procedure for the student data was nonprobability sampling. Nonprobability sampling is the recruitment of participants based on convenience and availability (Creswell & Creswell, 2018). The available data for prekindergarten program participation shared general trends with local and state data (Bright from the Start: Georgia Department of Early Care and Learning, 2021).

Data Analysis

The sample of 16,306 participants consisted of 3,867 third-grade students who participated in the prekindergarten program and 12,439 third-grade students who did not participate the prekindergarten program. The frequency analysis showed that 23.7% (n = 3,867) of the students participated in the prekindergarten program and 76.3% (n = 12,439) students did not participate in prekindergarten. Table 1 displays the frequency disaggregation for the independent variables by participation in prekindergarten and no prekindergarten categories and school year. Frequencies and percentages were calculated for Georgia Milestones reading and math scores.

Table 1

*Prekindergarten Enrollment by Year (*N *= 16,306)*

	Pre-K		No pre-K	
Year	*n*	%	*n*	%
2017	1,835	22	6,349	78
2018	2,032	25	6,090	75

Note. Pre-K = prekindergarten.

Table 2 displays the frequency of third grade Georgia Milestones reading scores, and Table 3 displays the frequency of third grade Georgia Milestones math scores. Table 2 illustrates that students who attended prekindergarten scored higher on the reading assessment (M = 500, SD = 54.624) than students who did not attend prekindergarten (M = 495.25, SD = 56.094). Students who attended prekindergarten scored higher on the math assessment (M = 506.19, SD = 48.191) than students who did not attend prekindergarten (M = 501.98, SD = 48.358).

Table 2

Descriptive Statistics for Reading and Math Scores of Participants

Score	Program code	*M*	*Mdn*	*SD*	*N*
Math	Pre-K	506.19	496.00	48.191	3867
	No pre-K	501.98	498.00	48.358	12439
	Total	502.98		48.350	16306
Reading	Pre-K	500.00	490.00	54.624	3867
	No pre-K	495.25	493.00	56.094	12439
	Total	496.38		55.784	16306

Note. Pre-K = prekindergarten.

Assumptions

The one-way MANOVA has 10 assumptions that must be considered when choosing this statistical analysis. The first three assumptions are related to study design and should be met

prior to conducting analysis (Pituch & Stevens, 2016). The remaining seven assumptions relate to how the data fit the one-way MANOVA model and how the data can be tested.

Assumption 1

Assumption 1 requires two or more dependent variables that are continuous. In the study, the dependent variables were continuous. Georgia Milestones' third-grade reading scores have a minimum score of 180 and a maximum score of 830 (Georgia Department of Education, 2017). The math scores have a minimum score of 290 and a maximum value of 705 for third grade (Georgia Department of Education, 2017), with students' scores having a value of anywhere between the minimum and maximum values.

Assumption 2

Assumption 2 requires one independent variable that consists of two or more categorical, independent groups. In my study, the hypothesis concerns one independent variable. The independent variable had two categorical groups: prekindergarten program participation and no prekindergarten program participation.

Assumption 3

Assumption 3 requires independence of observations, indicating no relationship between the observations in each group of the independent variable or between the groups. In my study, the groups were independent. Each participant belonged to either the prekindergarten program participation group or to the no prekindergarten program participation group.

Assumption 4

Assumption 4 requires there should be no univariate or multivariate outliers. The data in my study contain univariate outliers as indicated by a review of box plots. The data in my study also contain multivariate outliers as assessed by Mahalanobis distance (min: .001 max: 32.75, *M*

= 2.00, *SD* = 2.32). Due to the large sample size, it is unlikely that the univariate and multivariate outliers have a large influence on test results (see Lund Research LTD, 2018).

Assumption 5

Assumption 5 requires multivariate normality of data. I conducted a Shapiro-Wilk test to assess multivariate normality. The Shapiro-Wilk's test for normality produced scores below $p > .05$ for both categories of the independent variable. The scores from the Shapiro-Wilk's test suggest data were not normally distributed due to a sample greater than 50. However, MANOVA is robust enough to accommodate deviations from normality (O'Brien & Kaiser, 1985) so I conducted the test and reported the deviation from normality.

Assumption 6

Assumption 6 requires no multicollinearity of data. Multicollinearity occurs when two variables are highly correlated, resulting in the potential to adversely affect regression estimates (Daoud, 2017). To determine multicollinearity of data, I used Pearson Correlation coefficients between dependent variables. A Pearson *r* value >.9 indicates multicollinearity, which is a violation of MANOVA (Lund Research LTD, 2018). The analysis determined multicollinearity was not present ($r = .790$, $p = .001$).

Assumption 7

Assumption 7 requires a linear relationship between each pair of the dependent variables for each group of the independent variable. To assess the linear relationship, I examined the scatterplots for the dependent variables of Georgia Milestones third-grade reading and math scores and the relationship between pre-kindergarten program participation. The relationships followed a straight line indicating a linear relationship between the two dependent variables for each of the two groups of the independent variable.

Assumption 8

There should be an adequate sample size for the study. For the sample size, there should be as many cases in each group of the independent variable as there are number of dependent variables. For this study, there were two groups of the independent variable and two dependent variables of reading and math scores. At a minimum, a sample size of four is required. This study has 16,304 cases, which is sufficient to meet assumption eight.

Assumption 9

Assumption 9 requires homogeneity of variance-covariance matrices. To test for this assumption, I conducted Box's M test of equality of covariance matrices. There was no statistical significance of Box's M test of equality of covariance matrices ($p > .001$). The results indicate there was homogeneity of variance-covariance matrices, as assessed by Box's M test of equality of covariance matrices ($p = .077$). The results showed that the assumption was not violated.

Assumption 10

Assumption 10 requires equal variance between the groups of the independent variable (pre-kindergarten program participation and no pre-kindergarten program participation) for each dependent variable (third grade Georgia Milestone reading and math scores). To determine whether the data meets this assumption, I conducted Levene's Test of Equality of Error Variances. There was homogeneity of variances, as assessed by Levene's Test of Homogeneity of Variance ($p > .05$).

Analysis

I conducted a one-way multivariate analysis of variance to determine the statistical difference in third-grade math and reading scores between students who attended pre-kindergarten programs and students who did not attend a pre-kindergarten program. There was a

statistically significant difference between the pre-kindergarten participation on the combined dependent variables (F (2, 16303) = 12.25, p <.0005; Wilk's Λ = .998; partial η^2 = .002. As a result, I rejected the null hypothesis. I then conducted the tests of between-subjects effect. There was a statistically significant difference in reading exam scores between participants from the pre-kindergarten and no pre-kindergarten group, F (1, 16304) = 21.396, p < .001; partial η^2 = .001. There was a statistically significant difference in math exam scores between participants from the pre-kindergarten and no pre-kindergarten group, F (1, 16304) = 22.416, p < .001; partial η^2 = .001. The effect size for the analysis of reading scores was calculated by taking the difference between the two groups and dividing it by the standard deviation. The effect size for this analysis did not meet Cohen's (1998) threshold for a small effect size (d = .08). Using Cohen's d formula for effect sizes, the effect size for the analysis of math scores calculated by taking the difference between the two groups and dividing it by the standard deviation. The effect size for this analysis also did not meet Cohen's (1998) threshold for a small effect size for reading (d = .08) or math (d = .08).

Results

I determined that a one-way multivariate analysis of variance (MANOVA) was the appropriate statistical test to answer the research question and address the null hypothesis. A one-way MANOVA tests differences in the mean scores of multiple, continuous dependent variables by combining the two or more dependent variables to form a new dependent variable; this maximizes the differences between the groups of the independent variable, which allows the researcher to test for statistically significant differences between the groups (Lund Research LTD, 2018). In this study, the research question included two continuous dependent variables (test scores for Grade 3 math and reading) and a categorical independent variable (those who

enrolled in prekindergarten and those who did not), which is appropriate for a one-way MANOVA.

Summary

I conducted this one-way MANOVA to assess whether a statistical difference in third-grade reading and math assessment scores between students who attended prekindergarten programs and students who did not attended pre-kindergarten programs in the district. As part of the quantitative, causal-comparative ex post facto research, I used existing archival data from Georgia Milestones. Analysis of these data allowed me to answer the research question and accept or reject the null hypothesis.

The research question asked, What is the statistical difference in third-grade math and reading assessment scores between students who attended pre-kindergarten programs and students who did not attend pre-kindergarten programs? The findings indicated a statistical significant difference in third-grade reading and math assessment scores between the students who participated in pre-kindergarten programs when compared to students who did not participate in pre-kindergarten programs. I determined that participants who attended pre-kindergarten had a mean reading score of 500 and students who did not attend pre-kindergarten had a mean reading score of 495.25. Participants who attended pre-kindergarten had a mean math score of 506.19 and participants who did not attend pre-kindergarten had a mean math score of 501.98. As a result, I rejected the null hypothesis. The effect size was calculated by taking the difference between the two groups and dividing it by the standard deviation of one of the groups. Both reading and math scores had effect sizes below Cohen's d threshold for medium effect sizes ($p < 0.06$).

Chapter 5 will include discussion and interpretation of the findings, limitations, implications, and recommendations.

Chapter 5: Discussion, Conclusions, and Recommendations

The purpose of this study was to examine the statistical difference, if any, in third-grade reading and math scores between students who attended prekindergarten programs and students who did not attend prekindergarten programs. I conducted the study to examine whether third-grade math and reading assessment scores differed based on students' participation in the district's prekindergarten program. I used a quantitative, causal-comparative ex post facto research design to compare the reading and math achievement of students enrolled in third grade who attended a prekindergarten program with students who did not attend a prekindergarten program before entering kindergarten. To answer the research question, the following hypotheses were tested:

> H_0: There is no statistical difference in third-grade math and in third-grade reading assessment scores between the students who attended prekindergarten programs and students who did not attend pre-kindergarten programs.
>
> H_1: There is a statistical difference in third-grade math and in third-grade reading assessment scores between students who attended prekindergarten programs and students who did not attend prekindergarten programs.

The dependent variables of the study were the reading and math scores of third-grade students from 2017–2018. The one-way MANOVA analysis provided detailed information regarding the relationship between the independent variable (prekindergarten program participation) and the dependent variables (third-grade Georgia Milestones reading and math scores).

There was a statistically significant difference in the math and reading scores between third-grade students who attended pre-kindergarten and third-grade students who did not attend

pre-kindergarten in the district, F (2, 16303) = 12.25, p <.0005, Wilk's Λ = .998, partial η^2 = .002. Therefore, I rejected the null hypothesis for the research question. Due to statistical significance, each dependent variable was examined separately. The results for prekindergarten participation and reading F(1, 16304) = 21.40, p < .0005, partial η2 = .001, and prekindergarten program participation and math, F(1, 16304) = 22.42, p < .001, partial η2 = .001) were below Cohen's d threshold for medium effect sizes for reading (d =.*08*) or math (d =.08).

Interpretation of the Findings

Significant achievement gaps persist in reading and math for students in the United States (Reilly et al., 2018). Students who start their school year below grade level have achievement gaps that persist over time (Scammacca et al., 2020). This trend is concerning as data continue to indicate large achievement gaps that impact students' future college or career opportunities (Reilly et al., 2018).

Educational leaders have used prekindergarten programs as interventions to combat the achievement gap (Curenton et al., 2015). To investigate potential differences in third-grade reading and math scores of prekindergarten program participants and nonparticipants, I analyzed archival data from the Georgia Milestones third-grade reading and math data. I addressed the following research question: What is the statistical difference in third-grade math and reading assessment scores between students who attended pre-kindergarten programs and students who did not attend pre-kindergarten programs? To answer this question, I statistically analyzed the reading and math scores of third-grade students from the 2016-2017 and 2017–2018 school year in the district of study. This allowed me to examine the statistical difference, if any, between students who had attended prekindergarten programs and third-grade students who had not attended prekindergarten programs.

Findings showed a statistical difference in third-grade math and reading assessment scores between students who attended prekindergarten programs and students who did not attend prekindergarten programs, F (2, 16303) = 12.25, p <.0005, Wilk's Λ = .998, partial η^2 = .002. Therefore, I rejected the null hypothesis for the research question.

Each dependent variable was examined separately. The results for prekindergarten participation and reading $F(1, 16304) = 21.40$, $p < .0005$, partial $\eta 2 = .001$, and prekindergarten program participation and math, $F(1, 16304) = 22.42$, $p < .001$, partial $\eta 2 = .001$) were below Cohen's d effect size threshold for medium effect sizes for reading ($d = .08$) or math (d =.08). The results of this study have insufficient effect size to attribute the higher mean scores of reading and math scores to prekindergarten program participation.

I based the theoretical framework for this quantitative, causal-comparative ex post facto research on Bruner's (1977) social constructivism theory. Bruner focused on how young children construct new knowledge from previous experiences and ideas. Bruner also posited that young children learn best when surrounded by authentic, engaging experiences. According to Bruner, learning occurs as a process of discovery, in which the learner rearranges or transforms information to lead to new insights and new inquiry. When learners use background knowledge to learn new information, they are more likely to remember concepts and knowledge because the learner discovered the information on his or her own (Jiang & Perkins, 2013). In this theory, learning for students is a result of interaction with the world through exploration and manipulation of objects, active participation, problem-solving, and autonomy. The findings in this study suggest a link between social constructivism and early learning (Rachel et al., 2016). Woodson (2017) found that learning and knowledge acquisition of children is heavily dependent upon their early learning environments. Baroody and Diamond (2016) found that prekindergarten

environments are structured to support and promote early reading skills. Morin et al. (2017) found that number sense in prekindergarten was strongly correlated to problem-solving in later grades. Artz and Welsch (2016) study yielded mixed results. The researchers found pre-kindergarten participation resulted in a significant impact on fourth-grade standardized math scores. However, pre-kindergarten participation did not result in a significant impact on fourth-grade standardized reading test scores for their study (Artz & Welsch, 2016).

My study can be compared to similar studies of the reading and math performance on state assessment for students who participated in a prekindergarten program and students who did not participate in a prekindergarten program. Similar to Artz and Welsch (2016), the results of my study show little or no effect size for reading and math scores for prekindergarten program participants when compared to students who did not participate in a prekindergarten program. Lipsey et al. (2018) found that academic achievement attained in prekindergarten showed regression by third grade for students who attended prekindergarten when compared to participants who did not participate in the prekindergarten program. Abenavoli (2019) found that the cognitive abilities, academic knowledge, and social-emotional skills of prekindergarten participants faded out as participants progressed through school. Han et al. (2020) found that prekindergarten program participation was not a predictor of sustained academic achievement. The researchers found that when students experienced high levels of prekindergarten quality and lower quality home learning environments the positive effects of prekindergarten were less likely to be sustained (Han et al., 2020).

The reading and math scores in the district of study had effect sizes below Cohen's d threshold for medium effect sizes ($p < 0.06$). I interpret these findings to mean that prekindergarten experiences may not align with the cognitive demand needed for achievement on

state assessments. I also infer from the findings that the district of study's prekindergarten program and curriculum and instruction departments may be in need of policy to focus on reading and math instructional frameworks that sustain higher reading and math achievement in later grades.

Limitations of the Study

The limitations in this study include concerns regarding generalizability, validity, and research design. Causal-comparative ex post facto research designs have inherent limitations. In this study, I used a causal-comparative ex post facto research design to examine the relationship between prekindergarten program participation and third-grade reading and math scores after prekindergarten program participation had occurred. Unlike experimental research, I did not manipulate the variables, and I had no control over other variables that could impact the dependent variables. In my study, prekindergarten and no prekindergarten groups were assigned prior to the implementation of this study.. It is unknown if variations in prekindergarten program implementation may subsequently impact quality of instruction. It is also unknown whether students received additional instructional support beyond the school day, which may impact student assessment data. I was also unaware if students attended private prekindergarten programs or prekindergarten programs not reported during enrollment. Student demographic information, including race/ethnicity and socioeconomic status, is also unknown.

In this study, parental involvement could be a factor that impacts internal validity. Variation in scores between students who participated in prekindergarten programs and students who did not participate in prekindergarten programs could be attributed to parental involvement as opposed to the independent variable of prekindergarten participation.

Recommendations

The study revealed potential areas for future research. One recommendation would be to conduct a longitudinal study of students' performance from kindergarten to third grade. A longitudinal study would allow researchers to examine if achievement attained in prekindergarten showed regression in subsequent grades. Future researchers could expand on sample size and student demographics to examine if achievement differed among subgroup populations, which may be beneficial to future researchers in identifying confounding variables. This can be achieved by administering reading and math assessments in kindergarten, first, second, and third grades and examining individual student performance, which may be beneficial to future researchers in examining reading and math achievement fade-out in subsequent grades. This would be beneficial for teachers to have greater knowledge of student proficiency across grade bands. This would also be beneficial for future researchers examining prekindergarten achievement fade-out.

Further research on third-grade reading and math achievement is also recommended considering the results of my study. The Georgia Milestones Assessment assesses student reading and math through selected, constructed, and extended responses. Reading and math scores in this study had effect sizes below Cohen's d threshold for medium effect sizes ($p <$ 0.06). Additional qualitative research on prekindergarten program participation program quality and overall reading and math outcomes could support local and state leaders in aligning prekindergarten program outcomes with the needs of developing learners and guide future research.

Implications

The significant influence of pre-kindergarten program participation on third-grade reading and math achievement was studied for the potential to foster social change. As early as kindergarten, significant achievement gaps exist among students (Valentino, 2018). Students with achievement gaps continue to fall behind their peers as the achievement gap widens (Sanders et al., 2018). Achievement in third grade is seen as a pivotal, skills gained at this stage are necessary for learning content in subsequent grades (Hernandez, 2011, p. 4). As a result of the growing body of research on the effects of pre-kindergarten participation, the district of study has committed financial resources to the development of pre-kindergarten programs to ensure reading and math achievement outcomes for their students.

Reading and math scores had effect sizes below Cohen's *d* threshold for medium effect sizes ($p < 0.06$). Therefore, the data of this study has many implications. First, the data from this study adds to the body of growing knowledge regarding reading and math achievement of students who attend pre-kindergarten programs. My study also provides data that can promote positive social change by informing educators, parents, families, district leaders, and policy makers about the need for improvement of reading and math achievement of first through third-grade students in the district of study who attend pre-kindergarten. Because pre-kindergarten continues to be an intervention to address the achievement gap, it is imperative that the district of study continue to research additional factors that may contribute to the reading and math achievement of pre-kindergarten participants. As indicated in this study, participation in pre-kindergarten programs may be insufficient to ensure later reading and math achievement. The results of this study also contribute to positive change in the district of study by providing data

that can impact instructional practices to improve reading and math achievement of third-grade students who attend pre-kindergarten programs.

Conclusion

There is substantial research that indicates pre-kindergarten has the potential to benefit reading and math proficiency of students (Hustedt et al., 2021; McCoy et al. 2017). Research further indicates that without further intervention, the benefits fade out for students (Lipsey et al., 2018). Consistent with research, the results of this study indicate reading and math scores had effect sizes below Cohen's d threshold for medium effect sizes ($p < 0.06$). The results of this study provide data regarding the effects of prekindergarten participation on third reading and math achievement in the district of study. Pre-kindergarten programs have the potential to have a positive effect on the reading and math skills of students but current research, including this study, documents that reading and math achievement is not affected by pre-K attendance.

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