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A Comparative Analysis Of The Impact Of A Progressive Learning Curriculum on Student Achievement In A Northeastern Urban Public School District

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Abstract

This study used a non-experimental, one-group, pretest-posttest design to compare the scale scores on the 2017–2018 and 2018–2019 Mathematics sections of the New Jersey Student Learning Assessment (NJSLA). This investigation compared the 2018 New Jersey Student Learning Assessment in Mathematics (NJSLA-M) scale score means for sampled special education students in Grades 4 – 8 to the 2019 NJSLA-M scale score means for the same group. A Paired-samples *t*-Test was used to determine what statistical differences exist, if any, between the scores 2017–2018 results of the students prior to receiving instruction based on learning progressions and the 2018–2019 results after receiving instruction in learning progressions. Results show that there was no significant difference in the pretest and posttest mean scale scores suggesting that there was no significant impact of the learning progressions model of student performance after one year of exposure.

Dedication

This dissertation is dedicated to my mother, Miss Gladys McKinney. While you were here on earth you had nothing but high hopes and expectations for me in any of my endeavors. Once you became my guardian angel, I knew it was you pushing me and giving me the strength to persevere. She passed in August of 2002, and I pledged to keep my promise as her first child and only son to enter and finish college; that I will also complete my doctorate degree as per our many conversations and never stop striving to secure my leadership status. Thank you, Mom, your spiritual presence helped me to complete this task. Your words of praise and encouragement will never be forgotten. I hope I made you proud, I love you and I miss you.

This dedication also extends to my 3 loving and devoted children. Three beautiful healthy babies that have grown into 3 wise, ambitious college educated adults with extremely bright futures ahead of them. I am proud to be their father! This accomplishment is for each of them as they continue to aspire and fulfill their dreams. I expect to hear great things as each of you begin to start your different journeys in life. Remember to always, “Believe in Yourselves” and know, “The only person you are destined to become is the person you decide to be. (Ralph Waldo)

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I pray I made you all proud, and I am eternally grateful and blessed to have you all in my life

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CHAPTER I: INTRODUCTION

Introduction

Special education in the United States has been evolving and influenced by changing societal and philosophical beliefs changing from not accepting individuals with disabilities believing they should be segregated to protect them and society, to later being categorized, and finally educating, and included in society (D'Antonio, 2004; Winzer, 1993, 1998). Prior to the 1700s, individuals with disabilities were largely ignored or subjected to inhumane treatment, ridicule, isolation, and experiment. Through the mid-1960s and 1970s, individuals who had disabilities were forced into isolation and exclusion– until the passage of comprehensive disabilities legislation enacted to protect the rights of disabled individuals by legislating individualized services free of discrimination. In the United States, the governing federal law is the Individuals with Disabilities Education Act (IDEA). Under IDEA (2015), special education is defined as specially designed instruction, at no cost to parents, to meet the unique needs of a child with a disability (Section 1401 (29)).

Special Education is also referred to as Special Needs education. Special education includes the practice of educating students with disabilities in a way that addresses their individual differences and social, emotional, and learning needs.

Depending on classifications outlined in detail under federal law, students' may have one of 13 types of disabilities to qualify for special education. "To be eligible, the disability must adversely affect their educational performance" (Sec. 300.306). IDEA states that every child with a disability is entitled to a free and appropriate education or FAPE, in the least restricted environment or LRE; Where there must be a continuum of placements available, from self-contained to inclusion classrooms. Students classified as self-contained are taught in a much smaller controlled setting with a limited amount of students all having the same classification with similar disabilities. Resource rooms are used to pull students out of the general classroom setting periodically to meet the goals established in his/her IEPs; often times the pull out time is used to teach students life skills and behavior modification techniques. Students with mild to moderate disabilities may be mainstreamed and work in an "inclusion" classroom alongside their general education peers, in a regular classrooms with the assistance of an in-class support teacher that is there to work with all the students in the class, but specially with the classified student (Sec. 300.101).

Special education is often considered an umbrella term for many types of disabilities and can refer to gifted students as well but is generally used to specifically implicate instruction of students with disabilities. Students qualifying for special education services have needs that often require support that sometimes exceeds the services usually offered or received in the general education setting. This means that additional services, support, programs, specialized placements, or environments are supplied when necessary.

Recognizing Special Education

The nineteenth century ushered in rational philosophical beliefs about human dignity leading to changes in the treatment and societal perceptions of individuals with exceptionalities (Winzer, 1993). More protective and humanitarian attitudes relating to the welfare of individuals with disabilities took shape in the education arena. One of the early public uses of the term special education may have occurred in 1884 at a presentation by Alexander Graham Bell (Margret A. Winzer, 1998). "We always include the Canadian schools with the American schools," said Alexander Graham Bell, they being "about the same" and "employing the same methods in special education" (quoted by J. C. Gordon, ed., 1892a, p. 65). History and research also verify that the field of special education emerged long before the term was officially coined. Early efforts to provide specialized education are documented and provide the context for special education reform.

The first school in the United States designed to serve students with disabilities opened in 1817. The Connecticut Asylum for the Education and Instruction of Deaf and Dumb Persons was opened by Thomas Hopkins Gallaudet, (Christle, 2014) with the support of private funding from affluent and influential parents in the city of Connecticut, combined with publicly funded sources provided in the form of federal dollars and land grants. The school represented the first time that public funding was provided to educate students with disabilities. In 1830, the Perkins School for the Blind in Massachusetts opened when essential reading and arithmetic were considered to be beyond most people's reach without sight. Founded by Dr. John D. Fischer and directed by Dr. Samuel Gridley Howe, the school taught students to refocus their sense of touch to compensate for their lack of sight. Renamed the Perkins Institute for the Blind grew steadily through the nineteenth century until it became the world-renowned institution it is today. Established in 1848, the Massachusetts School for the Idiotic and Feeble-Minded opened as an experimental boarding school in South Boston for youths with intellectual deficiencies. Both Seguin and Howe believed in the importance of family and community. Each wanted their schools to prepare children with disabilities to live with the rest of society.

Although initial specialized instructional programs focused on individuals with sensory exceptionalities, special education eventually expanded to individuals with cognitive disabilities. Often, persons with mental disabilities were afforded accommodations.

Rather than educated. Intelligence testing, introduced in the early twentieth century, perpetuated biases associated with perceptions of "normality and aptitude"; in turn, encouraging a view of students with lower IQs as “feeble-minded," "mentally defective," "uneducable," and, in some extreme cases, as the root cause of societal problems. Such perceptions lead to the segregation of individuals with cognitive impairments through placement in specialized institutions and exclusion from compulsory education laws (Read & Walmsley, 2006; Yell et al., 1998).

During the late 1800s and early 1900s, excluding students with disabilities from public school education continued to be judicially supported. In 1893, the Massachusetts Supreme Court upheld a student's expulsion solely due to poor academic ability (Smith, 2004; Yell, Rogers, & Rogers, 1998). In April 1919, the Wisconsin Supreme Court denied education to a student with cerebral palsy because he “produced a depressing and nauseating effect upon the teachers and school children” (Smith, 2004).

Organizations designed to champion the rights of children with exceptionalities began to crop up during the early 1900s. In 1933, the Cuyahoga County Council for the Retarded Child was founded in Ohio. It was the first of many grassroots groups that would eventually come together to form the National Association for the Mentally Retarded (also known as the forerunner of today's Association for Retarded Citizens (ARC). The National Association for Retarded Citizens (NARC), established in 1950, would eventually work to get federal legislation and support for expanding teaching and research in the education of mentally retarded children, as well as to raise funding and support for people with disabilities for vocational rehabilitation, social security, and health programs.

The Brown v. Board of Education decision (1954) provided the precedence needed that all people, regardless of race, gender, or disability, have a right to public education.

Fundamentally, "separate educational facilities are inherently unequal" (Brown v. Board of Educ., 347 US 483, 1954). In the 1950s and 1960s, the Federal government began to validate practices for children with disabilities and their families. Until that time, about half of the estimated 8 million children with disabilities in the United States were being either inappropriately educated or entirely excluded from the public school setting (Pulliam & Van Patten, 2006).

Federal Legislation

Additional Federal acts that supported services to children with special needs were born during this era, such as the National Defense Education Act (NDEA), which marked the beginning of large-scale governmental involvement in education. NDEA was US federal legislation passed by Congress and signed into law by President Dwight D. Eisenhower on September 2, 1958, that provided funding to improve American schools and promote post-secondary education (Martin & Terman, 1996). The NDEA allowed more significant opportunities to develop support for the education of the disabled.

In November 1975, the Education for All Handicapped Children Act (currently known as the IDEA signed into law. (PL 94-142)

This law required that all children with disabilities have an individualized education program (IEP), a free and appropriate public education, and be serviced in the least restrictive environment; citing that "disability is a natural part of the human experience and in no way diminishes the right of individuals to participate in or contribute to society. Improving educational results for children with disabilities is an essential element of national policy. The goal is to ensure equality of opportunity, full participation, independent living, and economic self-sufficiency for individuals with disabilities" (IDEA, Section 1400 (c) (1). The Act focused on *access* to educational programs for students with disabilities; it did not address educational opportunity" (Yell & Drasgow, 1999). Although a growing number of students were receiving special education services, there was still a need to shift the focus from simply providing access to public education services toward providing “meaningful and measurable programs for all students with disabilities” (Hardman & Nagle, 2004).

The shift of trends in support of IDEA and, Every Student Succeeds Act (ESSA), placed an emphasis on reducing learning gaps and focused on more inclusive practices, such as involving students with disabilities in settings with their general education peers, IDEA, amended in 1997 then reauthorized in 2004, placed greater emphasis on accountability and results, shifting from an emphasis on procedural compliance (Shriner & Yell, 2005). Whereas integration was the prominent theme in decades past, today, public schools are held accountable for meaningful, formative, results-oriented, and individualized education for all students. Although legislation has been instrumental in protecting the rights of all students, the same NCLB/ESSA and IDEA laws are responsible for a “policy shift” by which students with disabilities, who have historically been exempt from high-stakes testing with limited expectations of accountability for performance are now included in state and local assessment, data, and accountability measures. As of 2020, there was no federal law that restricted states from imposing high-stakes testing and its consequences on individual students, including students with disabilities covered under IDEA or Section 504 of the Rehabilitation Act (Section 504). However, too often, the lack of access to accommodations and the opportunity to learn the academic content measured by the tests continues to result in significant performance gaps between students with disabilities and their non-disabled peers.

According to a Department of Education report, entitled the Condition of Education 2018, the number of students receiving special education in public schools is rising, with about 13% of all students receiving such instruction. The number of students aged 3 to 21 receiving special education services increased from 6.6 million to 6.7 million from the 2014–2015 school year to the 2015–2016 school year. Among those, 34% had specific learning disabilities. The growing special education population combined with the stringent accountability requirements dictates a need to anticipate the consequences of large-scale, high-stakes assessments for students with disabilities. The IDEA declared four goals or outcomes for our special education population, the first being equality of opportunity, then full participation, independent living, and economic self-sufficiency. All four speak to enhancing the quality of life of students with disabilities.

Academic Achievement

Academic achievement can and often is an indicator of a students' future quality of life. The National Center on Educational Outcomes (NCEO) established in 1990, was set up to work with state departments of education, national policy-making groups, and other stakeholders to facilitate and enrich the development and use of indicators of educational outcomes for students with disabilities. When collecting data, the center noted several states communicating challenges with defining what CCR or college to career readiness transition means to students with disabilities. Students with disabilities or special ed students, on average, start out with lower test scores than students in other at-risk subgroups, making it less likely that the subgroup will be able to reach grade-level proficiency standards in the time frame originally required (Sage journals, Eckes & Swango 2009). NAEP data from 2019 show the persistent achievement gap between general and special education students. According to the 2019 results for Reading, 39% of fourth-grade general education students were at or greater than proficiency, whereas 12% of fourth-grade students with disabilities scored at or greater than proficiency. In the same year, 37% of eighth-grade general education students were at or greater than proficiency, whereas 9% of eighth-grade students with disabilities scored at or greater than proficiency.

According to the 2019 results for Mathematics, 45% of fourth-grade general education students were at or greater than proficiency, whereas 17% of fourth-grade students with disabilities scored at or greater than proficiency. In the same year, 38% of eighth-grade general education students were at or greater than proficiency, whereas 9% of eighth-grade students with disabilities scored at or greater than proficiency.

New Jersey Context

New Jersey provides a representative example of the achievement differences between its students with special needs and those without or general education students. Information about the English Language Arts/Literacy and Mathematics sections of the *Partnership for Assessment of Readiness for College and Careers* (PARCC) assessment is presented below. The PARCC assessment has five performance levels, wherein levels 4 and 5 (met or exceeded expectations) indicate students who have demonstrated readiness for the next grade level/course and are on track for college and careers. The 2017–2018 NJ state summary reports revealed that the special education subgroup consistently maintained the same or nearly the same low proficient percentage (NJDOE, 2018).

- English Language Arts—21.6% of Students with Disabilities *(N=132,758*) either met or exceeded performance expectations; 63.9% of Students without Disabilities (*N=656,265*) either met or exceeded performance expectations.

• Mathematics, —17% of Students with Disabilities (*N=130,525*), either met or exceeded performance expectations; 50.5% of Students without Disabilities (*N=653,294*) either met or exceeded performance expectations. The score in Mathematics for Students with Disabilities students was 206.2.

The 2016–2017 NJ state summary reports revealed that the special education subgroup consistently maintained the same or nearly the same low proficient percentage annually

• English Language Arts—20.5% of Students with Disabilities (*N=125,303*) either met or exceeded performance expectations; 61.9% of Students without Disabilities (*N=616,654*) either met or exceeded performance expectations.

• Mathematics, —16.5% of Students with Disabilities (*N=123,032*), either met or exceeded performance expectations; 48.8% of Students without Disabilities (*N=614,406*) either met or exceeded performance expectations.

Statement of the Problem

State-level standardized test data often determine historic controversy around public school failure. Federally imposed policies and sanctions stemming from the Every Student Succeeds Act's regulations define annual academic progress for students. The Federal special education law, IDEA, requires states and school districts to include all students with disabilities in general state assessment programs, with appropriate accommodations and alternative assessments, but only if necessary, as indicated in their respective IEPs. States that adopt alternative assessments for students with the most significant cognitive disabilities must develop assessments that still align with the state's academic content standards. Consistent with 34 CFR 200.1(e), a state may not adopt modified academic achievement standards for any students with disabilities under section 602(3) of the Act.

Also, the Every Student Succeeds Act (ESSA) requires schools to disaggregate performance data into several subgroups, including special education students so that the public will know if schools are making adequate progress with historically low-performing groups of students. Subgroups are expected to maintain the same proficiency levels as their general education peers, an expectation that has proved to be problematic because special education students with cognitive impairments often start with lower average test scores than general education students (Eckes & Swando, 2009).

Several districts in New Jersey have implemented Mathematics Learning Progressions as an instructional intervention. The National Research Council (2001) defined Learning Progressions as “descriptions of the successively more sophisticated ways of thinking about a topic that can follow one another as children learn about and investigate a topic over a broad span of time” (pp. 165–166). The mathematics field commonly uses the term learning trajectories to describe a similar concept, so the terms may be used interchangeably throughout this paper. Little quantitative research from the field exists that explores the influence of learning progressions on elementary and middle school students mathematics achievement on state-mandated tests of mathematics.

Purpose of the Study

The purpose of this non-experimental, one-group pretest-posttest study was to explore the influence of mathematics learning progressions on students' academic achievement with disabilities as measured by their performance on 2018–2019 statewide assessments. An emerging field of study, Learning Progressions, supports the idea of moving children through a developmental progression of learning (Clements, 2002; Gravemeijer, 1999; Simon, 1995).

Theoretical Framework

Jean Piaget was an influential figure in the field of child development in the last century. Piaget's (1983) theories are almost always an obligatory reference to any other psychological development theory (see Muller et al., 2009; Scholnick, Nelson, Gelman, & Miller, et al., 1999). Jean Piaget's work on children's mental development, specifically with quantitative concepts, has sparked much attention within education. Piaget children's quantitative development work has provided mathematics educators with crucial insights into how children learn mathematical concepts and ideas.

Piaget reported that child development occurs through a continuous transformation of thought processes. Each stage consists of a period of months or years when certain development takes place. Although students are usually grouped by chronological age, their development levels may differ significantly (Weinert & Helmke, 1998) and the rate at which individual children pass through each stage. This difference may depend on maturity, experience, culture, and a child's ability (Papila & Olds, 1996).

Many of the research studies from mathematics education, developmental psychology, and cognitive development are influenced in some way by Piaget's ideas that children construct their concepts and that these ideas develop along learning paths. According to Piaget, "learning is the individual's construction and modification of structures for dealing successfully with the world" (Phillips & Soltis, 2009, p. 27). The same language is used to describe a modern-day special education teacher's role and purpose; someone whose job is to modify the general education curriculum into manageable chunks for the special education student. Differentiated Instruction builds upon these concepts also, offering varied instructional approaches and adapted curriculum suited to an individual's diverse needs (Tomlinson, 2014). Within this framework, teachers make instructional adjustments routinely to increase levels of equity, access, rigor, and engagement for all students (Bondie, 2018).

Tomlinson (2014) studied differentiated instruction to address different learners' needs and supports providing instruction that speaks to what and when students are ready to learn. An emerging field of study, Learning Progressions, supports the idea of moving children through a developmental progression of learning (Clements, 2002; Gravemeijer, 1999; Simon, 1995). According to National Research Council (2001), A learning progression is a sequenced set of objectives that students must master in route to mastering a more distant curricular aim. They consist of subskills and bodies of enabling knowledge. Learning trajectories to describe a similar concept so that the terms may be used interchangeably throughout this paper.

A focus on Learning Progressions for students with learning disabilities can change learning outcomes for these students and other students who struggle with mathematics, combined with a model that uses carefully designed assessments to produce useful and interpretable data for teachers. Learning progressions can be leveraged in mathematics education as a form of curriculum research that advances a linked understanding of students learning over time through the careful articulation of a curricular framework and progression, instructional sequence, assessments, and levels of sophistication in student learning (Fonger et al., 2018; Phillips & Soltis 2014). Under this broadened conceptualization, it recognized that there are variations in how the concept is understood.

The more current research of Clements and Sarama further supports that the early years are especially important when we talk about when a child should learn mathematics. Their research provides findings about the importance of mathematics for young children. The findings support a belief that far too often, teachers do not properly assess what young children know and can learn as it pertains to mathematics. Using research-based learning trajectories can be an effective resource for teaching and learning mathematics concepts. Although the construct of learning trajectories is less than a decade old, it stems from earlier theories of learning, teaching, and curriculum. Clements and Sarama support educators in “start[-ing] where the child is” (pg. 5). Learning trajectories can be identified as students following natural developmental paths in order to learn mathematics. As teachers become more familiar with these pathways and set-up activities and tasks based on these same pathways, they can build learning environments that are developmentally appropriate and more effective (Clements & Sarama 2014).). Learning trajectories are described in the literature; as a three-part construct: The first being - Goals: The big ideas. Goals should include the big ideas of mathematics-clusters of concepts and skills that are mathematically central and coherent, aligned with children’s thinking, and capable of producing future learning (e.g., counting and how to solve problems using counting). Next, we have Development Progressions: This is also referred to as pathways of learning. Developmental progression is a natural path children follow to achieve their goals. Learning trajectories provide simple labels and examples for each level of each developmental progression.

Lastly, Instructional Tasks: The paths of teaching. This final part consists of the teacher’s ability to match a set of tasks to each level of thinking in the developmental progression. This assigned task must be designed to help children learn the ideas and skills needed to achieve that level of thinking. "Teachers use these tasks to promote students' growth from one level to the next" (p. 7).

If fully accepted by educators, learning trajectories hold considerable promise for improving professional development and teaching mathematics. For instance, "the few teachers that led in-depth discussions in reform mathematics classrooms saw themselves not as moving through a curriculum, but as helping students move through levels of understanding."(pg.

5). Learning trajectories can bring about developmentally appropriate teaching and learning for all children.

The young state and complex nature of learning trajectories have further led to various interpretations and applications. Although most states have adopted their college and career readiness standards that serve to provide end goals for learning in each grade or course, the learning progressions studied within this paper emphasizes grade-level targets that build on each other.

New Jersey's current Student Learning Standards (NJSLS) provide less detail about how students move from learning expectation to expectation. Learning progressions can reduce this gap as students learn and develop increasing sophistication in their domain knowledge, thereby articulating the pathway and conceptual milestones that students need to reach toward achieving the target standards. The Learning Progression articulated in this study emphasizes a coherent, focused, and interconnected approach around two broad domains; whole number concepts and operations and rational number operations and concepts. Both domains support pre-algebraic concepts, specifically number sense and operations for whole numbers and fractions, for elementary and early middle school students. Although some research emphasizes the psychological/developmental progressions of learning over instructional sequences, for the purposes of this study, the learning progression describes learning in a specific mathematical domain through a series of smaller instructional topics. This sequence of topics designed to create mental processes to move children through developmental progressions of levels of thinking; created to support children's achievement of specific goals in a given mathematical domain (Clements, 2002; Gravemeijer, 1999; Simon, 1995). Learning progressions, used in this way, can inform the design of instruction and assessments that scaffolf learning, assist teachers in understanding how knowledge and skills build from elementary to advanced levels and suggest a learning trajectory that students may be expected to progress.

Research Question

The following overarching research question guided the study:

Is there a significant difference in mathematics achievement for students with disabilities in self-contained special education programs in Grades 4–8 after one year of mathematics learning progressions as measured by the New Jersey Student Learning Assessment in mathematics?

Hypotheses

The following hypotheses were made concerning this research study:

Null Hypothesis 1. There is no statistically significant difference in student achievement between the results of the Grade 4–8 2017–2018 and 2018–2019 NJSLA mathematics scale scores for students with disabilities who participated in Learning Progressions for one academic year.

Research Design

A non-experimental, one-group, pretest-posttest design will be used to compare the scale scores on the 2017–2018 and 2018–2019 Mathematics sections of the New Jersey Student Learning Assessment (NJSLA). A one-group, pre-test-post-test design is a non-experimental research design in which the same dependent variable is measured in one group of participants before (pretest) and after (posttest) treatment is administered. In this design, scores are measured before and after a treatment, then comparing the differences. While these designs can minimize problems related to having no control or comparison group, the disadvantage to the one-group design is the threat of internal validity associated with observing the same participants over time.

A Paired-samples *t*-Test will be used to determine what statistical differences exist between the scores 2017–2018 results of the students before receiving instruction based on learning progressions and the 2018–2019 results after receiving instruction in learning progressions.

Significance of the Study

Special education placements and IEPs must be individually tailored to meet student's unique educational needs and provide "meaningful educational benefits" (Yell & Katsiyannis, 2004, p.34). A student's IEP must specify the modifications and accommodations that the student requires to participate in state or district-wide assessments. Furthermore, IDEA requires states to include students with disabilities in performance goals, assessments, and the reporting of assessment results. This study provides additional literature about how learning progressions might influence learning for students with disabilities.

Limitations of the Study

In this study, a mechanism of randomization was not employed to assign groups. Samples were selected from already existing populations. The lack of random assignments is a limitation of the non-experimental study design. Statistical associations found within this study do not imply causality and give rise to alternative explanations for the apparent causal association. Fidelity of implementation is an additional limitation, as the researcher did not control implementation.

This study did not control for the additional variables relating to teacher affect, teacher quality, teachers’ knowledge of mathematics, or the varying levels of professional development related to mathematics instructional topics. Data of classroom instruction related specifically to the level of implementation for either treatment group was not available; Meaning, there are no formal observations, and while the district did not mandate a minimum or maximum level of implementation, the professional development providers and the district's existing classroom monitoring and accountability systems sought to support implementation in ways consistent with typical district practices.

While reading level may contribute to variances observed (Sconiers et al., 2002), this study did not control for reading level.

Control for additional variables relating to the impact of student intelligence beyond prior NJSLA mean score data revealing mathematics achievement was not employed in this study. According to Embretson (1995), general intelligence, described as the ability to think logically and systematically, is the best predictor of achievement across academic domains, including mathematics (e.g., Deary, et al. 2007; Jensen, 1998; Stevenson, et al. 1976; Taub, Floyd, Keith, & McGrew, 2008; Walberg, 1984). A 5-year prospective study of more than 70,000 students, Geary (2011) found that general intelligence, assessed at age 11 years, explained nearly 60% of the variation on national mathematics tests when assessed at age 16 years. (Kovas, et al.

2005), "these findings do not indicate educational interventions will not affect academic outcomes" (Geary, p. 1540).

It is noted by the National Research Council (NRC, 2004) that "it can take "up to three years for a curricular change to be reliably implemented in schools" (p. 61). Although each of the participating schools are required by the district to provide mathematics instruction a minimum of 5 days per week and for a minimum of 90 minutes each day, this study did not address actual 'seat time' extending beyond the 90-minute mandate.

Going back several years with the Spring 2019 New Jersey Student Learning Assessments in Mathematics and the English Language Arts, the New Jersey Department of Education cut the length and time of the tests and the item counts (i.e., test questions). For mathematics, this meant fewer units or testing blocks. In grades 3-5, the number of units was also cut from four to three, resulting in a reduction of testing time. For grades 6-8, the number of units was still three, but the time allotted for each unit was no longer 80-minutes but 60 minutes in testing time, or 20 minutes per unit. While the content assessed on the 2018 and 2019 NJSLA-M remained consistent, New Jersey's Department of Education decided on a name change of the assessment from the (PARCC) Partnership for the Assessment of Readiness for College and Careers to the (NJSLA) New Jersey Student Learning Assessment (NJDOE, 2019) thereby potentially impacting the ability to equate the scores from one year to the next vertically.

A final limitation of the study is the sample size which potentially impacts statistical power, type II error, and statistical significance (Cohen, 1988). Therefore, the study cannot stand alone as the source in the generalization for future findings.

Delimitations of the Study

The data were limited to this single school district. This study will focus specifically on self-contained special education students in Grades 4–8 having at least 1 year of prior state testing performance data and in self-contained settings as dictated by their Individualized Education Plans' conditions. By limiting this study to the grade levels where all students had taken the NJSLA in the prior year, the results will not be generalizable to all special needs students serviced in Grades K–12. This study's results reflect only NJSLA scores of students in Grades 4–8 from the 2017–2018 and 2018–2019 school years. Therefore, statistical analysis and conclusions will only discuss students within those grade levels.

Definition of Terms

Alternative Assessment: In education, "alternative assessment" is in direct contrast to what is known as "traditional testing," "traditional assessment," or "standardized assessment."

Cognitive Disability: Used to describe when a person has certain limitations in mental functioning and in skills such as communication, self-help, and social skills. These limitations typically impact the pace and complexity to which an individual learns.

Core Curriculum Content Standards (CCCS): The State Board of Education for NJ established curriculum goals for nine subject areas and adopted them in 1996 as the Core Curriculum Content Standards, which are revised every five years.

Differentiated Instruction: Adaptations of the content, process, or product of a learning objective to meet the needs of diverse learners based on the students' current level of performance and diagnose interests and learner profiles.

Disability: An impairment that substantially affects one or more major life activities

Evaluation: Procedures used to determine if a child has a disability and the nature and extent of the special education and related services that the child needs

Early Intervention: A process of providing interventions of appropriate intensity before problems become more severe. In most cases, this involves setting up prevention support systems (i.e., Tiers) to address the most common problems that have the highest impact on student outcomes.

Every Student Succeeds Act: The Act was signed into law on December 10, 2015, replacing the No Child Left Behind Act and includes provisions that will help to ensure success for students and schools (Advanced equity disadvantaged and high-need students; Requires that all students in the US be taught to high academic standards that will prepare them to succeed in college and careers; Requires that vital information is provided to educators, families, students, and communities through annual statewide assessments that measure students' progress toward those high standards)

Free Appropriated Public Education [FAPE]: Special education and related services provided in conformity with an IEP; these services are provided for “Free” or without charge, and meet standards of the State Department of Education All qualified persons with disabilities within the jurisdiction of a school district are entitled to a free appropriate public education. The ED

Section 504 regulation defines a person with a disability as any person who: fits the criteria set forth by legislation. IDEA In general, all school-age children who are individuals with disabilities as defined by Section 504 and IDEA are entitled to FAPE (IDEA Partnership, 2007).

High-Stakes Testing: In a nationwide effort to create standardized performance criteria, there has been an emphasis on testing data as the strict measurement of teacher and student success or failure (Volante & Sonia, 2010). These testing accountability systems, developed under No Child Left Behind (2001)…Not a definition

Individuals with Disabilities Education Act [IDEA]: first introduced as the Education for All Handicapped Children Act (P.L. 94-142) passed by Congress in 1975, directing every state to provide a free and appropriate education for all students with disabilities (Gallagher, 2000; Rothstein, 1995).

Inclusion: An educational setting in which students, classified with exceptionalities, receive specially designed instruction and support in the same setting as their typically performing peers.

Individualized Education Program [IEP]: The IEP, Individualized Education Program, is a written document developed for each public-school child who is eligible for special education. The IEP is created through a team effort and reviewed at least once a year. Before an IEP can be written, your child must be eligible for special education.

Inclusion: An educational setting in which students, classified with exceptionalities, receive specially designed instruction and support in the same setting as their typically performing peers.

Learning Progressions: A learning progression, defined as a carefully sequenced set of building blocks that students must learn en route to mastering a more distant curricular aim, consists of subskills and bodies of enabling knowledge. Clements & Sarama (2004) offered a definition specific to Learning Progressions as they apply to mathematics—Descriptions of children's thinking and learning in one particular mathematical domain, and a related conjectured route through a set of instructional tasks designed to move children through a developmental progression of thought, created with the intent of supporting children's achievement of specific goals in that mathematical domain (p. 286).

Least Restrictive Environment [LRE]: Legal requirement to educate children with disabilities in general education classrooms with children who are not disabled to the maximum extent possible.

Learning Trajectory: Specific paths or trajectories the learner experiences, consisting of 3 distinct parts. 1. A mathematic goal. 2. Levels of thinking, developmental sequence through which children learn skills/ topics; progressions followed naturally by learners and 3. Effective activities that help kids move from one level to the next or teaching. Supported by developmental research primarily because of child-centered approach to teaching mathematics. I was looking at how the mathematics concepts grows from within children.

No Child Left Behind [NCLB]: Sweeping federal legislation that included all children as being entitled to a thorough and efficient public education NCLB was replaced by the Every Student Succeeds Act in 2015.

National Defense Education Act [NDEA]: US federal legislation passed by Congress and signed into law on September 2, 1958, provided funding to improve American schools and to promote post-secondary education. The NDEA was considered a significant act of reform. It marked the beginning of large-scale involvement of the US federal government in education (Encyclopedia Britannica, August 26, 2018, T. Hunt)

PARCC Testing: The Partnership for Assessment of Readiness for College and Careers (PARCC) is a consortium of states and the District of Columbia working to create and deploy a standard set of K–12 assessments in mathematics and English (ISBE, 2009). The statewide assessment for ELA and mathematics were later renamed the New Jersey Student Learning Assessments for English Language Arts (NJSLA-ELA) and the New Jersey Student Learning Assessments for Mathematics (NJSLA – M).

Progress Monitoring: A process used to assess students' academic progress and evaluate the effectiveness of instruction. Progress monitoring tools should be brief and more frequently administered (i.e., in comparison to "universal screening tools").

Organization of the Dissertation

Chapter I provides a brief account of the evolution of special education in the United States, then exploring the current landscape of special education as it relates to public education and existing accountability measures for education to set the context for evidence-based academic interventions and approaches on the academic performance of special needs students.

Chapter II presents the historical and current landscape of special education as it relates to public education and existing accountability measures then explores the influence of interventions specific to mathematics trajectories and the impact on achievement as the driving force behind the research.

Chapter III explains the design and methodology of the study, a non-experimental pretest/posttest design. It speaks to a learning progression/intervention employed by a North

Jersey School District on its self-contained special education population in Grades 4–8. Chapter IV presents the results and findings of this study to address the problems posed in Chapter I. Chapter V discusses the major findings as related to the literature on learning progressions in mathematics and what implications for existing literature and recommendations for future study, concluding with a summary.

CHAPTER II: LITERATURE REVIEW

Introduction

This study explores the influence of mathematics learning progressions on students' academic achievement with disabilities as measured by their performance on 2018–2019 statewide assessments. An emerging field of study, Learning Progressions, supports the idea of moving children through a developmental progression of learning (Clements, 2002; Gravemeijer, 1999; Simon, 1995).

An emerging field of study, Learning Progressions, supports the idea of moving children through a developmental progression of learning (Clements, 2002; Gravemeijer, 1999; Simon, 1995). A literature search took place to obtain literature that (a) provides a historical context that unveils the evolution of special education in the United States, (b) explores the development of the large-scale governmental involvement in legislation that supports the rights of children with disabilities, (c) explores the current landscape of special education as it relates to public education and existing accountability measures for education, and (d) examines evidence-based academic interventions and approaches on the academic performance of special needs students.

History of Special Education in the United States

The history of special education within the United States spans merely forty-five years, beginning in 1975 with IDEA's passing (2004). Given the treatment of adults with disabilities in America before 1974, it may come as no surprise that children with disabilities were blocked from participating in public education. During the late 18th century into the 19th century, public opinion was largely to use as few resources as possible to care for these devalued members of society as this nation was forming (Torres, et al. 2017).

Exclusionary practices were often the norm in society until the 19th century, when European philosophers and physicians began making occasional attempts to provide education to children with disabilities (Fakhoury & Priebe, 2007). Neuhaus (2014) noted that as society changed its way of thinking, it began to apply rational thought when addressing citizens with disabilities.   In a report for UNICEF, Bengt Lindqvist (1993), the United Nations Special Rapporteur on Human Rights and Disability, provided the following challenge:

> A dominant problem in the disability field is the lack of access to education for both children and adults with disabilities. As education is a basic right for all, woven into the Universal Declaration of Human Rights and protected through various international conventions, this is a serious problem. Common in the literature, many countries find a dramatic difference in the educational opportunities provided for disabled children and those provided for non-disabled children. It will simply not be possible to realize the goal of Education for All if we do not achieve a complete change in the situation. (Education and Disability in Cross-Cultural Perspective, Susan J. Peters, 1993)

During mid-1900s citizens with disabilities became a valued topic of legislative discussion; likely occurring when Americans started gaining more knowledge and education about physical and mental impairments, coupled with social reform efforts such as the civil rights movement in support for oppressed and severely mistreated African Americans, Long before the existence of legislation like the Education for All Handicapped Children Act (EAHCA), the Individuals with Disabilities Education Act (IDEA), and the No Child left Behind Act (NCLB), school districts were not mandated to provide disabled students with access to education.

At a basic policy level, disability is perceived as an array of issues crossing health, education, social welfare, employment sectors... Therefore, policy development concerning educating individuals with disabilities has been complex and multifaceted. Initial efforts to deliver special education services and to develop specially designed instruction were focused on individuals with sensory disabilities. (Best, 1930; Winzer 1998). According to the literature, early practices that began to develop for individuals with sensory disabilities were somewhat successful overseas. As news began to spread outside of Europe, educators traveled to learn about these effective special education practices, implementing and expanding on them in their respective countries (Winzer, 1993). Thomas Gallaudet founded the first institution for the deaf in Hartford, Connecticut, after studying in Europe. Dr. John D. Fischer created the New England Asylum for the blind after studying overseas in Paris in 1829. Founded by Dr. John D. Fischer and directed by Dr. Samuel Gridley Howe, the school taught students to use their sense of touch to compensate for their lack of sight. This asylum was later renamed the Perkins School for the Blind (Fleischer & Zames, 2001; Winzer, 1993). While at Perkins, Samuel Howe successfully showed that Laura Bridgman, a deaf-blind student, could be educated. This groundbreaking work challenged the accepted beliefs that deaf-blind individuals could not learn and served as a forerunner for the ensuing accomplishments of Helen Keller and her teacher Anne Mansfield Sullivan (Osgood, 2005; Smith, 1998). The special education of individuals with cognitive disabilities began to occur due to these successful attempts at educating such individuals that would have otherwise been viewed and treated as uneducable.

Despite the accomplishments taking place at home and abroad, society was still very much influenced by negative stereotypes and perceptions and fears of individuals with disabilities. The mid-nineteenth century saw the growth of institutions and asylums for individuals with disabilities (Armstrong, 2002). Educating individuals with disabilities were not yet the focus in America. Institutions sought to deliver medical, vocational, custodial care, and moral and religious development (Giordano, 2007). These institutions were known as insane asylums that served as the vehicle that would ultimately separate, control, and 'mend' disabled individuals perceived as "defective" deviant and threatening (Armstrong, 2002; Humphries & Gordon, 1992; Winzer, 1998). It was thought that keeping individuals with disabilities in facilities with "similar" people and away from "normal citizens" was better for the health and safety of both groups. Jean-Marc-Gaspard Itard (Humphrey, 1962; Itard, 1801, 1962) developed a specially designed pedagogy that enhanced his subjects' language and cognitive development, showing that individuals that were once deemed uneducable could learn (Safford & Safford, 1996). Itard's break-through led to further discussions, resulting in Edouard Seguin's 19th-century publication, Moral Treatment of Idiots, which presented a set of specialized instructional principles, techniques, and devices, others with a pedagogical model for teaching individuals with cognitive disabilities (Giordano, 2007). The book memorialized the cornerstone ceremony and opening of the first school built solely for "idiots" in this country, in Syracuse, New York in 1884. This quote, "God has scattered among us, rare as the possessors of talent or genius, the idiot, the blind, the deaf-mute, to bind the talented to the incapable, the rich to the needy, all men to each other, by a tie of indissoluble solidarity" (p. 2) spoke to the state of mind assigned to people with disabilities in the United States during that time. "Yes, therein lies similar language inked in the preamble to our Constitution, but we all know that when that document was framed all men did not refer to 'all men'." Dr. Seguin also believed, "to see that stone, token of a new alliance between humanity and a class hitherto neglected, is the greatest joy of my life; for I, too, have labored for the poor idiot" (p. 2). At present, the field of special education has undergone significant changes. In the early 1970s, educators' views on learning difficulties manifested as either an issue resulting from the child's interaction with their environment or difficulties emanating from the child itself (Riddell & Brown, 1994). The former issue was acknowledged in the Warnock report (Department of Education and Science (DES), 1978) where policy developments in the 1980s and 1990s were rooted in this perception. According to Riddell and Brown (1994), "legislation abolished statutory categories of handicap, established the concept of special educational needs, and provided for assessment procedures and the drawing up of an official document stating the nature of the child's special needs and the measures proposed by the education authority to meet these needs" (p. 9).

Two important models support the definition of special educational needs; the medical model of disability and the social model of disability. Each one has several key beliefs that have significance, according to the literature. The Medical Model of Disability is explained in the literature as a problem directly caused by psychological and medical factors (Oliver, 1990). The medical model of disability focuses on the individual's limitations and ways to reduce those impairments or using adaptive technology to adapt them to society. This model holds that an individual's performance with special needs is associated with their medical situation. Hahn (1986) stated, "disabilities impose a presumption of biological or physiological inferiority upon disabled persons" (p. 89). The medical model of disability's main criticism is that it focuses on the situation, the symptoms, and the causes. The central argument from supporters of the medical viewpoint is that medicine is a health problem. Hence, it seeks to intervene and treat the individual and return them to a 'normal state, that is, able-bodied. The Social Model (Abberley, 1987; Oliver; 1990) proposed an alternative discourse that considers social interaction and challenges as a basic variable concerning disability. In the latter part of the last century, scholars such as Oliver (1990, 1996) Beresford (1994) and Middleton (1999) proposed an improved social model that directly criticizes the medical model.

Among advocates of disability rights who tend to subscribe to the social model instead, the medical model of disability is often cited as discriminatory and as the basis of an unintended social degradation and exclusion of disabled people. Resources are seen as excessively misdirected toward an almost-exclusively medical focus when those same resources could potentially be used toward things like universal design and societal inclusionary practices. In contrast, Middleton (1999) argued, "there is no rational basis for exclusion. Disabled children share the same right to be included as a child without impairment, and any segregated treatment should be justified with their short and long term well-being in mind" (p. 139). On a similar note, Oliver (1990) claimed that an unwillingness to accept children with special needs could be seen as a problem within society. A negative attitude toward people with special needs frequently prevents them from using their right to be involved in society. The social model of disability seeks to place responsibility for additional problems faced by disabled children in society. The social model, to has been criticized because of its insistence that disability can only be addressed through action to change society and does not recognize the real impact that people's impairments can have on their lives. Focusing just on the wider society may risk children's impairments being unrecognized or poorly understood so that children might not get the individual attention that might make their lives better.

Hammill (1990) identified multiple definitions that have been popular at some time during the brief history of learning disabilities, all of which refer to a specific learning disorder.

Table 1

Learning Disabilities

Organization	Definition
National Advisory Committee on Handicapped Children (NACHC, 1968)	Mentally retarded, hard of hearing, deaf, speech impaired, visually handicapped, serious emotionally disturbed, crippled, or other health impaired children who by reason thereof require special education (p. viii)
National Joint Committee on Learning Disabilities (NJCLD, 1990, 2014)	Learning disabilities is a general term that refers to a heterogeneous group of disorders manifested by significant difficulties in the acquisition and use of listening, speaking, reading, writing, reasoning, or mathematical abilities (online)
Association for Children with Learning Disabilities (ACLD, now Learning Disabilities Association [LDA]) (2019)	Learning disabilities are genetic and or neurobiological factors that alter brain functioning that affect one or more cognitive processes related to learning. Learning disabilities range in severity and may interfere with the acquisition and development of one or more of the following: oral language (e.g., listening, speaking, understanding); reading (e.g., phonetic knowledge, decoding, reading fluency, word recognition, and comprehension); written language (e.g., spelling, writing fluency, and written expression); and mathematics (e.g., number sense, computation, mathematics fact fluency, and problem solving) (online)
The American Association on Intellectual and Developmental Disabilities (AAIDD), formerly American Association on Mental Retardation (AAMR)	Intellectual disability is a disability characterized by significant limitations in intellectual functioning and adaptive behavior, which covers many everyday social and practical skills. This disability originates before the age of 18.
Interagency Committee on Learning Disabilities (ICLD, 1987)	Learning disabilities is a generic term that refers to a heterogeneous group of disorders manifested by significant difficulties in acquiring and using listening, speaking, reading, and writing. reasoning, or mathematical abilities, or of social skills. These disorders are intrinsic to the individual and presumed to be central nervous dysfunction (page 222).
IDEA (2004)	The term "specific learning disability" means a disorder in one or more of the basic psychological processes involved in understanding or in using language, spoken or written, which disorder may manifest itself in the imperfect ability to listen, think, speak, read, write, spell, or do mathematical calculations (Section 601(d). IDEA

The surveys conducted by Mercer and colleagues (1985;1990) indicated a trend toward increased implementation of the academic, exclusion, and discrepancy components recognized categories of exceptionalities. Many notable scholars (Algozzine, Braaten, Maheady, Sacca, O'Shea, et al. 1990; Kauffman, Nelson, & Polsgrove, et al. 1988; Jenkins, Pious, & Jewell, et. al. 1990; Liebermann, 1985, 1990; Stainback & Stainback, 1984) have taken part in recent debates and commentaries that have sought to question the present and future direction of special education in this country.

Included in IDEA under the lead definition of "child with a disability." To fully meet the definition, a child's educational performance must be adversely affected due to the disability.These are the 14 specific primary terms:

1. Autism: A developmental disorder of variable severity characterized by difficulty in social interaction along with difficulty communicating and restricted or repetitive patterns of thought and behavior and social interaction, generally evident before age three, adversely affects educational performance. The term autism may not apply if the child's academic performance is adversely affected mainly due to the child has an emotional disturbance, as defined in #5 below.

2. Deaf-Blindness: A [simultaneous] hearing and visual impairments, the combination of which causes such severe communication and other developmental and educational needs that they cannot be accommodated in special education programs solely for children with deafness or children with blindness.

Sec. 300.8 (c) - Individuals with Disabilities Education Act.

https://sites.ed.gov/idea/regs/b/a/300.8/c3. Deafness: A hearing disorder so severe that a child impaired in processing linguistic information through hearing, with or without amplification, adversely affects a child's educational performance.

4. Developmental Delay: is a delay in one or more of the following areas: physical development, cognitive development; communication; social or emotional development.

5. Emotional Disturbance: a disorder exhibiting one or more of the following characteristics over a long period and to a certain degree that adversely affects a child's educational performance:

(a) An inability to learn that cannot be explained by intellectual, sensory, or health factors.

(b) An inability to build or maintain satisfactory interpersonal relationships with peers and teachers.

Sec. 300.8 (c) - Individuals with Disabilities Education Act. https://sites.ed.gov/idea/regs/b/a/300.8/c(c) Unexplainable types of behavior or feelings under normal circumstances.

(d) Depression.

(e) A tendency to develop symptoms or display fears associated with personal or school related problems.

The term includes schizophrenia. The term does not apply to being socially maladjusted children unless it is determined that they have an emotional disturbance.

6. Hearing Impairment: A hearing, disorder permanent or fluctuating, that adversely affects a child's educational performance but is not included under the definition of "deafness."

7. Intellectual Disability: significantly sub-average general intellectual functioning, existing in harmony with shortages in adaptive behavior and manifested during the developmental period, that makes performing academically extremely challenging.

Editor's Note, February 2011: "Intellectual Disability" is a new term found in IDEA. Until October 2010, the law used the term "mental retardation." In October 2010, Rosa's Law was signed into law by President Obama. Rosa's Law changed the term to be used in the future to "intellectual disability." (S.2781 "Rosa's Law" 2010)

8. Multiple Disabilities: associated [simultaneous] impairments (such as mental retardation-blindness, mental retardation-orthopedic impairment), the combination of which causes such severe educational needs that they cannot be accommodated in a special education program solely for one of the impairments. The term does not include deaf-blindness.

9. Orthopedic Impairment: a severe orthopedic impairment that adversely affects a child's educational performance.

10. Other Health Impairment: limited strength, vitality, or alertness, including a heightened alertness to environmental stimuli, that results in limited alertness for the educational environment, that

(a) results from chronic health problems such as asthma, attention deficit disorder or attention deficit hyperactivity disorder, diabetes, epilepsy, a heart condition, hemophilia, lead poisoning, leukemia, nephritis, rheumatic fever, sickle cell anemia, and Tourette syndrome; and

adversely affects a child's educational performance.

11. Specific Learning Disability: a condition in one or more of the basic psychological processes involved in understanding or in using language, spoken or written, that may be

apparent in an imperfect ability to listen, think, speak, read, write, spell, or to do mathematical calculations. The term includes perceptual disabilities, brain injury, minimal brain dysfunction, dyslexia, and developmental aphasia. The term does not include learning problems that are primarily the result of visual, hearing, or motor disabilities; mental retardation; or emotional disturbance; or of environmental, cultural, or economic disadvantage.

12. Speech or Language Impairment: a communication disorder such as stuttering, impaired articulation, a language impairment, or a voice impairment that adversely affects a child's educational performance. Gilberg, Christopher, et al. 2004 "Co-existing disorders in ADHD-implications for diagnosis and intervention." 13(1),

13. Traumatic Brain Injury: can be identified as an acquired injury to the brain caused by an external physical force, resulting in total or partial functional disability or psychosocial impairment that adversely affects a child's educational performance. Traumatic Brain Injury: What About School? National Association of Special Education Teachers .... https://www.naset.org/index.php?id=exceptionalstudents2

14. Visual Impairment Including Blindness: vision that is impaired so severely that, even with correction, adversely affects a child's educational performance. The term includes both partial sight and blindness.

Large-Scale Governmental Legislation Supporting the Rights of Children with Disabilities

One of the most significant changes in the treatment of children with disabilities occurred when they were granted the right to be educated by the public school system. To fully understand the educational system's upward progression as it pertains to students with disabilities, one must look at the relevant legislation. The first major legislation aimed at improving students' success across the board was the Elementary and Secondary Education Act of 1965 (ESEA; P.L. 89-10), which emphasized that all students should have equal opportunities regardless of socioeconomic status. The act began to set federal standards and accountability within public education. ESEA laid the framework for early special education laws. The federal government acknowledges the inequality between students with disabilities and those without disabilities. Amendments to the act in 1966 (Public Law 89-750) provisioned for Title VI Aid to Handicapped Children.

The United States Congress enacted the Education of the Handicapped Act of 1970 (EHA; P.L.94-142) in 1975. This act made it mandatory for public schools accepting federal funds to provide equal access to education for children with physical and mental disabilities. For the first time, public schools were expected to evaluate children with disabilities and create an educational plan with parent input . The act was an amendment to Part B of the Education of the Handicapped Act enacted in 1966. The act also required that school districts provide administrative procedures so that parents of disabled children could exercise their rights and dispute decisions made about their children's education. Summary of S. 6 (94th): Education For All Handicapped .... https://www.govtrack.us/congress/bills/94/s6/summary the administrative efforts were exhausted, parents were then authorized to seek judicial review of the administration's decision.

(Individuals with Disabilities Education Act). https://_Disabilities_Education_ActPL 94-142) also mandated that disabled students be placed in the least restrictive environment, one that allows the maximum possible opportunity to interact with non-impaired students. Separate schooling may only occur when the nature or severity of the disability is such that instructional goals cannot be achieved in the regular classroom. Lastly, the law provided a due process clause that guarantees an impartial hearing to resolve conflicts between the parents of disabled children to the school system.

The law was passed to meet the following four goals:

- To ensure that special education services are available to children who need them
- To guarantee that decisions about services to students with disabilities are fair and appropriate.
- To establish specific management and auditing requirements for special education.
- To provide federal funds to help the states educate students with disabilities.

The EHA legislation's language was vague in that it did not outline or provide a road map on how to implement these progressive changes. It merely encouraged states to provide educational programs to children with disabilities while leaving the law's interpretation to the individual state (Martin, Martin, & Terman, 1996). Multiple court cases followed and continued to support special education even after the Education for all Handicapped Children Act in 1975.

As the idea of special education evolved into a movement, and like other movements of this era, it rode on the coattails of the civil rights movement and landmark supreme court cases as the notion of "separate but equal is not equal," became the foundation for legal actions brought by families of children with disabilities to guarantee that their children had the right to a free appropriate public education (FAPE). Brown vs. Board (1954) landmark case brought precedent to the issue that separate education was not equal under the law. This class action suit was brought about to challenge the school district's actions in providing educational services in separate schools for African American children. The Supreme Court decision was instrumental not only to African American students but also to special education as we know it today, especially to the inclusive education practice movement, which sought to educate students with disabilities in general education classrooms (Blanchett, et al. 2005: Morse, 2000; Salend, 2011). Separate facilities or other removal from the regular educational setting occurs only when the severity of the disability being addressed is such that education in regular classes using supplementary aids and services cannot be achieved safely or satisfactorily.

Section 504 of The Rehabilitation Act, approved in 1973, guarantees certain rights to people with disabilities. It was one of the first U.S. federal civil rights laws offering protection for people with disabilities. It set precedents for subsequent legislation for people with disabilities, including the Virginians with Disabilities act in 1985 and the Americans with Disabilities Act in 1990. Section 504 covers "any program or activity receiving federal financial assistance." If an organization receives federal support of any kind, even if the organization is not a federal or state organization, the organization must comply with Section 504. The law also pertains to any "local educational agency system of vocational education, or other school systems". As applied to K–12 schools, "the language broadly prohibits the denial of public education participation, or enjoyment of the benefits offered by public school programs because of a child's disability." Section 504 requires school districts to provide Free Appropriate Public Education (FAPE) to children with disabilities, in which within the general curriculum and standards for the grade level, an individualized program is crafted to assure for the maximum educational benefit to the student. Regardless of the child's disability, the school district must identify the child's educational needs and provide any regular or special education to satisfy the child's educational needs just as well as it does for the children without disabilities. This may be accomplished by developing an education plan for the child.

The Individuals with Disabilities Act of 1975 (IDEA), formerly Public Law 94- 142, brought about a keen awareness, to the maximum extent appropriate, that students with disabilities are to be educated with students who do not have a disability. Although the IDEA also applies to K-12 schools, it only protects the subset of children and youth who satisfy its definition for "child with a disability". The definition of disability under Section 504 is broader than that of the IDEA's definition, so some children who do not meet the IDEA definition of disability are eligible under Section 504. Section 504 of the Rehabilitation Act . https://en.wikipedia.org/wiki/Section_504 IDEA was reauthorized multiple times to ensure that students with disabilities had adequate public schools' access (Armstrong, 2002). The reauthorization of IDEA in 2004 aligned the statute with the requirements of the No Child Left Behind Act (NCLB). Two pillars operate within IDEA:

1. **Individualized Education Program (IEP)**

The IDEA guidelines require public schools to create an Individualized Education Program (IEP) for each student who is found to be eligible. The IEP describes the student's present levels of academic achievement and functional performance and how the student's disabilities affect or would affect the child's involvement in the general education curriculum. The IEP also specifies the services, accommodations, and modifications to be provided and how often it specifies accommodations and provides for the student.

2. **Free and Appropriate Public Education (FAPE)**

To provide FAPE, schools must provide students with an "education that emphasizes special education and related services designed to meet their unique needs and prepare them for further education, employment, and independent living" (Section 300.1(a)) The IDEA includes requirements that schools provide each disabled student an education that:

- is designed to meet the unique needs of that one student

- provides "access to the general curriculum to meet the challenging expectations established for all children"is provided under the Individualized Education Plan (IEP) as defined in 1414(d)(3)
- results in educational benefits to the child

Least Restrictive Environment (LRE)

Implementing IDEA requires that "to the maximum extent appropriate, children with disabilities are educated with children who are not disabled" (Sec. 300.114(b)). The regulations further state that "special classes, separate schooling or other removals of children with disabilities from regular educational environment occurs if the nature or severity of the disability is such that education in regular classes with the use of supplementary aids and services cannot be achieved satisfactorily" (Sec. 300.114(b)). Further, the guidelines for LRE involve (a) comparing the anticipated educational, behavioral, social, and self-concept outcomes of being taught in inclusive classrooms to the anticipated outcomes associated with special education classrooms; and (b) examining the impact of students with disabilities on the education of their general education peers and teachers; and considering the costs of educating students in inclusive classrooms and the effect of these costs on the district's resources for educating all students. "This requirement is met by providing personalized instruction and support services to permit the child to benefit educationally from the instruction..." (Bateman, 2008, p. 74).

Appropriate Evaluation

Evaluation is needed to provide students with appropriate help that helps them reach their goals set by the IEP team. Children become eligible to receive special education and related services through an evaluation process. The goal of IDEA's regulations for evaluation is to help minimize the number of misidentifications; to provide a variety of assessment tools and strategies; to prohibit the use of any single evaluation as the sole criterion of whether a student is placed in special education services; and to provide protection against evaluation measures that are racially or culturally discriminatory.

In assessing student outcomes, each state can develop alternate or modified assessments for students in special education programs, but benchmarks and progress must still be met on these tests that indicate Annual Yearly Progress (AYP). Also, these goals and assessments must be aligned similarly to students enrolled in general education. To make AYP, schools may additionally require that schools meet state standards of student retention in terms of dropout rates and graduation rates for their special education students.

Parent and Teacher Participation

Districts are required to include parents, teachers, and child study team members on each IEP team to determine goals, the Least Restrictive Environment LRE, and to discuss other important considerations for each student. Every member is expected to share their perspective in order for the team to have a clear picture and be able to fully access the students needs. The parent is made fully of aware of their rights and reassured the best interest of the child is the top priority.

Procedural Safeguards

Parents and teachers can challenge any decisions that they feel are inappropriate for the student. IDEA includes a set of procedural safeguards designed to protect the rights of children with disabilities and their families and to ensure that children with disabilities receive a FAPE.

According to the National Center for Education Statistics (2020), the number of students aged 3 to 21 who received special education services under IDEA in 2017–2018 was 7 million, or 14% of all public-school students.

Enacted in 1975, IDEA, formerly known as the Education for All Handicapped Children Act, mandates a free public - school education for eligible students aged 3 to 21. Eligible students are those identified and evaluated by a team of professionals as having a disability that adversely affects academic performance and needs special education services. Data collection to monitor compliance with IDEA began in 1976.

From the school year 2000–2001 to 2017–2018, the number of students aged 3 to 21 receiving disabilitis services under the Individuals with Disabilities Education Act (IDEA) increased from 6.0 million, or 13% of all public school students, to 7.0 million, or 14%. (Miller, Ellen, et al.)

During the 2017–18 school year, a higher percentage of students aged 3 to 21 receiving special education services under IDEA for specific learning disorders in one or more of the basic psychological processes involved in understanding or using language, spoken or written, that may present itself in experiencing difficulty listening, thinking, speaking, reading, writing, spelling, or doing mathematical calculations. (Nces.ed.gov.) In 2017–2018, almost 34% of all students who received special education services had specific learning disabilities. 19% had speech or language impairments, and 14% had other health impairments Students with autism, developmental delays accounted for between 5% and 10% of the students serviced under IDEA legislation. Students with multiple disabilities, such as hearing impairments, orthopedic impairments, visual impairments, traumatic brain injuries, and deaf-blindness accounted for 2% or less of those served under IDEA. Loprest, P. (2012). Disability and the Education System. *The Future of Children, 22*(1), 97-122.

The Current Landscape of Special Education and Accountability

Many New Jersey school districts have been developing Response to Intervention models (RTI). RTI is an identification system with a broader approach to adapting instruction to meet students' needs who are having problems learning the general curriculum. The process meets the students academically and provides needed services before they are classified or identified as special education students. Current federal education policy under ESSA mandates; students with disabilities participate in large-scale assessments and must be included in schools' scores towards adequate yearly progress. Students with significant cognitive disabilities may with determined guidelines participate in an alternate assessment with alternate achievement standards. However, Because most research with this population has focused on non-academic life skills, In the literature/research little exist to assist with teaching and assessing skills that are linked to grade-level content. One major challenge to developing research and practice in grade-linked academic content for students with significant cognitive disabilities is the absence of a clear conceptual framework. The reauthorization of the 1965 Elementary and Secondary Education Act, entitled the No Child Left Behind Act of 2001 (NCLB), required states to establish rigorous standards; to implement assessments that measure students' performance against those standards; and to hold schools accountable for achievement in reading, mathematics, and science.

The Every Student Succeeds Act (ESSA) was signed into law by President Barack Obama on December 10, 2015. The sweeping legislation replaced and updated the No Child Left Behind Act (NCLB). Like NCLB, ESSA reauthorized the Elementary and Secondary Act of 1965 as it pertains to students with disabilities and that is to provide them with a quality education, and to close educational achievement gaps.

ESSA took effect for the 2017-2018 school year with authorization through the 2020 - 2021 school year. Title I of ESSA permits states to develop Alternate Academic Achievement Standards (AAS) for students with the most significant cognitive disabilities. As reported by the National Council on Disability (2018), the

> AAS must be aligned to the state's challenging academic content state standards, promote access to the general education curriculum, and reflect the professional judgment of the highest possible standards achievable. Importantly, AAS must align to ensure students are "on track to pursue" postsecondary education or competitive integrated employment. The law does not permit states to develop any alternate or modified achievement standards for students with disabilities other than AAS. (p. 19)

Further, states must ensure that students with disabilities, as defined by IDEA or Section 504, "taking the general assessment must be provided appropriate accommodations, which may include the use of assistive technology, "necessary to measure the academic achievement." (p. 19) State-designed assessments should also be developed, incorporating principles of universal design for learning (UDL) to the extent practicable.

> The law requires the results of students to be reported by student subgroups (disaggregated) at the state, district, and school levels including a subgroup for students with disabilities. States must continue to test and report disaggregated assessment data on no less than 95 percent of all students in each student subgroup: low-income, race/ ethnicity, disability, EL, and any other subgroup established by the state. (p. 20)

The law requires states to adhere to a 1 percent student participation cap at the state level for each required subject. This new statutory cap exceeds the previous 1% rule under NCLB, which capped the counting of proficient scores. Under the new cap, states must ensure that they do not test students on the AA-AAS more than 1 percent of all tested students by subject. Districts do have flexibility if they need to exceed the 1 percent participation cap. (p. 20)

Special Education and Evidence-Based Academic Interventions and Approaches

Because the study of special education is fairly young, there is no coherent, most effective approach to raising student achievement evident in the literature. Present policy and instructional practice are embedded in special education's past. The professional past serves as a prerequisite for current and future practice. Even though children with exceptionalities have always existed, special education programs are a relatively recent development.

Principals and teachers must find the supplemental services best suited to the needs of the student. The knowledge and skills of teachers, the appropriate use of behavioral interventions, and an appropriately designed curriculum are all fundamental to students with disabilities. The question of interventions and their effectiveness can only be addressed by looking closely at our past. Special educators are aware of the need to use evidence-based academic interventions in their classrooms but are faced with scarce resources. How can these educators find out about best practices and read reviews or summaries of recent studies? There is no rigorous and comprehensive database to support educators (Freeman & Sugai, 2013). "The body of educational research in special education is extremely varied in both methodology and quality, often leaving special education teachers with the very difficult task of identifying and evaluating (evidence-based practices) without clear criteria" (p. 6).

The success of implementing some of the educational services, such as modifications, adaptations, and accommodations to the curriculum and activities, is rooted in the teachers' ability to engage effective instructional strategies and students and the parents' acceptance and agreement of the educational plans for the students, along with the administration's support, including resources, surrounding this educational initiative. A large portion in meeting their challenge, teachers, and staff, including principals, are concerned about the mandates and standards imposed by State and Federal government, as well as the pressures surrounding inadequate resources, parent concerns, and the reality of limitations on materials and human resources remains a factor (Collins & White, 2001).

Researchers show that students with disabilities require more education attention than their general education counterparts (Baxter, Woodward, Voorhies, & Wong, 2002). Mathematics learning disabilities have received increased attention from educational researchers, evaluators, and teachers. Once ignored or thought to be uncommon, researchers now agree that about 6% of students are affected by mathematics learning disabilities (Fleischner & Manheimer, 1997). Mathematics has always proved to be a challenging subject, even for general education students, in the United States.

America has a smaller-than-average share of top-performing mathematics students, and scores have essentially been flat for two decades, according to a study in USA TODAY, February 28, 2020 Erin Richards). In a UCLA 2018 Newsroom report, Mr. Stuart Wolpert quoted Professor James Stigler a developmental and cognitive psychology professor for the university, “based on placement tests, a staggering 60 percent of U.S. students who enter community colleges are not qualified to take a college mathematics course, even though they have graduated high school”, Stigler said, " Many of them never graduate for that reason," he added. On the National Assessment of Educational Progress (NAEP), only 6% of the students with disabilities who participated in the mathematics component of NAEP scored at or greater than the proficiency level (National Center for Education Statistics, 2004).

In their longitudinal study of early mathematics trajectories and their impact of low income students, Rittle-Johnson, et al. (2016) evaluated 517 low-income American children from the state of Tennessee aged 4 to 11(Rittle-Johnson, B. Fyfe, Hofer, & Farran (2016)). Their model included a broad range of mathematics topics and potential pathways ranging from preschool to middle-school mathematics achievement. A study reviewed in the research aims to clarify specific early mathematics knowledge that is predictive of later mathematics achievement for children from low-income backgrounds. (Jisu Han, Stacey Neuharth-Pritchett, Predicting Students’ Mathematics Achievement Through Elementary and Middle School) Proposed was an Early Math Trajectories model of specific early mathematics knowledge that influences later mathematics achievement, integrating a broader range of mathematics topics than has been considered in other studies. Unfortunately, as a result of societal factors, such as poverty, children from low-income families enter school with weaker mathematics knowledge than children from more advantaged backgrounds, and this weak early mathematics knowledge at school entry helps explain their weak mathematics knowledge later in elementary school (Jordan et al., 2009).

Early mathematics knowledge can be found beyond numeracy knowledge, though there is less consensus on which additional mathematics topics are important. Commonly highlighted topics are shape, patterning, and measurement knowledge (National Research Council, 2009).

Researchers considered patterning, as there is longitudinal evidence for its importance in mathematics, as well as shape knowledge given widespread beliefs about its importance. They did not include measurement knowledge given the lack of assessments and research on measurement knowledge before school entry. The study briefly reviewed evidence on the development of each of the early mathematics trajectories.

Non-symbolic quantity knowledge is knowledge of sets' magnitude, without the need to use verbal or symbolic number names. We determined that this knowledge begins to develop in infancy, and it includes the ability to discriminate between small set sizes (Starkey & Cooper, 1980) as well as large set sizes (Xu, Spelke, & Goddard, 2005). Non-symbolic quantity knowledge provides a foundation for mapping between magnitudes and verbal and symbolic numbers (Gilmore, McCarthy, & Spelke, 2010; Piazza, 2010; van Marle, Chu, Li, & Geary, 2014) not to mention also an intuitive understanding of simple arithmetic (Barth, La Mont, Lipton, & Spelke, 2005). Beginning as early as preschool, individual differences in the speed and precision of non-symbolic quantity knowledge of both small and large set sizes are related to mathematics knowledge six months to two years later (Chen & Li, 2014; Desoete & Gregoire, 2006; LeFevre et al., 2010; Libertus, Feigenson, & Halberda, 2013). The relation is strongest before age six (Fazio, Bailey, Thompson, & Siegler, 2014). Although there is some controversy over this relation's strength with appropriate controls (De Smedt, Noël, Gilmore, & Ansari, 2013), we expected non-symbolic quantity knowledge in preschool to predict later mathematics achievement even with a range of control variables.

In the Early Math Trajectories model, children were assessed at four-time points: the beginning of the pre-k school year, the end of pre-k, the end of kindergarten, and the end of first grade. Their mathematics achievement was then assessed four years later when most children were in Grade 5 (age 11), to determine how early mathematics knowledge predicted success learning the more challenging and diverse mathematical content of the middle grades (p. 11). According to the literature, comparing low-income children to their more advantaged peers indicated that their mathematics development is delayed, but did not follow a different trajectory (Claessens & Engel, 2013; Jordan et al., 2006). It was hypothesized that children in this study might develop specific mathematics knowledge at a slower rate but follow the same trajectory proposed by the model. As predicted, non-symbolic quantity knowledge in preschool is tied to later mathematics progress even with a range of control variables whereby individual differences in non-symbolic quantity, counting, and patterning knowledge in preschool were predictive of fifth-grade mathematics achievement above and beyond a variety of other mathematics and cognitive skills.

By the end of first grade, individual differences in symbolic mapping, calculation, and patterning knowledge were important predictors of later mathematics achievement; first-grade knowledge mediated the relation between preschool mathematics knowledge and fifth grade mathematics achievement, supporting their proposed trajectory. The findings of this study extends past research in multiple crucial ways. Non-symbolic quantity, counting, and patterning knowledge in preschool predicted fifth-grade mathematics achievement. Both theory and practice must attend more to early mathematics achievement trajectories after controlling for other mathematics and non-mathematics knowledge. This paper focuses on the transferable benefits that learning progressions and or interventions have on disadvantaged students' achievement.

Conclusion

Few studies, if any, have been conducted to determine quantitatively if learning progressions/ interventions may influence the overall academic achievement of students with disabilities; yet studies such as this current study reveal several mathematics topics assessed during the earlier years had significant associations with mathematics achievement in later middle school years. Students were found to be two to three years behind their peers yet still progressing along the same mathematic trajectory.

This study's complete research design, results, and findings are discussed in the chapters that follow.

CHAPTER III: RESEARCH DESIGN AND METHODOLOGY

Introduction

Students' academic achievement with disabilities continues to be a long-standing concern (McDonnell & Swando, 2009). Since No Child Left Behind became federal law, legislators, policymakers, and educational leaders have examined, re-examined, funded and reallocated, standardized and assessed, reformed and re-enacted, and reinvested in almost every aspect of education to improve the academic achievement of all students. However, much of the mathematics curricula adopted by states, districts, and schools for students with cognitive disabilities or instructional learning gaps continue to be purchased and used without outcome-based, empirically derived evidence of effectiveness.

This study intends to explored the influence of mathematics learning progressions on students' academic achievement with disabilities as measured by their performance on 2018–2019 statewide assessments. An emerging field of study, Learning Progressions, supports the idea of moving children through a developmental progression of learning (Clements, 2002; Gravemeijer, 1999; Simon, 1995). This study will add to the current literature by examining another type of instructional method that may support the growth of students with cognitive disabilities.

Research Design

A non-experimental, one-group, pretest-posttest design was employed to compare the scale scores on the 2017–2018 and 2018–2019 Mathematics sections of the New Jersey Student Learning Assessment (NJSLA). A one-group, pre-test-post-test design is a non-experimental research design. The same dependent variable is measured in one group of participants before (pre-test) and after (post-test) treatment is administered. In this design, scores are measured before and after treatment, then comparing the differences. While these designs can minimize problems related to having no control or comparison group, the disadvantage to the one-group design is the threat of internal validity associated with observing the same participants over time.

A Paired-samples *t*-Test will be used to determine what statistical differences exist, if any, between the scores 2017–2018 results of the students prior to receiving instruction based on learning progressions and the 2018–2019 results after receiving instruction in learning progressions. The paired sample-test is simply a statistical procedure used to determine whether the mean difference between two sets of observations is zero. In a paired sample -test, each subject is measured twice. The paired sample t-test has dualing hypotheses, The null hypothesis assumes that the true mean difference between the paired samples is zero. Contrariwise, the alternative hypothesis assumes that the true mean difference between the paired samples is not equal to zero. Constance A. Mara & Robert A. Cribbie (2012)

Herein the scores will be assigned Pre-Test (2017–2018 PARCC-M) and Post-Test (2018–2019 NJSLA-M) data. A Paired-samples *t*-Test will be used to analyze the PARCC-M/NJSLA-M data. The analysis will be completed using the Statistical Package for Social Sciences (SPSS). The output of the *t*-test, the *t*-value, measures the size of the difference relative to the variation in your sample data and is represented in units of standard error.

Non-experimental designs using quantitative methods are frequently used when it is not logistically feasible or ethical to conduct a randomized controlled trial and can be classified as a non- or quasi-experimental design (sometimes called the pre-post intervention design often). This design is often used to evaluate the benefits of specific interventions.

Instrumentation

This investigation compared the 2018 New Jersey Student Learning Assessment in Mathematics (NJSLA-M) scale score means for sampled special education students in Grades 4 – 8 to the 2019 NJSLA-M scale score same group. The PARCC/NJSLA tests are a series of state assessments administered to New Jersey public school students to determine student achievement levels in language arts, mathematics, and science. The assessments, grounded in the state's content standards (the NJSLS), are standardized tests administered to all New Jersey public school students in Grades 3 through high school during April and/or May, and are an extension of federal and state accountability requirements. The results of the elementary-level assessments are meant to measure and promote student learning of the state's curriculum standards and provide information about student performance.

The assessments' empirical reliability and validity are reported within the NJDOE's New Jersey Student Learning Assessment's Technical Reports (NJDOE, 2018) and is explained in the next subsection. The Mathematics portion of the PARCC/NJSLA tests measures students' ability to solve problems by applying mathematical concepts in an online, technology-enhanced testing environment. Mathematics portion focused on skills and concepts, as well as understanding multi-step problems that require abstract reasoning, along with modeling real-world problems with precision, perseverance, and strategic use of tools. Students demonstrate their understanding of acquired skills and knowledge by answering selected-response items and fill-in-the-blank items (NJDOE, 2018).

Student results are reported as a scale score. A scale score is a numerical value that summarizes student performance and reflect the conversion from the raw score (actual points earned on test items) adjusted for differences in difficulty among the various assessment forms and administrations of the test. Scale scores range from 650 to 850 for all tests. Scale Scores are categorized into Performance Levels. Each performance level is a broad, categorical level used to report overall student performance. By describing how well students met the expectations for their grade level/course. There are five performance levels for PARCC assessments:

- Level 5: Exceeded expectations (Begins based upon assessment - 850)
- Level 4: Met expectations (Begins at 750 however ends based upon assessment)
- Level 3: Approached expectations (725 – 749)
- Level 2: Partially met expectations (700 – 724)
- Level 1: Did not yet meet expectations (650-699)

Students performing at levels 4 and 5 have met or exceeded expectations, have demonstrated readiness for the next grade level/course, and are ultimately on track for college and careers (NJDOE, 2019).

Accommodations for Students with Disabilities

Based upon the 2016 Technical Report (NJDOE, 2016), "it is important to ensure that performance in the classroom and on assessments is influenced minimally, if at all, by a student's disability or linguistic/cultural characteristics that may be unrelated to the content being assessed. For PARCC/NJSLA assessments, accommodations are considered to be adjustments to the test format, or test administration that provide equitable access during assessments for students with disabilities. As much as reasonably possible, accommodations should

- provide equitable access during instruction and assessments;
- mitigate the effects of a student's disability;
- not reduce learning or performance expectations;

- not change the construct being assessed;
- and not compromise the integrity or validity of the assessment.

Accommodations are intended to reduce and eliminate the effects of a student's disability; however, accommodations should never reduce learning expectations by reducing the scope, complexity, or rigor of an assessment. Moreover, “accommodations provided to a student on the PARCC assessments must generally be consistent with those provided for classroom instruction and classroom assessments” (page 33).

The researcher requested approval from the district’s internal Institutional Review Board (IRB) and Seton Hall University’s IRB to collect NJSLA-M scale score data from the 2018 and 2019 administrations of the NJSLA-M and use data for the purposes of this study.

Validity

The 2019 Technical Report described the validity of the PARCC assessment. PARCC item analysis included data from the following types of items: key-based selected-response items, rule-based machine-scored items, and hand-scored constructed response items. For each item, the analysis produced item difficulty, item discrimination, and item response frequencies.

A set of classical item statistics were computed for each operational item by form and by administration mode. Each statistic was designed to evaluate the performance of each item. The following statistics and associated flagging rules were used to identify items that were not performing as expected:

Classical item difficulty indices (p-value and average item score).

When developing PARCC tests, a wide range of item difficulties is desired so that students of all ability levels can be assessed with better precision. At the operational stage, item difficulty statistics are used by test developers to build forms that meet desired test difficulty targets. Some of the items proved to be unexpectedly difficult (page 60).

For dichotomously scored items, item difficulty is indicated by its *p*-value, which is the proportion of test-takers who answered that item correctly. The range for p values is from .00 to 1.00. Items with high p values are easy items and those with low p values are difficult items. Dichotomously scored items were flagged for review if the p-value was greater than .95 (i.e., too easy) or less than .25 (i.e., too difficult). For polytomous scored items, the difficulty is indicated by the average item score (AIS). The AIS can range from .00 to the maximum total possible points for an item. To facilitate interpretation, the AIS values for polytomous scored items are often expressed as percentages of the maximum possible score, which are equivalent to the p values of dichotomously scored items. The desired p-value range for polytomous scored items is .30 to .80; items with values outside this range were flagged for review.

The percentage of students choosing each response option.

Selected response items on PARCC assessments refer primarily to single-select multiple-choice items. These items require that the test taker select a response from a number of answer options. These statistics for single-select multiple-choice items indicate the percentage of students who select each of the answer options and the percentage that omit the item. The percentages are also computed for the high-performing subgroup of students who scored at the top 20% on the assessment. Items were flagged for review if more high-performing test-takers chose the incorrect option than the correct response. Such a result could indicate that the item has multiple correct answers or is mis-keyed.

Item-total correlation.

This statistic describes the relationship between test takers' performance on a specific item and their performance on the total test. The item-total correlation is usually referred to as the item discrimination index. For PARCC operational item analysis, the assessment's total score was used as the total test score. The polyserial correlation was calculated for both selected-response items and constructed response items as an estimate of the correlation between an observed continuous variable and an unobserved continuous variable hypothesized to underlie the variable with ordered categories (Olsson, Drasgow, & Dorans, et al. 1982). Item-total correlations can range from -1.00 to 1.00. Desired values are positive and larger than .20. Negative item-total correlations indicate that low ability test takers perform better on an item than high ability test takers, an indication that the item may be potentially flawed. Item-total correlations below .20 were flagged for review. Items with extremely low or negative values were considered for exclusion from IRT calibrations or linking.

Distractor-total correlation.

For selected-response Items, this estimate describes the relationship between selecting an incorrect response (i.e., a distractor) for a specific item and performance on the total test. The polyserial correlation is calculated for the distractors. Items with distractor-total correlations greater than .00 were flagged for review as these items may have multiple correct answers, be mis-keyed, or have other content issues.

Percentage of students omitting or not reaching each item.

For both selected response and constructed response items, this statistic is useful for identifying problems with test features such as testing time and item/test layout. Typically, if students have an adequate amount of testing time, approximately 95% of students should attempt to answer each question on the test. A distinction is made between “omit” and “not reached” for items without responses: a. An item is considered “omit” if the student responded to subsequent items. b. An item is considered “not reached” if the student did not respond to any subsequent items. Patterns of high omit or not reached rates for items located near the end of a test section may indicate that test-takers did not have adequate time. Items with high omit rates were flagged. Omit rates for constructed-response items tend to be higher than for selected-response items. Therefore, flagging individual items' omit rate was 5% for selected-response items and 15% for constructed response items. If a test taker omitted an item, the test taker received a score of '0' for that item and was included in the *N*-count. However, if an item was near the end of the test and classified as not reached, the test taker did not receive a score and was not included in the *N*-count for that item. 6. Distribution of item scores. For constructed response items, examination of the distribution of scores is helpful to identify how well the item is functioning. If no students’ responses are assigned the highest possible score point, this may indicate that the item is not functioning as expected (e.g., the item could be confusing, poorly worded, or just unexpectedly difficult), the scoring rubric is flawed, and/or test-takers did not have an opportunity to learn the content. In addition, if all or most test-takers score at the extreme ends of the distribution (e.g., 0 and 2 for a 3-category item), this may indicate that there are problems with the item or the rubric so that test-takers can receive either full credit or no credit at all, but not partial credit. The raw score frequency distributions for constructed-response items were computed to identify items with few or no observations at any score points. Items with no observations or a low percentage (page 62).

The *p*-value information by grade and mode for the ELA/L and mathematics operational items from the Spring 2016 operational administration are included in the Appendix.

Reliability

As reported in the 2016 Technical Report, reliability focuses on the extent to which differences in test scores reflect true differences in the knowledge, ability, or skill being tested rather than fluctuations due to chance. Thus, reliability measures the consistency of the scores across conditions that can be assumed to differ at random, especially which form of the test taker is administered and which persons are assigned to score responses to constructed-response questions. In statistical terms, the variance in the distributions of test scores, essentially the differences among individuals, is partly due to real differences in the knowledge, skill, or ability being tested (true variance) and partly due to random errors in the measurement process (error variance). Reliability is an estimate of the proportion of the total variance that is true variance. The type of reliability estimate reported within the 2016 PARCC Technical Report is an internal-consistency measure derived from analysis of the consistency of individuals' performance across items within a test. Reliability coefficients range from 0 to 1. The higher the reliability coefficient for a set of scores, the more likely individuals would be to obtain very similar scores upon repeated testing occasions if the students do not change in their level of the knowledge or skills measured by the test. The reliability estimates in the tables (see Appendix) reflect the consistency of scores. Reliability of classification estimates the proportion of students who are accurately classified into proficiency levels. There are two kinds of classification reliability statistics: decision accuracy and decision consistency. Decision accuracy is the agreement between the classifications actually made and the classifications that would be made if the test scores were perfectly reliable. Decision consistency is the agreement between the classifications that would be made on two different independent forms of the test.

Another index is inter-rater reliability for the human scored constructed-response items, which measures individual raters' agreement (scorers). The inter-rater reliability coefficient answers the question, "How consistent would the scores of these test-takers be over replication of scoring of the same responses by different scorers?" The standard error of measurement (SEM) quantifies the amount of error in the test scores. SEM is the extent to which test takers' scores tend to differ from the scores they would receive if the test were perfectly reliable. As the SEM increases, the variability of students' observed scores is likely to increase across repeated testing. Observed scores with large SEMs pose a challenge to the valid interpretation of a single test score.

Mathematics

The average reliability estimates for the Grades 3 to 8 mathematics and end-of-course (EOC) assessments range from .86 to .93 for the CBT tests and from .75 to .93 for the PBT tests. Most of the average reliability estimates are above .90 except for some of the Integrated Mathematics tests. Integrated Mathematics I for PBT did not have sufficient sample sizes perform to estimate reliability. The SEM as a percentage of total score consistently ranges from 4% to 5% of the maximum score. The SEMs for the scale scores are the highest for Integrated Mathematics I and III and grade 8 and the lowest for geometry and grades 6 and 7. The PBT scale score SEMs are within one scale score point of the CBT scale score SEMs.

The average reliabilities for the larger student groups (Not Economically Disadvantaged, Non-English Learners, and Students without Disabilities) are quite similar to the students' total group. For Economically Disadvantaged, English Learners, and Students with Disabilities, the average reliabilities average .04 to .05 lower than those for the entire group.

Students Taking Accommodated Forms: Mathematics

Only the Text-to-Speech forms had sufficient sample sizes for reliability and SEM estimation. Except for the Integrated Mathematics I, II, and III courses, the Text-to-Speech reliabilities are very close to the total group reliabilities. The corresponding SEMs were somewhat greater than those for the total group SEMs.

Research Question

What is the difference in mathematics achievement for students with disabilities in Grades 3 through 9 after one year of mathematics learning progressions as measured by the New Jersey Student Learning Assessment in mathematics?

Hypotheses

The following hypothesis concerning this research study:

Null Hypothesis 1. Findings show no statistically significant difference in student achievement between the results of the Grades 4 through 8 as measured by the 2017–2018 and 2018–2019 NJSLA-M scale score means of students with disabilities who participated in Learning Progressions Treatment for one academic year.

The Setting for the Study

The study took place within the urban public school district in a state in the Mid-Atlantic region. The district is considered to serve a majority of students in poverty. In response to poor performance on state mathematics assessments, the district initiated its search for promising Common Core State Standards-aligned mathematics strategies for its students in self-contained classroom settings. In September of 2018, the district's administrations implemented the Learning Progressions Model supported by the Houghton Mifflin Harcourt-published *Go Math* program within all of its schools, K – 8, serving special education students in self-contained settings. The Learning Progressions Model (referenced as Treatment within this study), was implemented within all seven of the district's K - 7 schools; thereby replacing the prior Mathematics programs used within the sites' indergarten, through Grade 8 classrooms.

Treatment

The Learning Progressions Model used grade-level standards, assessment data and benchmarks to decide what content is most crucial to emphasize and to develop long- and short-term goals accordingly. At the district-level, essential prerequisite (progressions) and foundations skills in mathematics were pre-determined. Teachers carefully planned and sequenced lessons that built on each other with district-level guidance and made content connections explicit in both planning and delivery; incorporating lessons that activated students' prior knowledge. The model allowed for ongoing changes (e.g., pacing) throughout the sequence based on student performance and needs. Teachers continuously assessed individual students' needs and adapted curriculum materials and tasks to meet their instructional goals.

Frequency

Students were instructed in the Learning Progressions Model each school day, averaging five (5) days per week.

Intensity

On average, 90 minutes per session dedicated to Mathematics instructions following the Learning Progressions Model.

Fidelity of Implementation

The Learning Progressions Model was incorporated into teachers' daily lessons beginning in September 2018 – June 2019 in all self-contained special educations classrooms district-wide. The implementation of the Learning Progressions Model is supported by the Houghton Mifflin Harcourt-published *Go Math* program. The program included a teacher's edition, student resources and workbooks, enhanced technology components, differentiated resources for reteaching and enrichment, and RTI components to address student deficiencies. The program is organized in a mastery framework, where the emphasis is distributed amongst the development of conceptual understanding, procedural fluencies, and problem-solving skills (Houghton Mifflin Harcourt, 2011). The curriculum topics in-depth and emphasizes essential mathematics skills outlined within the Common Core State Standards (2010). Also, teachers used the program's embedded assessments to monitor student progress and make instructional design decisions for personalized learning and instruction.

A professional development framework that accompanied the Learning Progressions Model's implementation was included and would support the participating teachers' development of a clear, well-defined image of effective classroom practice aligned to a Learning Progressions Model. The overall goal of the trainings, accomplished for the 2018-2019 school year, was to engage teachers in the use of learning progressions and its research to better understand student needs, consider differences among students in terms of their knowledge and understandings, resulting in motivation for acquiring new knowledge and skills, and strengths and challenges associated with learning mathematics. The training sessions were designed to help teachers understand the intermediate learning that must occur for students during the school year and decipher the best routes for individual students to take in pursuit of annual academic goals.

In a quantitative analysis of the factors influencing the quality of implementation of school-wide programs, Cooper (1998) revealed six within schools factors: (1) creation of a supportive culture for institutional change, (2) surpassing program resistance on the part of a minority of teachers, (3) a commitment to implementing the structures of the program, (4) strong school-site facilitator, (5) less concern among teachers for handling an increased workload, and (6) availability of program materials. At the outset of the implementation in the eight sites, school leadership was receptive to its implementation. Underscoring factors one, four, and six, piloting principals actively encouraged their teaching staff to participate in initial training sessions. The district supplied all program materials (teacher and student textbooks, web-based technologies, curriculum articulation documents, tutorials, etc.) to each school before trainings and implementation. While the district did not mandate a minimum or maximum implementation level, the district's academic coaching and professional development frameworks and the district’s existing classroom monitoring and accountability systems sought to support implementation in ways consistent with typical district practices (see Limitations).

Sample

Two hundred seventy-nine (279) students in kindergarten through Grade 12 from the nine treatment sites were involved in the Learning Progressions Model implementation during the 2018–2019 school year. After delimiting, the qualifying treatment sample represented the subset of special education students in self-contained settings who were enrolled within their respective treatment site during school years 2017-2018 and 2018-2019 and having mathematics score data from both administrations of the 2018 the 2019 New Jersey Student Learning Assessments (NJSLA). The qualifying Treatment sample reflected 111 students in Grades 4, 5, 6, 7, and 8 instructed in the Learning Progressions Model in School Year 2018-2019 (see Table 2).

Table 2

Sample

	MATH04	MATH05	MATH06	MATH07	MATH08	Total Sample
Total (N)	28	25	27	20	11	111
Male	16	14	18	14	6	68
Female	12	11	9	6	5	43
White	0	0	0	0	0	0
Black	17	16	19	12	8	72
Hispanic	11	9	7	8	3	38
Other	0	0	1	0	0	1
Spec Ed	28	25	27	20	11	111
LEP	1	0	1	0	0	2

Data Collection and Analysis

For this study, redacted student level data were used for this study. I requested approval to collect and use data for the purposes of this study School District's internal Institutional Review Board (IRB) and Seton Hall University's IRB. Appendix A will reflect documentation of IRB approval. Throughout this study, data is reported in aggregate at either the treatment level. Data files contain the following information:

Table 3

Description of Variables

Field	**Description**
Dependent Variable	MathScaleScore2018 - Continuous variable representing the 2018 NJSLA scale scores ranging from 650 - 750
Independent Variables	
MathScaleScore2019	Continuous variable representing the 2019 NJSLA scale scores ranging from 650 - 750
PerformanceLevel2018	Categorical variable representing the 2018 NJSLA proficiency levels:
	Level 5: Exceeded expectations
	Level 4: Met expectations
	Level 3: Approached expectations
	Level 2: Partially met expectations
	Level 1: Did not yet meet expectations
PerformanceLevel2019	Categorical variable representing the 2019 NJSLA proficiency levels:
	Level 5: Exceeded expectations
	Level 4: Met expectations
	Level 3: Approached expectations

	Level 2: Partially met expectations Level 1: Did not yet meet expectations
Test Code	Categorical variable representing the grade level assessment administered as the post-test: MATH04 MATH05 MATH06 MATH07 MATH08
Grade Level When Assessed	Categorical variable representing the grade level of the student when administered the post-test: Grade 4 Grade 5 Grade 6 Grade 7 Grade 8
Gender	Dichotomous variable representing gender; male or female
Race/Ethnicity	Black or African American Hispanic/Latino American Indian/Alaska Native Native Hawaiian or Other Pacific Islander White Asian Two or More Races
English Learner	Students unable to communicate fluently or learn effectively in English
Students w/Disabilities	Students with some physical or mental impairment that substantially limits one or more major life activities.

A Paired-samples *t*-Test will be employed to determine whether there is a difference in the means of the 2017–2018 and 2018–2019 NJSLA results for students in grades 4, 5, 6, 7, and 8. A Paired-samples *t*-test is a statistical procedure used to determine whether the mean difference between two sets of observations is zero. In a Paired Sample-*t*-test, each subject or entity is measured twice. Common applications of the Paired Sample *t*-Test include repeated-measures designs. The Paired Samples Test compares two means that are from the same individual, object, or related units.

Preliminary analyses will be run to test for:

- A dependent variable that is continuous (i.e., interval or ratio level)
- Related samples/groups (i.e., dependent observations)
- Random sample of data from the population
- Normal distribution (approximately) of the difference between the paired values
- No outliers in the difference between the two related groups

Effect Size

For all *t*-tests, Cohen's *d* will be used to calculate effect sizes of statistically significant outcomes whereby 0.2 equates to a small effect, 0.5 equates to a medium effect, and a medium effect larger than 0.8 equate to large effects (Cohen, 1988). Although rough guidelines for interpreting effect sizes have been included as a limitation in this study, effect size can also be interpreted as a comparison between the reported effect size and those reported in prior studies of a similar nature (Thompson, 2002a; Vaccha-Haase & Thompson, 2004).

Conclusion

By using a Paired-samples *t*-Test, it is possible to determine whether there is a difference in the means of the 2017–2018 and 2018–2019 NJSLA results for students in Grades 4, 5, 6, 7, and 8. Chapter 4 reports the results of the statistical analyses previously mentioned in this chapter. In addition, Chapter 4, when applicable, includes the verification of parametric assumptions (e.g. normality, appropriate sample size, homogeneity of variance), as well as dependent variable scores and means, standard deviations, significance, *T*-values, and effect sizes.

CHAPTER IV: DATA ANALYSIS

Introduction

The purpose of this study was to examine the influence of a district wide special education learning progressions curricula focused on improving the mathematics test results on the state assessment PARCC/NJSLA. Chapter 4 will present the results and findings of this study to address the problems posed in Chapter 1. Data analyses were conducted and the results are reported in this chapter to answer the primary research question and test the hypotheses. The goal was to determine the influence of a district-wide learning progressions curricula implementation as well as to provide valid, informative, and credible data. PARCC/NJSLA-M scale score data from the 2018 and 2019 test administrations of the NJSLA-M displayed in the table below illustrates the correlation and statistical significance being analyzed in this study.

A non-experimental, one-group, pretest-posttest design was used to compare the scale scores of 111 students in Grades 4, 5, 6, 7, and 8 on the 2018 and 2019 Mathematics sections of the New Jersey state assessment. A Paired-samples *t*-Test was used to determine what statistical differences exist, if any, between the 2018 results of the students prior to receiving instruction based on learning progressions and the 2019 results after receiving instruction in learning progressions. Herein the scores were assigned Pre-Test (2018 PARCC-M) and Post-Test (2019 NJSLA-M) data.

Research Question

What is the difference in mathematics achievement for students with disabilities in Grades 3 through 9 after one year of mathematics learning progressions as measured by the New Jersey Student Learning Assessment in mathematics?

Hypotheses

The following hypothesis was made concerning this research study:

Null Hypothesis 1. There's no statistically significant difference in student achievement between results of the Grades 4 through 8 as measured by the 2017–2018 and 2018–2019 NJSLA-M scale score means of students with disabilities who participated in Learning Progressions Treatment for one academic year.

Sample

Two hundred seventy-nine (279) students in kindergarten through Grade 12 from the nine treatment sites were involved in the Learning Progressions Model implementation during the 2018–2019 school year. After delimiting, the qualifying treatment sample represented the subset of special education students in grades 4-8, assigned to self-contained classroom settings, enrolled within their respective treatment site during school years 2017-2018 and 2018-2019, and having mathematics score data from both administrations of 2018 the 2019 New Jersey Student Learning Assessments (NJSLA). The qualifying Treatment sample reflected 111 students in Grades 4, 5, 6, 7, and 8 instructed in the Learning Progressions Model in School Year 2018-2019 (see Table 2).

Table 2

Sample

	MATH04	MATH05	MATH06	MATH07	MATH08	Total Sample
Total (N)	28	25	27	20	11	111
Male	16	14	18	14	6	68
Female	12	11	9	6	5	43
White	0	0	0	0	0	0

Black	17	16	19	12	8	72
Hispanic	11	9	7	8	3	38
Other	0	0	1	0	0	1
Spec Ed	28	25	27	20	11	111
LEP	1	0	1	0	0	2

Table 3

2018 PARCC/NJSLA-M Scores

	N	Minimum	Maximum	Mean	Std. Deviation
PARCC - 2018	111	650	756	695.00	20.396

The 2018 scores represent the students' assessment level before they enrolled in the learning progressions program. One hundred and eleven (N=111) students represent the qualifying sample. The minimum test result score was 650. The maximum score was 756. The mean score M = 695; (SD = 20.396).

Table 4

2019 PARCC/NJSLA-M Scores

	N	Minimum	Maximum	Mean	Std. Deviation
PARCC - 2018	111	650	752	694.14	20.481

The 2019 scores represent the students' assessment level before they were enrolled in the learning progressions program. One hundred and eleven (*N*=111) students represented the qualifying sample. The minimum score was 650. The maximum score was 752. The mean score *M* = 694.14; (*SD* = 20.481).

Primary Analyses

A paired samples *t*-Test was used in this study to explore Grade 4 – 8 student performance on the 2019 NJSLA-M at the *Treatment level.*

Table 5 describes the independent and dependent variables

Table 5

Description of Variables

Field	**Description**
Dependent Variable	MathScaleScore2018 - Continuous variable representing the 2018 NJSLA scale scores ranging from 650 - 750
Independent Variables	
MathScaleScore2019	A continuous variable representing the 2019 NJSLA scale scores ranging from 650 - 750
Performance-Level 2018	A categorical variable representing the 2018 NJSLA proficiency levels:
	Level 5: Exceeded expectations
	Level 4: Met expectations
	Level 3: Approached expectations
	Level 2: Partially met expectations
	Level 1: Did not yet meet expectations
Performance-Level 2019	A categorical variable representing the 2019 NJSLA proficiency levels:
	Level 5: Exceeded expectations
	Level 4: Met expectations
	Level 3: Approached expectations
	Level 2: Partially met expectations
	Level 1: Did not yet meet expectations

Test Code	A categorical variable representing the grade level assessment administered as the post-test: MATH04 MATH05 MATH06 MATH07 MATH08
Grade Level When Assessed	A categorical variable representing the grade level of the student when administered the post-test: Grade 4 Grade 5 Grade 6 Grade 7 Grade 8
Gender	A dichotomous variable representing gender; male or female
Race/Ethnicity	Black or African American Hispanic/Latino American Indian/Alaska Native Native Hawaiian or Other Pacific Islander White Asian Two or More Races
English Learner	Students who are unable to communicate fluently or learn effectively in English
Students w/Disabilities	Students with some physical or mental impairment that substantially limits one or more major life activities.

A paired samples *t*-Test was conducted to determine whether there were statistically significant differences in the overall performance between the 2018 Pre-test and 2019 Post-test results as measured by the mean scales scores. The results are shown in Table 6. The mean scale score of the pretest ($N = 111$) was 695.00 ($SD = 20.396$); the mean scale score of the 2019 posttest ($N = 111$) was of 694.14 ($SD = 20.481$). No statistically significant difference exist between the pretest and posttest mean scale scores; $t(111)= 0.394$, $p = 0.694$, $d =0.0374$.

Table 6

Paired Samples Statistics

`		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	PARCC_2018	695.00	111	20.396	1.936
	PARCC_2019	694.14	111	20.481	1.944

Table 7

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	PARCC_2018 & PARCC_2019	111	.374	.000

Table 8

Paired Samples Test

		Paired Differences			
					95% Confidence Interval of the Difference
		Mean	Std. Deviation	Std. Error Mean	Lower
Pair 1	PARCC_2018 - PARCC_2019	.856	22.862	2.170	-3.444

Table 9

Paired Samples Test

		Paired Differences			
		95% Confidence Interval of the Difference			
		Upper	*t*	*df*	Sig. (2-tailed)
Pair 1	PARCC_2018 - PARCC_2019	5.156	.394	110	.694

Table 10

Paired Samples Effect Sizes

					95% Confidence Interval	
			Standardize	Point Estimate	Lower	Upper
Pair 1	PARCC_2018 - PARCC_2019	Cohen's d	22.862	.037	-.149	.223
		Hedges' correction	22.940	.037	-.148	.223

Review of the Findings

This chapter concludes with a brief discussion of the results and findings associated with the research question and the hypothesis.

Research Question: What is the difference in mathematics achievement for students with disabilities in Grades 4 through 8 after one year of mathematics learning progressions as measured by the New Jersey Student Learning Assessment in mathematics?

Null Hypothesis: No statistically significant difference exists in student achievement between the results of the Grades 4 through 8 as measured by the 2017–2018 and 2018–2019 NJSLA-M scale score means of students with disabilities who participated in Learning Progressions Treatment for one academic year.

The null hypothesis was accepted. These results suggest that the treatment had no significant impact on student performance.

Conclusion

A complete evaluation of the hypothesis, along with a summary of findings, recommendations for policy and practice, recommendations for future study and final thoughts are presented in Chapter 5.

CHAPTER V

Conclusions and Recommendations

The purpose of this study was to explore the influence of mathematics learning progressions on the academic achievement of students with disabilities as measured by their performance on statewide assessments. This chapter includes a discussion of major findings as related to the literature on learning progressions in mathematics, conclusions, and recommendations for school leaders, policy, and future research.

This chapter contains discussion and future research possibilities to support the research question: What is the difference in mathematics achievement for students with disabilities in self-contained special education programs in Grades 4–8 after one year of mathematics learning progressions as measured by the New Jersey Student Learning Assessment in mathematics?

As an emerging field of study, Learning Progressions supports the idea of moving children through a developmental progression of learning (Clements, 2002; Gravemeijer, Simon, 195). Learning Progressions, as an intervention for students with learning disabilities has, the potential to change learning outcomes for these students and other students who struggle with the mathematics and can be leveraged in mathematics education to mitigate performance gaps between students with disabilities and their non-disabled counterparts. Students qualifying for special education services have needs that often require support that sometimes exceeds the services usually offered or received in the general education setting.

IDEA requires states and school districts to include all students with disabilities in general state assessment programs, with appropriate accommodations and alternative assessments, if necessary, as indicated in their respective IEPs. While no conclusive findings suggest that there was a significant impact of the learning progressions model on student performance after one year of exposure, Chapter 5 supports recommendations for future study in an attempt to assist stakeholders in the exploration of interventions designed to level the playing field for all students.

Summary of Findings

The participants in this study were classified self-contained students in grades 4 - 8 within the Northeastern Urban Public School District in New Jersey. A non-experimental, one - group, pretest-posttest design was used to collect and analyze the data on 111 self-contained students to compare the scale scores on the 2017-2018 and 2018-2019 mathematics sections of the New Jersey Student Learning Assessment (NJSLA). The results were measured before and after the learning progressions model was implemented, then comparing the differences. A paired-samples *T*-Test was used to determine what statistical differences exist between the pre- and post-test results. Results showed that there was no statistically significant difference in student achievement, thereby suggesting that the treatment had no significant impact on student performance.

Students' academic achievement with disabilities continues to be a long-standing concern (McDonnell and Swando, 2009). Although it is well-established that out-of-school demographic and family-level variables strongly influence student achievement on large-scale standardized tests (Tienken, 2019), a districtwide shift in implementing a new model for curricula can provide an element of support for students that otherwise may not have existed.

In the school district studied, the results were not significant enough to conclude that learning progressions implementation impacted the scores of students with disabilities after just one year. The original goal of implementing the treatment was to provide struggling students with individual instruction according to their schema in order to boost their academic performance.

It may be unrealistic to look towards state assessments to capture the full aspects of a student’s learning experiences, as standardized and statewide test results are not always the most accurate depiction of a student's ability (Tienken, 2020). According to the literature, diagnostic assessments may be a more ‘sensitive’ and meaningful measure of a student’s performance over time. Evaluation can drive both learning and curriculum development and needs to be given serious attention at the earliest stages of change. Diagnostic assessments are intended, as an early warning system, to inform teachers' instructional design and delivery decisions to support struggling students' learning needs. "Diagnostic assessments should yield results that precisely identify the knowledge and skills for which individual students need intervention. Such information can help teachers identify students’ prior knowledge and skills, determine students’ misconceptions and errors, and isolate gaps in students’ understanding within a domain” Ketterlin-Geller, et al. P. (2019).

Additionally, interventions take more than one year to show that they accelerate learning beyond that which is gained in one year of school. Remediation means exceeding the amount of growth that typically takes place in one year. Bloom (1984) found 1:1 tutoring to be the most effective instructional tool with an effect size of 2.0. It is beyond the scope of this study to determine the length of time needed to determine treatment effectiveness. The actual course difficulty will be an interaction between the content and a range of individual and social factors (e.g., prior instructional history, readiness to learn, socioeconomic factors) (e.g. Gašević, et al. 2016). Even if there was conclusive data to support the implementation .

A learning progressions model over the traditional teaching model is but a single study, confined to a small urban district. It added to the conversation on the need to explore alternatives to traditional teaching methods as there continues to be debate over achievement gaps in education, particularly between special and general education students.

Recommendations for Practice

Research suggests intervention is more likely to impact student achievement positively. Principals and district decision-makers should summon future research that includes longitudinal data to ascertain a strong correlation between the implementation of learning progressions and student achievement.

Principals must also invest in professional development that will improve the implementation of an adopted learning progressions model. This can be accomplished in many flexible yet meaningful ways. For instance, time can be dedicated to training teachers during set faculty meetings. Weekly grade level meetings can also be used to share literature on learning progressions and additional implementation training. Ideally, principals can form Learning Progressions Model committees comprised of representatives from each of the participating grade levels, which can agree to come together on their own and dissect the literature to turnkey the same to their respective grade levels.

Recommendations for Policy

The leaders and policymakers charged with creating and enacting policy must examine all viable options for improving student outcomes. Until a proven strategy is uncovered, districts should not expect more than a single year's growth from a single year study after multiple years of collected data and further research.

We are interested in transforming the education system by implementing learning progressions models to create autonomous spaces to encourage innovative modeling, loaded with shared resources and data. Esteemed educator John Dewey said it best, "if we teach today's as we taught yesterday's, we rob them of tomorrow" (Dewey, 1915). Learning has to be personalized. Students must be allowed to learn at their own pace. This necessitates a change in the teacher's role, requiring an ability to use real-time data, infuse technology, and examine and adopt new instruction models. Learning progressions can be one option, made possible by the wave of new digital technologies.

Given this study's findings, policymakers would be better suited to provide funding to develop assessments that would measure student growth in greater detail using multiple measures. Standardized tests should never be the sole or deciding factor when determining academic growth. **“**To make diagnostic inferences, teachers need fine-grained feedback that focuses on specific concepts and procedures that can be targeted during instruction” (Gierl, Alves, & Majeau, 2010). Grain size is commonly used to describe the level of detail in which student performance is analyzed and reported (Leighton & Gierl, 2011; Rupp, 2007). Coarse-grained feedback provides information about broad categories of proficiency, such as those measured on state accountability tests. In contrast, fine-grained feedback is associated with students' thinking in more narrowly defined content domains (e.g., comparing fractions, equivalent fractions). Creating tests steeped in theories of learning in the domain of interest (e.g., mathematics) may generate fine-grained information about students’ thinking that is particularly useful for making diagnostic inferences (Leighton & Gierl, 2007; National Research Council [NRC], 2001).

Recommendations for Future Study

Many of the recommendations below suggest revisiting this study.

Recommendation 1. It is noted by the National Research Council (NRC, 2004) that "it can take "up to three years for a dramatic curricular change to be reliably implemented in schools" (p. 61). Although each of the participating schools are required by the district to provide mathematics instruction a minimum of 5 days per week and for a minimum of 90 minutes each day, this study did not address actual 'seat time' extending beyond the 90-minute mandate. Future research could replicate the current study to measure student mathematics achievement on a longitudinal basis and over a longer period. Ideally, three or even five consecutive years of data in order to discern the effectiveness of the learning progressions model

Recommendation 2. Future research could extend the current study using the same intact groups to measure mathematics performance while identifying a control group to provide greater strength of the conduct of this comparative analysis.

Recommendation 3. While reading level may contribute to variances observed in mathematics performance (Sconiers et al., 2002), this study did not control for reading level. Using the same intact groups, future research could replicate the current study to examine the influence of reading level on student mathematics achievement, using NJSLA – English scores as additional independent variables.

Recommendation 4. This study did not control for additional variables relating to student intelligence's impact beyond prior mathematics achievement. According to Embretson (1995), general intelligence, described as the ability to think logically and systematically, is the best individual predictor of achievement across academic domains, including mathematics (e.g., Deary, Strand, Smith, & Fernandes, 2007; Jensen, 1998; Stevenson). Future research could incorporate a qualitative design that explores the implications of prior knowledge on future outcomes.

Recommendation 5. This study did not control the additional variables relating to teacher affect, teacher quality, teachers' knowledge of mathematics, or the varying professional development levels related to mathematics instructional topics. There are no formal observations data of classroom instruction related specifically to the implementation level for either treatment group. While the district did not mandate a minimum or maximum implementation level, the professional development providers and the district's existing classroom monitoring and accountability systems sought to support implementation in ways consistent with typical district practices. Whereas this study incorporated a quantitative methodology, future research could incorporate a descriptive, qualitative case study design that explores teacher variables' influence (teacher effect, degree of mathematics professional development, mathematics content knowledge) on student outcomes.

Recommendation 6. In this study, groups were not assigned through the mechanism of randomization. Samples were selected from already existing populations. The lack of random assignment is a limitation of the non-experimental study design. Statistical associations found within this study do not imply causality and give rise to alternative explanations for the apparent causal association. Further, a final limitation of the study reflects the relatively small sample size which potentially impacts statistical power, type II error, and statistical significance (Cohen, 1988). For this reason, it may not be possible to make generalizations about the findings to the broader community based on this study alone.

Whereas this study incorporated a non-experimental design, this study could be redesigned to incorporate a more purposeful experimental design that increases the number of students and the number of years to increase statistical power.

Recommendation 7. Because the study of special education is fairly young, there is no coherent and most effective approach to raising student achievement evident in the literature. Few studies, if any, have been conducted to determine quantitatively if learning progressions/interventions influence the overall academic achievement of students with disabilities. studies show school districts in New Jersey have been developing Response to Intervention models (RTI). RTI is an identification system with a broader approach to adapting instruction to meet students' needs who are having problems learning the general curriculum. This study's results can serve to benefit a district's adoption of RTI models while continuing to provide students currently classified with the interventions and data needed to promote academic growth.

Conclusion

It is noted by the National Research Council (NRC, 2004) that "it can take "up to three years for a dramatic curricular change to be reliably implemented in schools" (p. 61). A key goal of the Elementary and Secondary Education Act of 2001 was to close the achievement gap between subgroups, including the gap between students who receive special education services and those considered general education students. States typically looked at performance over time by comparing students' test scores in specific grades across several years. Such comparative approaches produced inaccurate pictures of achievement gaps because different students may be enrolled in the specific grades each year (Thurlow, Wu, Lazarus, and Ysseldyke , 2016.) "It would not be an exaggeration to say that we are in a state of ignorance about how schools change over extended periods…there is a real need for those at the cutting edge of statistical analyses to show the way forward in the analysis of three or more years of data" (Tymms, 1995, p. 115).

Therefore, it is this researcher's final recommendation that future educational performance and school effectiveness designs in the area of special education add to the literature that supports:

"…longitudinal [designs], with repeated measures on multiple cohorts of students arranged within classes and schools to estimate change over time, and also that multilevel analysis be employed to account for the inherent hierarchical structure of the data (i.e., repeated measures clustered within students who are grouped within classes and schools)" (Hill & Rowe, 1998). This study's findings warrant repeating on multiple cohorts to discern change over time and the effectiveness of a learning progressions model on students with disabilities.

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