Summer 2024

Program Evaluation of Big Ideas Math Among Third-Grade Students in Polston School District Title 1 Schools

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PROGRAM EVALUATION OF *BIG IDEAS MATH* AMONG THIRD-GRADE STUDENTS IN POLSTON SCHOOL DISTRICT TITLE I SCHOOLS

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A Dissertation Submitted to the
Gardner-Webb University College of Education
in Partial Fulfillment of the Requirements
for the Degree of Doctor of Education

Gardner-Webb University
2024

Approval Page

This dissertation was submitted by Melissa Pollard-Hudson under the direction of the persons listed below. It was submitted to the Gardner-Webb University College of Education and approved in partial fulfillment of the requirements for the degree of Doctor of Education at Gardner-Webb University.

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Acknowledgments

"So do not fear, for I am with you; do not be dismayed; for I am your God. I will strengthen you and help you; I will uphold you with my righteous right hand." Isaiah 41:10 (NIV)

Embarking upon this journey was a challenging yet rewarding experience. Thank you to my village: the people who surrounded me with love and helped me through this process. I could not have done so without the love of my family, who supported all my personal and professional endeavors. I would like to thank my mother, Nancy, who has been and continues to be my biggest cheerleader and prayer warrior. She supported me in everything I set out to accomplish as a teacher, student, and parent.

Writing a dissertation while becoming a new mom was not an easy process; however, with the help of my mother; my aunts, Dorothy Addison and Sandra Quick; and my uncle, Larry Addison, I was able to focus on completing this task. Dr. Angela N. McLeod helped me navigate topic after topic and provided professional and spiritual guidance while assisting me with the writing process at the doctoral level. To my brothers, Jeremy and Curtis, and sister-in-love, Maysha, I truly thank you all for the encouragement you provided. You always shared kind words and supported me in more ways than I can count.

Thank you to my dissertation chair and committee for their professionalism, expertise, and guidance. Special thanks to Dr. Dale Lamb who always made space for me. I want to thank him for his encouragement, prompt responses, flexibility, availability, and academic support.

I dedicate this dissertation to my deceased grandparents, Thomas and Ida Mae

Alston, who always imparted wisdom and encouraged me to pursue an education. They taught me the importance of finishing what I started and giving my best effort in everything I set out to do.

I want to include my daughter, Eliyanah; my niece, Trinity; and nephews, Kylan and Jordan. I hope the completion of this dissertation inspires you to not only pursue advanced degrees but to accomplish the goals you set. Here is a quote from my children's book, *Dream Chasers:*

> "Accept a new challenge and always explore, you could find the key that unlocks the door. Dream the impossible and the possible, too. The dream that you're chasing lives within you."

Abstract

PROGRAM EVALUATION OF *BIG IDEAS MATH* AMONG THIRD-GRADE STUDENTS IN POLSTON SCHOOL DISTRICT TITLE I SCHOOLS. Pollard-Hudson, Melissa, 2024: Dissertation, Gardner-Webb University.

This quantitative study explored how well the *Big Ideas Math (BIM)* curriculum helped third-grade students in Title I schools within the Polston School District (pseudonym) improve their math skills and high-stakes testing scores. Thirteen elementary schools were selected based on factors such as diversity, poverty rates, and academic performance. The study addressed 2019-2023 except for the COVID-19 year, 2020. Using the logic model and constructivism as the conceptual framework, the study assessed student progress through quarterly benchmarks and the SC READY exam. This analysis was performed using repeated measures and a one-way analysis of variance (ANOVA). The analysis showed progressions and regressions in math scores across schools and years, suggesting that *BIM* might impact student performance. The study determined a statistically significant difference in the SC READY scores. *BIM* could be influencing math proficiency, but it was noted that some schools experienced declining scores over time, which highlighted the importance of continually evaluating educational programs like *BIM* to ensure they meet district goals. While BIM helps students with math, ongoing monitoring and adjustments are crucial to address any issues and ensure it is effective for all third-grade students in Title I schools. This study added to the knowledge of how well *BIM* works as a curriculum and highlighted the need for evidence-based decisions in education. Implications of findings include continued monitoring, professional development, tailored school support, addressing test score fluctuations, expanding the research, and addressing academic gaps.

Keywords: quantitative, ANOVA, repeated measures, high-stakes testing, Big Ideas Math, program evaluation, logic model

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Chapter 1: Introduction

Educational stakeholders must be driven by the specific needs of students to ensure preparedness for chosen pathways such as college or career readiness (Sattar et al., 2022). The South Carolina College- and Career-Ready (SCCCR) Content Standards for Mathematics and the Mathematics Process Standards play a vital role in achieving this goal (South Carolina Department of Education, 2023a). The Mathematics SCCCR content standards, provide the combination of procedures, concepts, and knowledge expected of students in all grades (Hadley et al., 2021).

The SCCCR Standards for Mathematics, as an overarching framework, are underpinned by the SCCCR Content Standards for Mathematics, which are engineered to strike a balance between abstract conceptual understanding and practical procedural adeptness within the domain of mathematics (Young et al., 2017). These content standards are characterized by their methodical delineation of the precise mathematical concepts expected to be acquired and proficiently executed by students at various junctures along their educational paths (South Carolina Department of Education, 2023a).

From initial steps in elementary education to advancement into secondary education, these standards provide much the same pedagogical compass, guiding systematically the development of students' mathematical knowledge and skills (South Carolina Department of Education, 2023a). By doing so, they endow students with the essential cognitive scaffolding and analytical skills indispensable for navigating the challenges encountered through advanced academic pathways and competently addressing the subsequent requirements associated with vocational and professional avenues (South Carolina Department of Education, 2023a).

Furthermore, the SCCCR Graduation Standards, a subset of the SCCCR Content Standards for Mathematics, outline the expectations for math that would equip high school students for completion of higher education and career readiness (South Carolina Department of Education, 2023a). These graduation standards are reinforced and expanded upon by the SCCCR Content Standards for Mathematics. To align with their intended career paths, which may involve beginning employment soon after graduation or enrolling in higher education institutions, students should take courses that enable them to learn all the SCCCR Graduation Standards relevant to their chosen paths (Hadley et al., 2021).

The SCCCR Mathematical Process Standards, included in the SCCCR Standards for Mathematics, outline how the individual student and students collectively should successfully navigate the math concepts covered in the content standards. Consequently, it is necessary that all students, regardless of grade level, be exposed to instruction that has the foundation of the SCCCR Content Standards for Mathematics and the SCCCR Mathematical Process Standards (South Carolina Department of Education, 2023a).

The SCCCR Mathematical Process Standards describe how students effectively learn and use math skills to understand concepts (South Carolina Department of Education, 2015). They are meant to be included along with the SCCCR Content Standards for Mathematics outlined for all math courses and all grades. These standards and protocols guide teaching methods and how students should show they understand the content. When assessing how well students grasp the material, the process standards must be an important part of what we expect from them (Hadley et al., 2021).

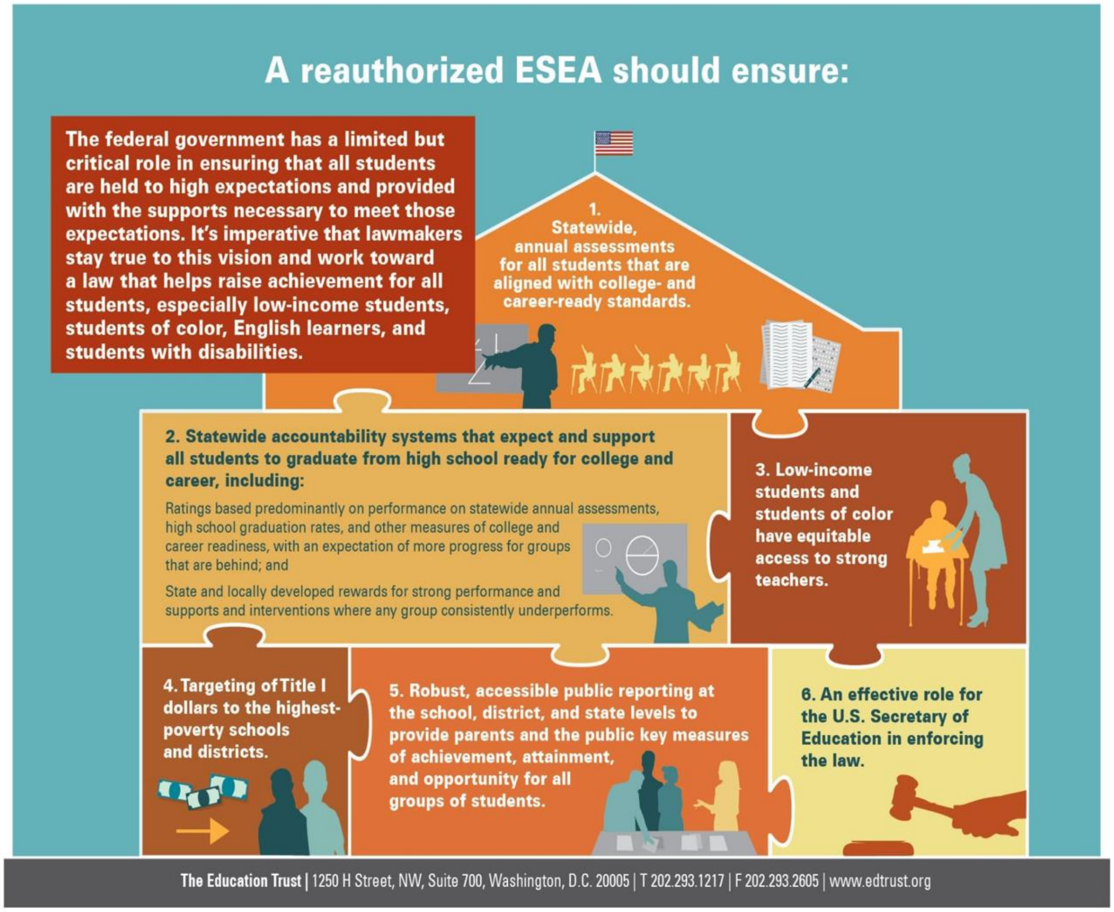
Background

The Elementary and Secondary Education Act (ESEA) was signed by President Johnson in 1965 (Skinner, 2024). This act made one of the major stipulations for all students to be given a quality education. Additionally, the act emphasized the demand for funding in critical needs areas and districts with higher poverty rates, minority students, and low standardized testing performance, which further increased the need for formative assessments (ESEA Network, n.d.). ESEA would provide funding for educating children from low-income households, providing library and classroom-based materials and training centers, and issuing grants from the Department of Education and the provisions as deemed necessary by educational stakeholders (Sharp, 2016).

By 1966, the ESEA was amended. Provisions of this adjustment included making funding available for any students determined to have special needs or disabilities (Guthrie, 2022). In 1967, an additional revision resulted in funding for language learner programs to help students needing linguistic support (ESEA Network, n.d.). In 2015, the Obama administration reauthorized ESEA to include an accountability system of fiscal responsibility, equity, and a lower focal point on standardized or high-stakes testing (American Federation of Teachers, 2015). Figure 1 depicts a visual representation of the changes brought about by the 2015 reauthorization of ESEA.

Figure 1

ESEA Reauthorization Components



Statement of the Problem

Schools with a high enrollment of students in poverty or students representing lower incomes receive financial assistance from the state. Such funding is provided through Title I, Part A (Title I) of ESEA (U.S. Department of Education, 2018). The anticipated outcome of these accommodations is that these students who may be deemed at risk have sufficient opportunity to achieve or outperform the expectations of the academic standards determined by the state. Federal funding is distributed using a formula that considers estimated poverty levels and costs associated with education in all states (Reber & Gordon, 2023). The financial support that Title I funds provide is important as many studies have shown the relationship between students from low-income backgrounds and challenges in academic performance (U.S. Department of Education, 2018). The district of interest serving as the basis for this investigation receives that type of federal assistance.

In South Carolina, the process of selecting textbooks involves several steps. The State Department of Education creates criteria for choosing instructional materials. Textbook adoption occurs every 6 years. All materials should align with SCCCR Standards and provide appropriate instructional materials for students with different ability levels (South Carolina Department of Education, n.d.-b). An advisory committee then reviews recommendations and establishes a panel to thoroughly review the materials (Anderson et al., 2020). Vendors solicit bids, and the panel evaluates the submitted materials based on standards, curriculum frameworks, and other relevant factors. After this, the state superintendent of education allows a public review of the recommended materials before presenting them to the state Board of Education. The instructional review panel provides options to the Board, which approves the instructional materials (Anderson et al., 2020). Due to the time and complexity required for this process, educational stakeholders must make informed decisions when selecting textbooks.

The district being investigated, the Polston School District (pseudonym) began the math textbook adoption process during the 2019-2020 school year. According to district policy, teacher representatives from kindergarten through 12th grade were included on the textbook adoption committee (South Carolina Department of Education, 2024b). The schools received textbooks from vendors, and a math content specialist developed a tool to evaluate the textbooks. With the onset of the pandemic (COVID-19), the traditional textbook adoption process was disrupted. Further, students stopped attending school. Teachers participated in a virtual vote and selected the *Big Ideas Math: Modeling Real Life (BIM)* textbook. Training for teachers on implementing the *BIM* curriculum was scheduled to be conducted online during the summer of 2020 (South Carolina Department of Education, 2024b).

Although the *BIM* curriculum has been used for 3 years, an evaluation of this program and its impact on district goals or mission has yet to be conducted. An evaluation of this math program was critical in identifying strengths and weaknesses within the modules, standard alignment, and the degree to which the curriculum assists students in meeting or exceeding the expectations of mathematical standards (South Carolina Department of Education, 2024b).

SC READY Mathematics Results

The South Carolina College- and Career-Ready (SC READY) assessment is administered statewide to third- through eighth-grade students in math, reading, and social studies. Questions on the state assessments are aligned with South Carolina's state standards (South Carolina Department of Education, 2023a). The standards include knowledge and skills in which students must show proficiency to meet or exceed grade-level expectations. Figure 2 summarizes 2020-2021 SC READY mathematics scores for students in the Polston School District for Grades 3-8. Scores are divided into categories that include the percentage of students who do not meet, approach, or exceed grade-level expectations.

Figure 2

2021 Polston School District SC READY Mathematics Results

Mathematics

Grade	Number Tested	Does Not Meet Expectations	Approaches Expectations	Meets Expectations	Exceeds Expectations	Meets or Exceeds Expectations	Approaches Meets or Exceeds Expectations	Mean Score	Standard Deviation
3	1,770	33.00%	24.30%	26.40%	16.30%	42.70%	67.00%	427.50	111.20
4	1,667	35.50%	25.00%	23.60%	16.00%	39.60%	64.50%	457.70	102.80
5	1,710	35.20%	30.20%	18.70%	15.80%	34.60%	64.80%	507.40	111.50
6	1,555	40.60%	30.50%	15.90%	12.90%	28.80%	59.40%	498.90	104.20
7	1,483	38.40%	31.80%	19.40%	10.40%	29.70%	61.60%	529.20	93.10
8	1,485	46.70%	31.40%	12.00%	9.90%	21.90%	53.30%	549.20	98.20

Figure 2 shows a total of 1,770 third graders assessed. The average percentage of students not meeting and approaching expectations was 57.3%. The average percentage of students meeting or exceeding expectations was 42.7%. Figure 3 shows the same breakdown of information for the state of South Carolina in 2021.

Figure 3

2021 South Carolina SC READY Mathematics Results

Mathematics

Grade	Number Tested	Does Not Meet Expectations	Approaches Expectations	Meets Expectations	Exceeds Expectations	Meets or Exceeds Expectations	Approaches Meets or Exceeds Expectations	Mean Score	Standard Deviation
3	51,268	31.0%	22.1%	26.5%	20.3%	46.9%	69.0%	439.7	119.6
4	51,119	32.5%	25.6%	21.8%	20.1%	42.0%	67.5%	468.6	109.1
5	51,489	33.4%	28.5%	19.1%	19.0%	38.1%	66.6%	516.8	116.8
6	50,963	35.5%	30.6%	18.0%	15.8%	33.9%	64.5%	513.2	108.9
7	51,230	36.5%	33.1%	15.8%	14.6%	30.4%	63.5%	536.4	100.9
8	50,480	40.2%	29.1%	15.6%	15.2%	30.7%	59.8%	571.0	108.9

A total of 51,268 third-grade students were assessed in 2021. Of that total, 53.1% of students on the third-grade level did not meet or were approaching state expectations, while 46.8% of the third-grade population met or exceeded state expectations. Figure 4 shows the assessment categories, grade levels assessed, proficiency percentages, and mean scores for third- through eighth-grade students in the Polston School District.

Figure 4

2022 Polston School District SC READY Mathematics Results

Mathematics

Grade	Number Tested	Does Not Meet Expectations	Approaches Expectations	Meets Expectations	Exceeds Expectations	Meets or Exceeds Expectations	Approaches Meets or Exceeds Expectations	Mean Score	Standard Deviation
3	1,962	23.4%	22.5%	28.8%	25.2%	54.0%	76.6%	457.9	119.1
4	2,072	25.9%	28.3%	20.8%	25.0%	45.8%	74.1%	483.5	112.5
5	2,044	25.8%	27.5%	25.1%	21.5%	46.7%	74.2%	534.8	114.2
6	2,164	31.1%	32.6%	18.9%	17.4%	36.3%	68.9%	520.8	108.6
7	2,169	36.2%	34.2%	17.0%	12.6%	29.6%	63.8%	535.5	96.5
8	2,226	35.6%	33.2%	17.9%	13.3%	31.3%	64.4%	574.1	98.4

There were 1,962 third graders assessed in 2022, which is 192 more students than those assessed in 2021. An average of 45.9% of students assessed did not meet or approach meeting the expectations for third-grade students. The total percentage of students who met or exceeded state expectations was 54%. Figure 5 shows the results for students assessed in Grades 3-8 in South Carolina.

Figure 5

2022 South Carolina Mathematics Results

Mathematics

Grade	Number Tested	Does Not Meet Expectations	Approaches Expectations	Meets Expectations	Exceeds Expectations	Meets or Exceeds Expectations	Approaches Meets or Exceeds Expectations	Mean Score	Standard Deviation
3	55,896	26.8%	22.2%	26.6%	24.4%	51.0%	73.2%	452.5	122.6
4	56,404	28.7%	27.9%	19.6%	23.7%	43.4%	71.3%	478.5	115.0
5	57,066	29.5%	27.2%	23.6%	19.7%	43.3%	70.5%	526.2	115.1
6	57,662	33.8%	30.5%	19.3%	16.5%	35.7%	66.2%	518.6	110.0
7	60,155	35.8%	33.3%	15.3%	15.5%	30.9%	64.2%	541.7	104.3
8	60,987	40.8%	29.0%	14.1%	16.0%	30.2%	59.2%	571.1	107.4

In 2022, 55,896 third-grade students were assessed, 49% of whom did not meet expectations for state academic standards assessed on SC READY. That percentage is broken down to 26.8% not meeting and 22.2% approaching state expectations. The approaching percentage would equate to an estimated 2,518 students being close to hitting the state's target. The data indicate that 51% of the third-grade population met or exceeded expectations. Figure 5 shows an increase of 4,628 students assessed on the third-grade level from 2021. Figure 6 shows the 2023 Polston School District mathematics results, and Figure 7 shows the 2023 South Carolina mathematics results for SC READY.

Figure 6

2023 Polston School District SC READY Mathematics Results

Mathematics

Grade	Number Tested	Does Not Meet Expectations	Approaches Expectations	Meets Expectations	Exceeds Expectations	Meets or Exceeds Expectations	Approaches Meets or Exceeds Expectations	Mean Score	Standard Deviation
3	2,080	25.7%	22.2%	31.0%	21.1%	52.1%	74.3%	448.5	112.4
4	2,070	26.3%	24.8%	23.9%	25.0%	48.9%	73.7%	487.4	113.6
5	2,133	23.2%	31.4%	26.6%	18.8%	45.4%	76.8%	533.9	109.1
6	2,070	36.1%	28.4%	20.9%	14.6%	35.5%	63.9%	515.2	103.4
7	2,183	40.3%	32.7%	15.1%	11.9%	27.0%	59.7%	529.3	100.0
8	2,153	42.9%	31.7%	13.3%	12.1%	25.4%	57.1%	558.4	96.1

A total of 2,080 third graders were assessed in 2023, 47.9% of whom did not meet or were approaching the state's expectation, while 52.1% met or exceeded expectations for third grade. Based on the information provided in Figures 2, 4, and 6, the number of students assessed in 2023 increased from 2022 by 118 students, and the 2023 population increased from 2021 by 310 students.

Figure 7

2023 South Carolina SC READY Mathematics Results

Mathematics

Grade	Number Tested	Does Not Meet Expectations	Approaches Expectations	Meets Expectations	Exceeds Expectations	Meets or Exceeds Expectations	Approaches Meets or Exceeds Expectations	Mean Score	Standard Deviation
3	56,739	24.1%	22.3%	28.7%	24.9%	53.6%	75.9%	458.6	118.5
4	56,536	28.7%	24.3%	20.7%	26.3%	47.0%	71.3%	487.8	123.1
5	57,553	23.7%	31.6%	24.7%	19.9%	44.7%	76.3%	535.1	111.9
6	57,926	34.2%	29.2%	20.8%	15.9%	36.6%	65.8%	519.6	106.7
7	58,566	35.3%	33.7%	15.5%	15.5%	31.0%	64.7%	543.9	105.9
8	60,737	39.2%	29.2%	15.4%	16.2%	31.6%	60.8%	575.3	106.5

Figure 7 shows the 2023 South Carolina mathematics results for students in Grades 3-8. There were 46.4% of third-grade students who did not meet state expectations, while 53.6% of the third-grade population met or exceeded the state's expectations.

Need for the Study

According to the Every Student Succeeds Act (ESSA), the United States Department of Education has developed specific provisions that acknowledge and advance equity by protecting the needs of disadvantaged students (National PTA, n.d.). Students will be presented with a rigorous curriculum with high standards with the goal that they will be adequately prepared to enter the workforce or to enroll in higher education. Statewide assessments will inform educational stakeholders, families, and students while measuring student progress toward meeting and exceeding academic standards. In any school where students are not making progress or where the school is performing poorly, actions will be taken to address these concerns and render positive outcomes, including holding responsible parties accountable (South Carolina Department of Education, 2022a).

South Carolina included specific school measures of performance in the ESSA accountability plan (South Carolina Department of Education, 2024a). States must identify performance indicators of schools that include academic achievement by proficiency levels on annual state assessments in mathematics and language arts in Grades 3-8 (Ginsberg et al., 2022). The state uses proficiency levels to determine school performance ratings. Based on ESSA requirements, South Carolina created long-term goals where 90% of students in all subgroups will reach Level 2 on the SC READY mathematics and English language arts (ELA) assessments by 2035, and 70% of students in all subgroups will be proficient on the SC READY mathematics and ELA assessments (Anderson et al., 2020). Figure 8 shows the established school performance indicators for South Carolina elementary and middle schools.

Figure 8

South Carolina School Performance Indicators

Level	Indicators
All schools	**Academic achievement:** Schools must meet the 95 percent participation rate for all students and subgroups **English language proficiency:** Progressing towards English proficiency on state assessment – WIDA ACCESS for ELLs 2.0 **School quality or student success** • Preparing for success: Weighted achievement on state science and social studies assessments – SCPASS and end-of-course examination program (EOCEP) • Positive and effective learning environment – student engagement survey for grades three through 12
Elementary and middle grades	**Academic achievement:** Weighted achievement on state English language arts and math assessments – SC READY **Other academic indicator:** Student growth on state English language arts and math assessments – SC READY • Growth of all students • Growth of the lowest-performing quintile of students

Figure 8 highlights other academic indicators that include growth in not only ELA and math but also growth for all students, including the lowest-performing. To provide the best conditions for potential growth in standardized state testing, the Polston School District administers various assessment opportunities for students. Some of those assessments include district-wide quarterly benchmarks and Measures of Academic Progress (MAP). These assessments are presented to third-grade students twice in an academic year for students in Grade 3, and classroom-based common formative assessments often connected with the mathematics and ELA curriculum.

While the Polston School District and state are showing growth in mathematics, a large student population has not demonstrated mastery of the state standards according to the data provided over the past 3 years. For the school term of 2019-2020, the Polston School District adopted the *BIM* curriculum for students in K-12. This program proposes to create innovative, hands-on activities paired with scaffolded instruction (Big Ideas Learning, 2022). With learning targets and success criteria, students can focus on learning. At the same time, teachers use the data to drive future instruction and provide additional opportunities for students to become more comfortable with strategic thinking and problem-solving (Big Ideas Learning, 2022). Although this program does not explicitly use SCCCR Standards, there is a close alignment. Figure 9 compares the 2007 South Carolina Academic Standards, Common Core, and SCCCR Standards for Mathematics (SC Education Oversight Committee, 2015).

Figure 9

Third-Grade Standards Alignment

3rd Grade Comparison		
2007 SC Academic Standards for Mathematics	**Common Core Standards for Mathematics**	**South Carolina College- and Career-Ready Standards for Mathematics**
3-2.1 Compare whole number quantities (through 999,999) with symbols (<, >, =) and words (***is less than, is greater than***, ***is equal to***).		**3.NSBT.5** Compare and order numbers through 999,999 and represent the comparison using the symbols >, =, or <.
3-2.2 Represent whole numbers in word form. (through 999,000)		**3.NSBT.4** Read and write numbers through 999,999 in standard form and equations in expanded form.
3–2.3 Apply an algorithm to add and subtract whole numbers fluently.	3.NBT.2: Fluently add and subtract within 1000 using strategies and algorithms based on place value, properties of operations, and/or the relationship between addition and subtraction.	**3.NBST.2** Add and subtract whole numbers fluently to 1,000 using knowledge of place value and properties of operations.
3–2.4 Apply procedures to round any whole number to the nearest 10, 100, or 1000.	3.NBT.1: Use place value understanding to round whole numbers to the nearest 10 or 100.	**3.NBST.1** Use place value understanding to round whole numbers to the nearest 10 or 100.
3–2.5 Understand fractions as parts of a whole.	3.NF.1: Understand a fraction 1/***b*** as the quantity formed by 1 part when a whole is partitioned into ***b*** equal parts; understand a fraction ***a***/***b*** as the quantity formed by ***a*** parts of size 1/***b***.	**3.NSF.1** Develop an understanding of fractions (denominators limited to 2, 3, 4, 6, 8, 10) as numbers. **a.** A fraction ***1/b*** (called a unit fraction) is the quantity formed by one part when a whole is partitioned into ***b*** equal parts;

Student understanding of math concepts and how well they can apply the skills are measured with the SCCCR Mathematical Process; therefore, SCCCR and SCCCR

Process Standards should be integrated for all grade levels (South Carolina Department of Education, 2015). A program evaluation of the *BIM* program is necessary to ensure that the curriculum is helping the students in Polston School District Title I schools reach school-, district-, and state-level goals. The data gathered from this study contributed to the decision-making for future textbook adoptions and curriculum changes.

Purpose of Evaluation

Polston School District needed to comprehensively evaluate the *BIM* curriculum to determine if Grade 3 students were making academic gains and improvements on math formative and summative assessments. Upon entering the third grade, students receive formal instruction in multiplication after having more than 2 years of practice with addition and subtraction, and it is important to recognize that multiplication is different from addition and subtraction (South Carolina Department of Education, 2022a). When multiplying, students collaborate with composite units, not just individual units. This shift from thinking about simple collections to understanding more complex multiplicative concepts is critical for developing strong mathematical skills (South Carolina Department of Education, 2023a).

As students progress to higher grades, they must be comfortable and skilled in addition, subtraction, multiplication, and division. Such skill is defined as automaticity, which is providing a correct response from memory (Nelson et al., 2013). Fluency is related to automaticity, which includes speed and accurate responses. Many researchers use automaticity as a performance predictor for high-stakes assessments (Baker & Cuevas, 2018). It is important to note that having a solid foundation in basic math skills affects how students respond to higher-level or multi-step mathematical problems. When automaticity is achieved at the appropriate developmental level, there is a higher chance of students experiencing continued mathematical success (Baker & Cuevas, 2018). For these reasons, assessing the math skills of third-grade students is crucial in helping educational stakeholders estimate student readiness for more advanced math functions or the need for academic assistance as students make progress to higher grade levels.

This study used the logic model to evaluate the effectiveness of the *BIM* curriculum specifically considering whether it influenced the performance of third-grade students. The focus of the evaluation included the background of the district, along with the demographic profiles of the enrolled students. The study included information regarding the district's mathematics goals, objectives for implementing the *BIM* curriculum, and to what extent desired goals have been achieved.

I analyzed *BIM* curriculum quality, resource appropriateness, and alignment with state standards. The evaluation examined the implementation of the *BIM* curriculum regarding classroom instruction and the use of suggested instructional strategies. In the Polston School District, students take three Mastery View predictive assessments every year. These formative assessments help teachers make data-informed instructional decisions that are suited for addressing all learners' needs and clarifying misconceptions in mathematical data. Via careful analysis, I aimed to measure any influence the *BIM* exerted on students' overall performance.

This program evaluation sought to provide information about the effectiveness of the *BIM* curriculum and to determine if the program aligns with the district's goals and objectives. Potentially, this study can assist educational stakeholders in making data-informed decisions regarding future textbook adoptions, the development of mathematics curricula, and alignment between the two.

Significance of Study

This program evaluation may contribute to stakeholders' understanding. It addresses an important gap in the literature on the effectiveness of the *BIM* instructional model in improving K-12 mathematics education. The study contributes to the research by identifying and analyzing the factors that facilitate or hinder the successful implementation and sustainability of the *BIM* instructional model in different school contexts. This study can help educational stakeholders make more informed decisions about new policies and practices geared toward adopting and utilizing evidence-based instructional models in K-12 schools (Smith et al., 2020). This program evaluation can impact teachers, administrators, and curriculum leaders, specifically those creating or providing mathematics instruction. By providing insights into the strengths and weaknesses of the *BIM* instructional model, the study can guide the development of more effective and efficient instructional approaches to improve students' mathematical proficiency and engagement.

Overall, this program evaluation may have far-reaching implications. Specifically, it is possible that improvement in K-12 mathematics education could occur through my generation of evidence-based insights into the effectiveness and implementation of the *BIM* instructional model. In addition, the results of this investigation can augment existing research on implementing math instruction with fidelity and how such instruction can impact student achievement over time. As math scores continue to be a nationwide concern, educational stakeholders must use instructional time and resources wisely.

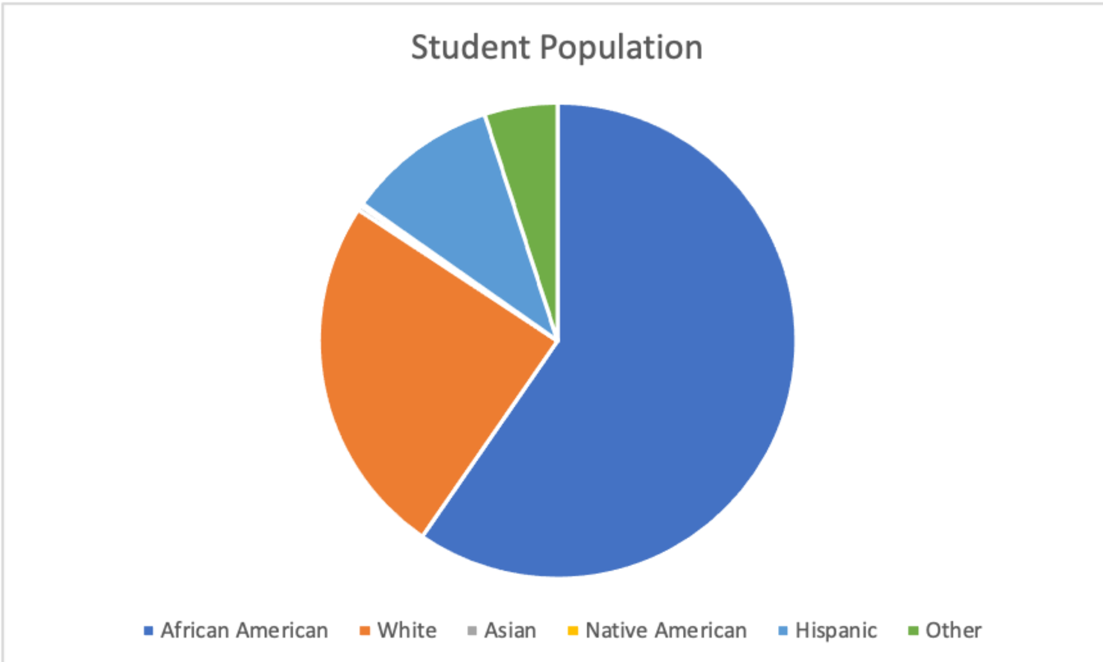
The study could provide specified areas where students require differentiated instruction or academic interventions to increase proficiency in math fluency. This study’s findings have the potential to assist educators, administrators, and policymakers who rely on precise and accurate assessments to identify students’ needs, formulate informed decisions about instruction, and allocate resources to support student learning. Furthermore, this research adds value to previous research on benchmark assessments and their role in promoting student achievement in Title I schools. This research is particularly crucial in Title I schools, where low-income students’ needs are more pronounced, and accurate assessments are essential for providing appropriate interventions.

Site Description

The Polston School District is reported to be one of the largest school districts in South Carolina. The district covers 242 miles and is situated geographically in an area that attracts a great diversity of cultural groups. There are 28,197 students ranging from prekindergarten to 12th grade. More than 3,500 full-time employees are in the district. Statistics reveal that 51% of students receive free or reduced lunch. The district is diverse in that the enrollment consists of African American (58%) students, White (24%) students, Asian (3%) students, Native American (0.18%) students, Hispanic (10%) students, and Other (4.82%) students. Figure 10 shows a visual of the student population based on these numbers.

Figure 10

Polston School District Student Population Demographics



The population of minority students continues to grow, and more than 60 languages have been reported. There are reported areas of segregation attributed to the location and size of housing areas, rural and urban regions. Approximately 11,000 students attend private schools, representing mostly underrepresented ethnic groups. As a result of these trends, there is a low enrollment of Caucasian students in the district's schools. Success with magnet schools has contributed to some of the district's current perspectives. Among them is that whenever a curriculum utilizes best practices and follows scientific evidence, the school demographics will be influenced and student achievement will be improved. The Polston School District has presented a definition of minority group isolation. It is believed that this occurs when students within specified ethnic groups at individual schools within the district have performance that is higher than average scores within the district. The district has a continuum of elementary, middle, and high STEAM magnets. The district of interest began implementing magnet schools in the early 1990s. Currently, there are 14 elementary schools, 11 middle schools, and 10 high schools considered magnets in the Polston School District. During 2016-2017, an estimated 1,570 elementary, 1,796 middle, and 609 high school magnet applications were filed.

Parents are permitted to select the preferred school of attendance. The selected school does not have to be where the child is zoned. One of the requirements is that parents have reliable transportation for their children to and from school. Anyone not participating in the choice program or attending a zoned school as a car rider, will ride the bus to and from school. This results in high transfer rates throughout the district.

Program Description

BIM is a comprehensive mathematics program created in the early 2000s by Ron Larson and Laurie Boswell. While initially published by Holt McDougal, Cengage Learning now owns and publishes the program (Big Ideas Learning, 2022). *BIM* uses a hands-on approach with scaffolded instruction. The National Council of Teachers of Mathematics (NCTM) standards determine the foundation of the program along with the Common Core State Standards and the reform movement in mathematics education, focusing on student-centered learning, problem-solving, reasoning, and communication (Big Ideas Learning, 2022).

Edreports (2019) conducted an alignment study and rated *BIM* as partially meeting expectations about college- and career-ready standard alignment. Alignment was based on the analysis of two gateways. According to Edreports, the gateways focus on standards and the instructional alignment and rigor of standards that promote student learning. Third-grade alignment partially met expectations as Gateway 1 met 14 of 14 criteria. However, Gateway 2 received 11 of 18, citing the curriculum as lacking rigor and full application of mathematical standards (Edreports, 2019). The report indicated minimal opportunities to demonstrate student understanding of mathematical concepts (Edreports, 2019).

BIM emphasizes the big ideas or concepts in mathematics. Such concepts are essential in helping students make mathematical connections and understand mathematical standards (Big Ideas Learning, 2022). The *BIM* program uses an adaptable approach that can be used in different classroom settings and teaching styles. In addition, *BIM* includes resources such as lesson plans, assessments, and virtual professional development opportunities (Big Ideas Learning, 2022). The *BIM* program has made updates based on research and best practices in mathematics. *BIM* uses feedback from educators to make improvements to the program continuously.

Although many school districts use the *BIM* curriculum, there is limited empirical evidence on its effectiveness in improving student learning outcomes. While some studies have reported positive results regarding various curriculums geared toward teaching mathematics, there is limited research on how the *BIM* curriculum aligns with curriculum standards, its impact on student achievement, and its suitability for diverse student populations. Moreover, it also needs to be discovered how well the program can be implemented with accuracy and whether comparable results are attainable in different school contexts. This program evaluation study evaluated the effects of the *BIM* instructional approach on student academic performance, as well as examined the factors that promote or impede its implementation and longevity within a selection of Title I schools located in a particular school district in South Carolina.

Conceptual Framework

In educational research, understanding the dynamics of learning interventions and their impact on student outcomes has always been important (Luft et al., 2022). Researchers and practitioners continually strive to identify the factors contributing to successful educational programs, seeking effective frameworks to guide investigations (Shikalepo, 2020). This study addressed the academic need by exploring the interplay between the logic model and constructivism.

The logic model provides a systematic approach to program planning, implementation, and evaluation, offering a coherent structure for understanding educational interventions' underlying mechanisms and outcomes (Milstein & Chapel, 2023). The logic model is a valuable tool for designing and assessing the effectiveness of educational initiatives. Its utility is characterized by its ability to delineate the logical relationships between program inputs, activities, outputs, and outcomes (Kalu & Norman, 2018).

Constructivism presents an alternative philosophical lens, emphasizing the active construction of knowledge through individual experiences, social interactions, and reflective thinking (Kumar Shah, 2019). Constructivist theories argue that learners actively engage with the learning environment, constructing their understanding and meaning from the information presented. This perspective acknowledges the role of learners' prior knowledge, motivations, and socio-cultural contexts in shaping their learning experiences and outcomes (Mugambi, 2018).

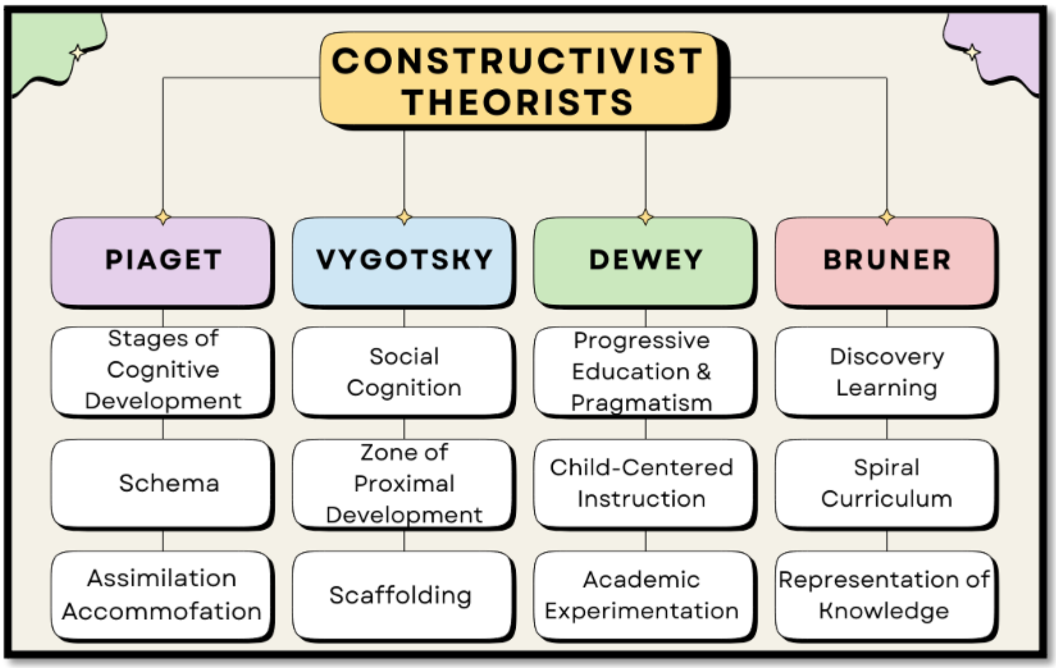
Recognizing the potential synergies between the logic model and constructivism, this dissertation sought to bridge the gap between these two frameworks, harnessing the collective strength to enrich the understanding of educational interventions. Integrating the logic model's systematic approach with the constructivist principles of active engagement and learner-centeredness provides a comprehensive conceptual framework that guides the design, implementation, and evaluation of effective educational interventions.

Constructivist Learning Theory

The constructivist learning theory is one of the grounding theories for education today. This theory fundamentally calls for a different learning model where management and apprenticeship undergo a drastic turn in which the student becomes the subject of the change (Devi, 2019). The constructivist learning theory is a prominent educational framework emphasizing learners' active knowledge and understanding construction. This theory sees learning as a process where students create meaning (Piaget & Indelder, 1969). The work behind this theory is attributed to Jean Piaget, Lev Vygotsky, John Dewey, and Jerome Bruner. Constructivists argue that people learn by doing, creating, and reflecting (Fernando & Marikar, 2017). Knowledge is not transmitted but rather generated by learners' previous understandings and real-world experiences. Figure 11 shows a breakdown of constructivist theorists and their topical contributions to the research.

Figure 11

Constructivist Theorists



The nature of constructivist theory rests on the role of social interaction in learning (Piaget, 1955). It is believed that students learn best when they discuss, debate ideas, and work collectively to find solutions to problems. According to Piaget (1952), this deepens understanding because learners are driven to negotiate meaning, share perspectives, and expand upon what one another knows. Another aspect of this type of learning is that it must be related to real-life experiences where learning experiences become enhanced when connected to students' interests and life experiences.

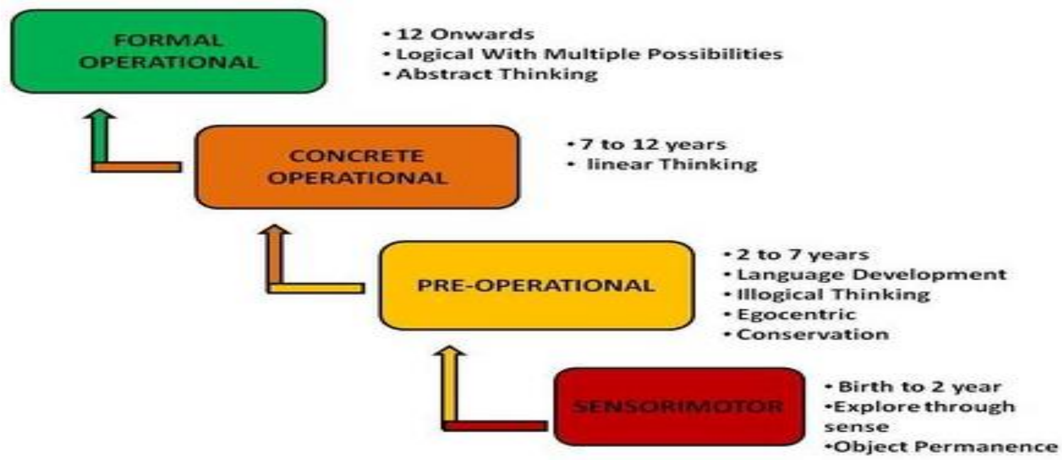
Constructivist methodologies stress learning as a continuous process. Learners constantly develop and refine the knowledge created by relating new information to the preexisting knowledge structure, while rearranging, reflecting, and self-assessing internal models (Piaget, 1964). Reflective practice is backed by metacognitive awareness that will help learners evaluate themselves where they are in their learning process and identify areas of weakness and limitation and ways of lifelong learning (Chand, 2023).

Educators implementing constructivist principles dismantle learning environments that motivate investigative study, combined with inquiry and discovery (Matthews, 2003). They provoke student-initiated activities that enhance critical thinking combined with creativity and problem-solving skills. According to Jones and Brader-Araje (2002), cultivating an environment unique to inspiring curiosity, in which students can take ownership in their learning venture, educators currently push learners not only for academic knowledge but especially toward adaptive skills and self-confidence to confront the complexities of a changing world driven by rapid growth.

Piaget (1952) proposed that knowledge is constructed through active participation within an environment and identified stages of cognitive development, identifying how learners progress from simple to more complex understandings of the world. Piaget (1952) proposed that knowledge is constructed through such stages and life experiences within their environment. Figure 12 depicts Piaget’s (1952) cognitive development stages.

Figure 12

Piaget's Four Stages of Cognitive Development



Piaget (1964) identified the first stage as sensorimotor, which occurs between 0 and 2 years of age. Babies learn through exploration using their senses and reasonable actions. The next stage is preoperational. Children between 2 and 7 years of age use language. The concrete operational stage involves logical thinking but heavily relies on real experiences for children from 7 to 11 years old. For 12-year-olds and beyond, abstract and logical thinking are developed in the formal operational stage (Piaget, 1964, as cited in Gauvain & Cole, 2005). These stages represent active learning where new information is integrated with existing knowledge, creating a scaffolded understanding. Active learning includes an element of social interaction where learning is enriched by collaboration and dialogue. Contextual learning occurs when knowledge takes on new meaning when connected to real-life contexts and experiences. Discovery learning is the last element of active learning (Triantafyllou, 2022). During this process, through independently investigating, asking questions, and discovering new information, students develop new understandings.

Vygotsky's theory furthered the ideals of constructivism by emphasizing the critical role of social interaction in the learning process (Vygotsky & Cole, 1978). He believed that learning thrives through collaboration and support from more knowledgeable individuals, introducing game-changing concepts like the zone of proximal development (ZPD), scaffolding, and the intricate relationship between language and thought (Vygotsky & Cole, 1978). The ZPD reveals that learners can tackle more challenging tasks with the right support from teachers or peers, highlighting the transformative impact of guided assistance and collaborative learning. ZPD is where differences are noted regarding what learners can accomplish individually and with assistance from a skilled peer (Kurt, 2021). Figure 13 shows a visual depiction of the zones of proximal development.

Figure 13

Vygotsky's Zones of Proximal Development

Scaffolding includes the provision of support until the learner can complete tasks individually. Providing temporary support for the learner helps them progress through the

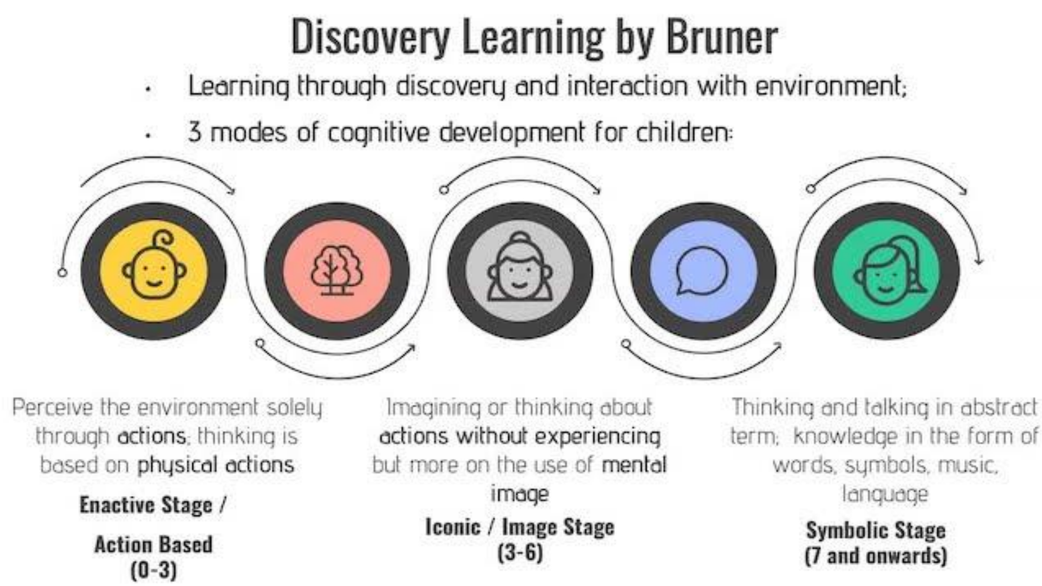
ZPD (Vygotsky & Cole, 1978). Social interaction, language, and thought are important in the development of cognition. Vygotsky purported that language is a separate system from thought in early years but begins to connect near 3 years of age (Miranda, 2011). Vygotsky believed that culture and community influenced learning and development (Vygotsky & Cole, 1978).

Dewey (1916) stressed the importance of active learning and experience in the educational process. Learning occurs through education, experience, and reflection. Dewey also believed a direct approach was necessary to help humans learn. Additionally, Dewey cultivated the idea that students should hone critical-thinking skills through inquiry-based learning. This approach immerses students in opportunities to question, explore, and engage deeply, forging meaningful connections to the real world (Bruner, 1964).

Bruner (1964) propelled the understanding of cognitive development and knowledge construction even further, enriching the educational landscape with his insights and theories. The key ideas around his research involve enactive, iconic, and symbolic representation. Figure 14 shows Bruner’s process of discovery learning.

Figure 14

Bruner's Discovery Learning Diagram

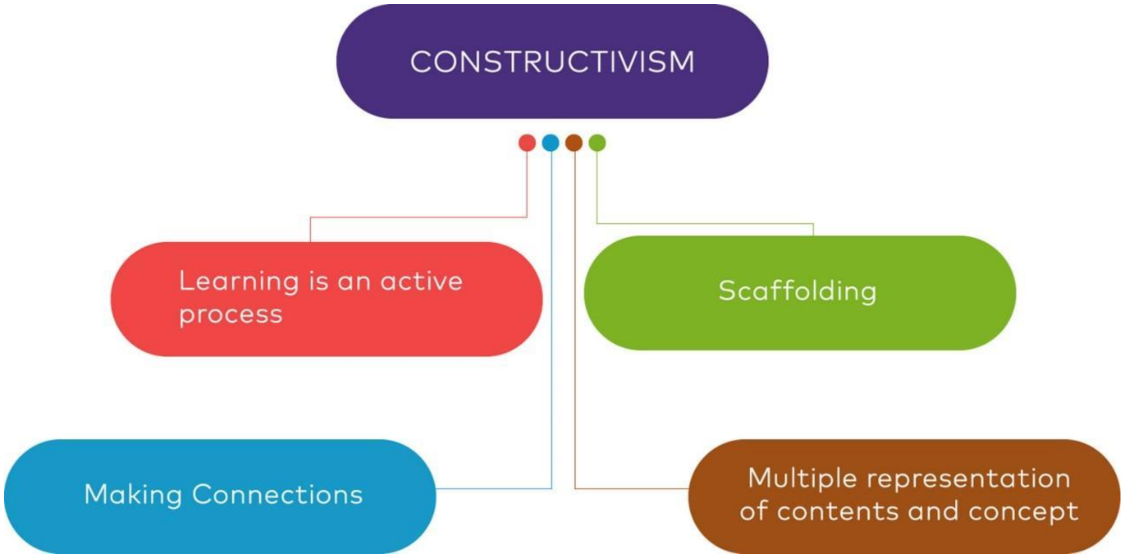


According to Bruner (1986), the enactive representation occurs from 0 to 1, and knowledge is stored from motor responses. Iconic representation occurs from 1 to 6 years of age, and knowledge is stored visually as images. Symbolic representation occurs from 7 and up. Knowledge is stored in the form of symbols, such as language, which encourages more critical thinking and problem-solving. In addition, Bruner (1964) introduced the idea of the spiral curriculum where complex ideas can be taught on simplistic levels first and more complex later. He believed that children, at any stage of development, can be taught, if the information is presented appropriately.

The constructivist learning theory is a pertinent theoretical framework for this dissertation, which examines the effectiveness of the *BIM* program. Grounded in constructivist principles, this framework emphasizes that learners actively construct their understanding and knowledge through interactions with the learning environment. Figure 15 depicts a graphic organizer that illustrates the flow of the constructivist learning theory.

Figure 15

Image of the Constructivist Learning Theory



The *BIM* program aligns with the core principles of the constructivist learning theory, incorporating active engagement, social interaction, authentic contexts, metacognition, and reflection. Through active engagement, students have direct experiences and opportunities to solve real-world problems. In addition, students can explore mathematical concepts and models that require student participation and critical-thinking skills (Saleem et al., 2021). Through social interaction, collaborative learning is fostered through the program's emphasis on cooperative group work and peer discussions. Students are given opportunities to engage in mathematical discourse, share their ideas, and solve problems collaboratively (Powell & Kalina, 2009). As students interact with one another, they extract meaning and increase understanding, which leads to increased knowledge.

Logic Model

A logic model is a tool that evaluators use to manage and learn from a program's implementation and beyond (W.K. Kellogg Foundation, 2004). A logic model can be used for program or project planning, monitoring, managing, or evaluating (National Reporting System for Adult Education, n.d.). The logic model expresses the design of the program and intended activities and outcomes and serves as a visual plan that incorporates actionable steps to bring about change (Savaya & Waysman, 2005). Examination of the logic model provides opportunities to identify areas of improvement or how to enhance sustainability. The model's components include a description of the situation; inputs; activities; participation outputs; and short-, medium-, and long-term outcomes.

Joseph Rice conducted the first formal program evaluation in America between 1887 and 1898 (Phillips, 2018). He conducted a comparative study of the value of drills in spelling instruction in several school districts. Rice used test scores as his criteria measures in evaluating spelling instruction. He found no significant learning gains between systems that spent up to 200 minutes a week studying spelling and those that spent as little as 10 minutes per week. Rice's results led educators to reexamine and eventually revise their approach to teaching spelling. More important from the point of view of this history of program evaluation is his argument that educators had to become experimentalists and quantitative thinkers and his use of comparative research design to study student achievement (Hogan, 2007).

During the 1990s, the logic model became a prominent and highly recommended tool or method for planning program evaluations. Variations of the logic model also circulated under various names such as chains of reasoning, theory of action, and performance framework (Dwyer & Makin, 1997). The term logic model appears to have had the greatest endurance and has garnered utility beyond the realm of program evaluation. Many researchers and practitioners are credited with developing and popularizing logic models and evaluation methods (Greenfield et al., 2015). Their contributions have been of a very high order in clarifying program evaluation with tools and frameworks to conduct planning, implementation, and assessment of programs. Some key people include Carol H. Weiss, who was seen as a prominent figure in program evaluation. Her interests were directed toward the importance of understanding the theory of change that underlies programs of which a logic model is a central component. Her work on program theory and the development of methods for evaluating their execution lent credence to logic models (Goldsworthy, 2021).

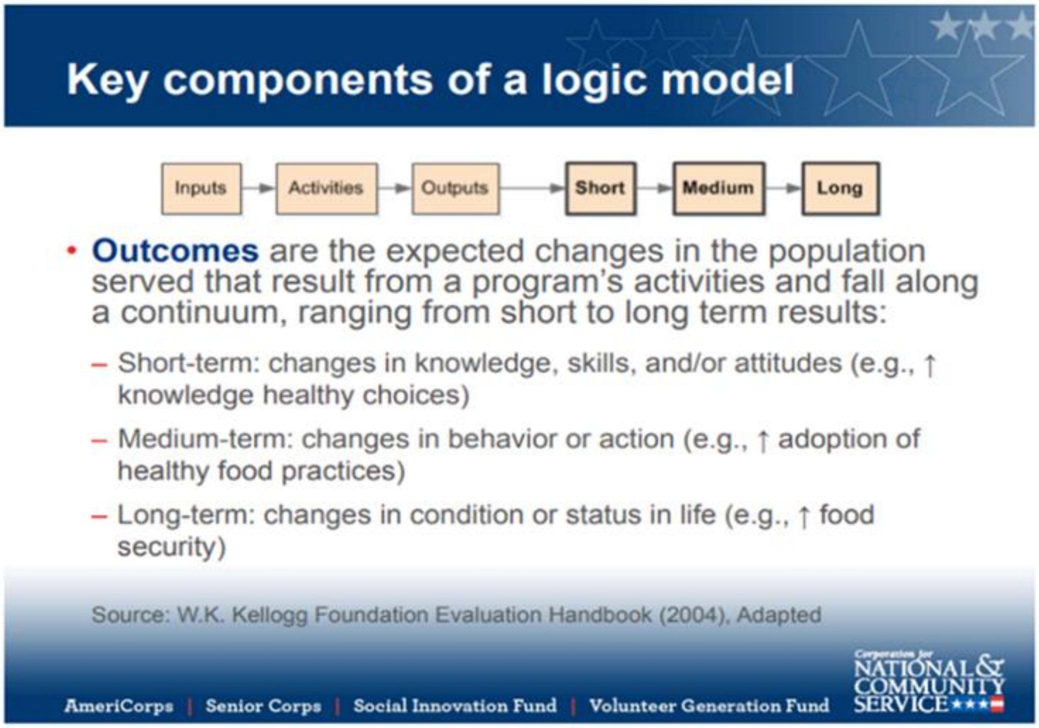
In addition, Joseph Wholey is best known for his work on the encouragement of the use of logic models in performance measurement and management. He wrote of the need for systematic approaches to planning and evaluating programs that ground problems to improve accountability and effectiveness (Millar et al., 2001). Michael Quinn Patton is one of the most influential evaluators, probably best known for his work on utilization-focused evaluation which underlines the actual use by stakeholders themselves of evaluation results. In his career, though, he never focused too much on logic models. The impact of his work, however, has been upon the broader landscape of methods of evaluation (Patton & Campbell-Patton, 2022).

Rossie et al. (2018) made major contributions to program evaluation with their broad frameworks and methodologies that give in-depth detail regarding how to conduct a program evaluation. The W.K. Kellogg Foundation (2004) was influential in promoting the use of logic models within program planning and evaluation. It produced comprehensive guides and associated resources that have been used within most fields. These researchers and organizations have cumulatively helped frame this field of program evaluation, providing key frameworks, methods, and practical tools that made logic models and other methods of evaluation an integral part of effective program planning and assessment (Hayes et al., 2011).

For outcomes of the program evaluation to be obtained, the process begins with inputs. Such resources include specific curriculum, personnel, funding, and instructional materials. Activities are the actionable steps taken and the use of inputs to achieve the program's desired outcomes (Kekahio et al., 2015). Outputs include activities and participation and consist of what is done or given to arrive at specific outcomes or target populations (University of Wisconsin-Madison, 2024). Outcomes are the changes or results that have come about because of the program. Within the model, desired outcomes can be described as either short-term, medium-term, or long-term (Newcomer et al., 2015). Figure 16 visually represents short-, medium-, and long-term goals and how they fit into the logic model.

Figure 16

Key Components of a Logic Model



Short-term outcomes affect learning, awareness, knowledge, or skills. Medium-term outcomes affect action, behavior, and practice. Long-term outcomes affect the conditions, including a more significant impact on the environment or organization (Friedman, 2018). Assumptions are what is believed about the program, and external factors include anything outside of the organization's control that could impact the program or its desired results (Elite Research, 2023). By reviewing and analyzing the components of the logic model, the evaluators can determine if all elements are implemented appropriately and identify areas that may require improvement to ensure the success of the program.

As it relates to mathematics, using math to solve real-world problems is critical. More opportunities to practice and work with such problems can assist students with practical skills, mathematical concepts, and content application to real-world connections (National Reporting System for Adult Education, n.d.). A logic model helps us understand how *BIM* supports this process. It is a visual representation of how various parts of the program work together, from the resources and activities to the outcomes for students.

Regarding *BIM*'s real-life situations, the logic model starts with what is brought into the program (Eaton, 2010). Some resources include textbooks and workbooks, trained educators, required technology, computers, and calculators. Real-world data sets are included as inputs as they bridge the gap between abstract math concepts and real-life applications. With inputs in place, the *BIM* program can be implemented through the instruction of trained teachers to introduce and teach students about different math concepts and skills (Suber, 2019). Students engage in problem-solving activities, including real-life scenarios that require them to apply their math knowledge. Teachers guide discussions and provide support as students work on modeling activities. Classroom technology is used to analyze data and create mathematical models. Collaborative projects and investigations, using real-world data, help students connect their learning to the world around them.

As a result of these activities, specific outcomes, or outputs, are achieved (Goldman & Schmalz, 2006). Students develop a better understanding of math concepts and skills, which helps them initiate solutions to problems and increase their skills to think critically about concepts. They gain the confidence to apply math to real-life situations and improve their ability to analyze data. Importantly, the program has the potential to create an engaging learning environment that sparks students' interest and enthusiasm for math.

In the short term, these outputs lead to visible changes and accomplishments (Ontario, 2021). Students perform better on math assessments, demonstrating their improved understanding and application of math concepts. They also become more confident and excited about solving math problems, setting the stage for future success. Through exposure to real-life scenarios, students learn to identify situations where math can be applied. They also develop skills to interpret and analyze complex data, building their data literacy.

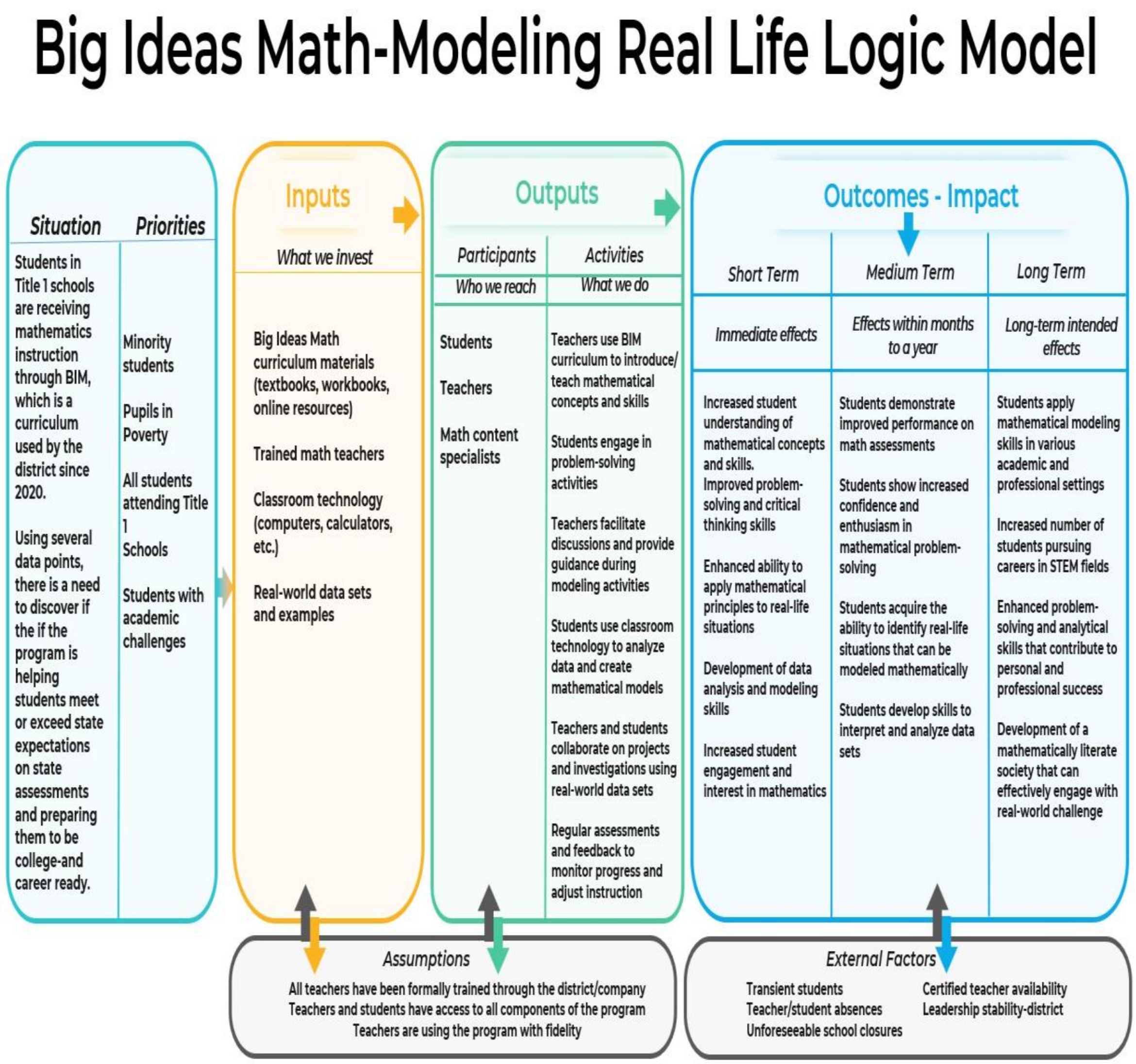
As students progress, the impact of the *BIM* program in the mid-term can be seen. Students can apply their modeling skills to other subjects and real-life situations, recognizing that math is connected to many areas of study. Such progress provides an opportunity for students to come to understand the real-world relevance of math beyond the classroom. This understanding translates into better performance in STEM fields and increased interest in pursuing STEM careers.

In the long term, the effects of the *BIM* program go beyond the classroom. Graduates of the program use their modeling skills in various academic and professional settings, equipped with analytical abilities to tackle complex challenges. As more students pursue careers in STEM fields, the program contributes to scientific and technological advancements. The emphasis on problem-solving and analytical thinking also cultivates broader skills that benefit students in all aspects of their lives.

By examining the connections between inputs, activities, outputs, and outcomes, the logic model for *BIM* provides a comprehensive understanding of how the program supports students in applying math to real-world situations. Figure 17 depicts the logic model for the *BIM* program used in the Polston School District.

Figure 17

BIM: Modeling in Real-Life Logic Model



Situation

The situation is identified as the existing problem the program aims to address. It is important to not only identify the problem but to discover why it exists, whom it affects, key stakeholders who would benefit from the resolution, and what the research or prior experience says about the problem (Julian, 1997). The current state of the *BIM* program is identified in the situation statement. Students in Title I schools receive mathematics instruction through *BIM*, a curriculum used by the district starting in 2020. There is a need to discover if the *BIM* curriculum helps students meet or exceed expectations on state assessments. Student readiness for college and careers must also be explored. The evaluation aims to identify its effectiveness in advancing student achievement in mathematics instruction. The populations who would benefit from this evaluation are minority students, pupils in poverty, all students attending Title I schools, and students with academic challenges.

Inputs

The inputs are the resources needed for program implementation (MacDonald, 2018). These resources include *BIM* curriculum materials such as textbooks, workbooks, online resources, trained math teachers, classroom technology computers, calculators, and real-world data sets and examples.

Outputs

Outputs can typically be tangible and result from the activities (Institute of Education Sciences, n.d.). This logic model shows a series of outputs for all input categories. Outputs were divided by activities and participation, including increased student understanding of mathematical concepts and skills, improved analytical thinking and generation of solutions, enhanced ability to apply mathematical principles to real-life situations, data analysis, modeling skills development, and increased student engagement and interest in mathematics. Teachers facilitate discussions and guide modeling activities as students use classroom technology to analyze data and create mathematical models. There is a collaboration among teachers and students on projects and investigations using real-world data sets. In addition, regular assessments are administered and feedback is provided to monitor progress and adjust instruction.

Outcomes

The outcomes are the resulting actions based on the activities and outputs employed. Outcomes are often tied directly to the program's goals and should be listed in the order of expected attainability (Fox, 2020). The *BIM* logic model includes short-, intermediate-, and long-term outcomes; however, this study focused on short-term outcomes. Short and intermediate outcomes can be implemented quickly to make changes that would positively affect a program. Long-term outcomes change the status of the program over time.

Short-Term Outcomes. There should be an increase in student understanding of mathematical concepts and skills, along with increased analytical thinking and generation of solutions. Learners develop the capacity to apply mathematical principles to real-life situations while developing data analysis and modeling skills. In addition, there should be an increase in student engagement and interest in mathematics (Shakman & Rodriguez, 2015).

Medium Outcomes. Students should demonstrate improved performance on mathematics assessments. In addition to demonstrating increased confidence and enthusiasm in mathematical problem-solving, students should acquire the ability to identify real-life situations that can be modeled mathematically. Students should develop skills that will assist with interpreting and analyzing data sets (McCawley, n.d.).

Long-Term Outcomes. Long-term outcomes impact the program holistically and lead to long-term changes that will lead to continued improvement (Institute of Education

Sciences, n.d.). Students should apply mathematical modeling skills in various academic and professional settings. More students should pursue careers in STEM fields, enhancing problem-solving and analytical skills contributing to personal and professional success, and developing a mathematically literate society that can effectively engage with real-world challenges.

Assumptions

Logic model assumptions include the thoughts or beliefs participating stakeholders have about how the program works and often guide the decision-making process (University of Wisconsin-Madison, 2024). The assumption for the *BIM* program evaluation is that all teachers have been formally trained throughout the district. Teachers and students should have access to all program components, and the program should be implemented with fidelity.

External Factors

External factors are circumstances that are beyond the organization's control and have the potential to influence the success of program implementation or its participants (University of Wisconsin-Madison, 2024). Regarding the *BIM* logic model, external factors include transient students, certified teacher availability, teacher and student absences, district-based leadership stability, and unforeseeable school closures.

Research Questions

1. What are the variations in student achievement among third-grade students in Polston School District Title I schools?
2. How did the *BIM* program influence SC READY third-grade student proficiency during 2019-2023 in Polston School District Title I schools?

By answering these questions, the program evaluation study can provide valuable insights into the strengths and weaknesses of the *BIM* instructional model and inform future efforts to improve mathematics education in K-12 schools.

Definition of Terms

The following terms are used in this study.

Benchmark/Formative Assessments

Assessments are administered throughout the school year at scheduled intervals to measure student progress toward learning goals. These assessments guide educators in determining student needs and the development of plans for addressing them. It is important to note that formative assessments are low stakes and should not be used as a grade (Carnegie Mellon University, n.d.).

Mastery View Predictive Assessments

Formative assessment is designed to predict future performance in a particular subject area, standard, or indicator. Teachers typically use the data from these assessments to pinpoint students who are candidates for additional support or may be experiencing academic challenges (Instructure, 2023).

MAP

The MAP assessment is a computer-adaptive test designed to measure student academic progress and growth in math, reading, and language usage (Meyer & Dahlin, 2022).

SC READY

SC READY assessment is the high-stakes test used in South Carolina to measure student achievement in ELA and mathematics (South Carolina Department of Education, 2024c).

Organization of Study

This study consists of five chapters. Chapter 1 introduced the study, including background information, research questions, the significance of the study, an overview of the theoretical and conceptual frameworks, and definitions of key terms. Chapter 2 reviews the literature on national and local mathematical deficits and trends. Chapter 2 also reviews the literature on the use of the *BIM* instructional program. Chapter 3 provides an overview of the methods utilized, which include the research design, descriptions of participants, data collection procedures, data analysis methods, limitations, delimitations, and ethical considerations.

Chapter 4 presents the study's findings, including the relationship between math instruction and quarterly benchmark assessments. Chapter 5 expounds on the study's implications for educators, policymakers, and researchers, outlining how it can inform their practices and future investigations. Chapter 5 also examines the constraints of the study and offers suggestions for future research. Overall, this dissertation sought to evaluate math instruction and provide valuable insights into the effectiveness of *BIM* instruction and its effect on student achievement by way of Mastery View benchmark assessments and available SC READY scores.

Chapter 2: Literature Review

Finding the proper tools and materials for effective math instruction can be challenging (Powell et al., 2022). The effort to address this challenge has led to curriculum revisions and policy changes over many years. Hill (2021) reported that for more than 30 years, there has been a focus among education policymakers on ways to improve math instruction in Grades K-8. Specifically, early work included the 1990 revisions to state mathematics standards. Then, over time, the reforms resulted in the employment of Common Core State Standards by 2010 (Carmichael et al., 2010). As a result of these changes, students were tasked with demonstrating that they understood what math meant instead of only learning math facts. Teachers assist students with figuring out the meaning, and students are expected to engage in math in a way that allows them to explain the operations and create models (NCTM, 2023). If the materials and standards are effective, teachers are expected to have greater math knowledge and more expert teaching skills; however, it is uncertain whether these methods are working.

New Math

The advent of the New Math initiative from the 1950s to mid-1970s aimed to completely transform the landscape of mathematics education by championing the principles of abstract reasoning and problem-solving, thereby replacing a more conventional approach that prioritized memorization and algorithmic methods (Fey, 1978). This reform was spurred by apprehensions that American students were trailing their global counterparts in mathematical dexterity.

The New Math curriculum was characterized by introducing innovative concepts, including set theory, non-decimal numerical systems, and symbolic logic, and placed great emphasis on the study of mathematical notation and abstract mathematical structures such as groups and fields (Furinghetti et al., 2013). The goal was to cultivate a more profound and intuitive comprehension of mathematics rather than simply memorizing formulas and methods; however, the New Math initiative encountered fierce resistance from some teachers, parents, and students who found the new concepts and approaches difficult to grasp (Herrera & Owens, 2001).

Kendig (1974) noted that critics contended the focus on abstract concepts and symbolic notation diminished students' ability to acquire practical arithmetic skills and solve problems effectively. In response to these criticisms, the New Math initiative gradually faded from prominence in the 1970s, though its influence continues to resonate in modern mathematics education (Canada, 2007). Despite its oppositional reception, the new math movement impacted math education in the U.S. It brought about novel methods of teaching math, raised the bar for math education, and stimulated discussions about the merits of abstract concepts in math education that endure to this day (Herrera & Owens, 2001).

Back to Basics

The Back-to-Basics movement emerged in the 1960s as a reaction to increased public concern about declining academic standards in the United States and a math crisis (Mueller, 1966). It supported a return to more conventional educational priorities, focusing on reading, writing, and arithmetic. Advocates of this movement maintained that foundational basic skills were essential for future success in academic and professional settings (Morgan & Robinson, 1976).

The Back-to-Basics initiative influenced educational policy and practice. Schools' curricula were redesigned to give prominence to basic subjects. The testing and assessment practices were integrated with this new focus, all of which resulted in enhanced interest in standardized testing to be used as a benchmark for measuring student success and the effectiveness of schools (Weingartner, 1977).

Despite its wide acceptance for implementation, the Back-to-Basics movement was under heavy criticism. This initiative was viewed as disregarding the needs of different learners, especially those from other cultural, linguistic, and socioeconomic backgrounds (Offner, 1978). Critics noted that the movement was concentrated only on rote learning and memorization, with hardly any emphasis on developing higher-order thinking abilities, such as critical thinking, creativity, and problem-solving. Indeed, this criticism raised a growing fear that the movement was not preparing students adequately for the unwanted changes of modern life, in which adaptability and innovative thinking are more important than ever (Kraus, 1978).

In addition, the educators and researchers also pointed out that this Back-to-Basics approach overlooked the vital areas of education, such as the arts, social sciences, and health and physical education, all combining to provide a balanced education (Brodinsky, 1977). Arguments arose about the proper weight between the covered basics and a wide range, raising experience for children at their intellectual and emotional levels of growth. Although the Back-to-Basics movement aimed at correcting perceived deficiencies in academic standards through a return to fundamental education practices, it also raised a lot of controversy and criticism (Burk, 1979). Though the impacts of this movement on education policy and practice were strong, its limitations concerning encompassing the diverse needs of learners and nurturing comprehensive critical-thinking skills brought forth well the complexities of educational reform and continued challenges to meet the diverse needs of learners (Barnes, 2020).

An Agenda for Action

The National Commission on Excellence in Education (1983) wrote a seminal report entitled *An Agenda for Action*, outlining concerns about American education (Klein, 2003). The paper responded to a crisis in terms of faltering academic performance, insufficient qualifications of educators, and a lack of training. The Research Advisory Committee of the National Teachers of Mathematics (1984) identified the recommendations the report made that were designed to revive American education and make it more competitive with the rest of the world.

The most prominent suggestions were raising academic standards, especially in core subjects such as mathematics, science, and English, and emphasizing academic rigor (Ross et al., 1995). This proposal was based on the rigorous educational background in these fields that formed the basis of student success in an increasingly technological, knowledge-based economy. The report added that there had to be much more than incremental changes in the field of education and vast improvements were needed (National Commission on Excellence in Education, 1983).

Pejouhy (1990) discussed the emphasis the report placed on raising teacher competence through the improvement of their preparation through better programs that would be designed to equip them with current pedagogical skills and content knowledge, professional development to update the skills of teachers on new educational research and teaching methods, and better pay to recruit and retain competent teachers. It insisted on better working conditions to enable teachers to deliver their roles and reduce burnout

(Crosswhite et al., 1989).

The most critical aspect was that of school leadership. The report emphasized the need for effective school leadership as a catalyst for improvement within schools (Middleton et al., 2004). It urged that principals needed more authority to enable them to make basic decisions that would directly impact school performance and enhance accountability. The report also advocated for increased parental and community involvement in decision-making, acknowledging that a collaborative approach enhances educational outcomes and makes schools more responsive to the communities served (Morris & Arora, 1992).

It also demanded more accountability from the system of education. Part of the effort at more rigorous testing and evaluation of student performance was to ensure that academic standards were being met (NCTM, 1980). It emphasized the transparency and public disclosure of school performance data as other important elements toward building accountability and continuous improvement. The report favored more innovation and experimentation in education to try out pioneering technologies and teaching methodologies (Osborne & Kasten, 1992). Greater flexibility should be introduced in curriculum design and scheduling to meet the diverse needs of students and to adjust to changes in educational needs.

The recommendations in "An Agenda for Action" generated new reforms in education at the federal, state, and local levels of government (Crosswhite, 1985). Many of these reforms were designed to deal with the serious issues raised in the report and altered educational policies and practices throughout the United States. Indeed, the repercussions of the recommendations still shape American education, and glance at the fact that the impact of the commission's work has not diminished.

A Nation at Risk Report

In 1983, a Reagan administration report, *A Nation at Risk*, discussed the failing status of America's educational system (National Commission on Excellence in Education, 1983). The report exposed deficiencies and set forth recommendations that would potentially stop the decline in our nation's schools. Such recommendations included increasing graduation requirements, toughening academic standards and graduation requirements, raising expectations for the academic and behavioral performance of students, extending school days and the school year for more instructional time, extending preparations for teachers, and providing supplies and instructional materials (Bill of Rights Institute, n.d.).

Ironically, *A Nation at Risk* was among the most criticized reports for that period (Gardner, 1984). Critics argued that while the report had grasped with great effect the problems that plagued public education in the country, it was weak in making an effective diagnosis of those problems (Gerardi & Benedict, 1984). The subtext of this criticism was that there was a chasm between the symptom identification phase and understanding the contributory factors to falling standards in education.

In response to these deep-seated problems in education, President Clinton signed the Goals 2000: Educate America Act in 1994 (Schwartz et al., 2000). It was designed to provide a framework for educational reform by offering funds to states to develop tough academic standards and clarify student performance expectations. Stedman (1994) reported that Goals 2000 strove to improve quality and accountability by linking student outcomes to definite standards. This focus on standards and accountability led to the new federal education policy.

The No Child Left Behind Act of 2002 (NCLB), proposed by the Bush administration, further intensified the emphasis on standardized assessments as indicators of student success (Sclafani, 2002). NCLB represented a significant reauthorization of the original ESEA of 1965, which President Lyndon B. Johnson had implemented as a portion of his war on poverty. NCLB proposed a plan to close achievement gaps by holding schools accountable for the academic performance of every student, especially those facing significant disadvantages (Fritzberg, 2003). It mandated annual testing, increased federal oversight, and imposed sanctions on schools that failed to make adequate yearly progress.

In 2009, the Obama administration formulated a new accountability system through the Race to the Top initiative that was grounded on the accountability set by NCLB (U.S. Department of Education, 2009). This competitive grant program provided monetary incentives for states that took comprehensive educational changes such as enhancing teacher effectiveness, turning around low-performing schools, and adopting college- and career-ready standards. Since Race to the Top encouraged innovation and experimentation across leading educational systems of states, more emphasis was given to the role of the federal government in bringing about improvement in education (Maranto, n.d.).

In 2015, the Obama administration designed ESSA as the successor to NCLB. ESSA was intended to respond to some of the criticisms of its predecessor by providing states with more latitude in implementing federal requirements while maintaining a strong emphasis on accountability (Maranto, n.d.). ESSA provided for standardized testing methodologies to be used in all states for a consistent measure of student performance; it made provisions for selecting highly qualified teachers; and it weighed measures taken on monitoring schools underperforming to support them. ESSA was an outgrowth of desires to balance federal oversight with state autonomy, with the aspiration of founding an educational system that is more effective and fair (South Carolina Department of Education, 2024a).

Such acts and initiatives of a legislative nature, taken together, reflect the changes in U.S. education policy. They reflect that the academic standards and increase in accountability have been protected to ensure the delivery of quality education to each student (Jennings, 2018). From *A Nation at Risk* to ESSA, every policy has learned from its forerunners to move ahead toward the goal of creating an education system that can meet the numerous needs of America's young people and ensure their long-term success.

Math Wars

The math wars have been an ongoing and contentious series of debates and disagreements that have plagued the United States for decades regarding the optimal approach to mathematics education (Whitehurst, n.d.). These debates have revolved around two opposing schools of thought–traditional or basic skills approaches and reform or conceptual approaches. The traditional approach emphasizes the rote memorization of basic mathematical skills and procedures, including arithmetic facts and algorithms, while the reform approach prioritizes problem-solving, reasoning, and conceptual understanding (Wright, 2012).

Schoenfeld (2003) highlighted the concerns over declining math achievement scores, the best mathematical teaching practices, and the role of calculators and other technological advancements in mathematics instruction that sparked the math wars. Those in favor of traditional approaches for teaching math, such as memorization and focusing on basic skills, were necessary for students academically and professionally. On the contrary, the opposing side believed that students would be more successful with a mathematics curriculum that provided opportunities for more critical thinking and problem-solving to experience success academically and professionally (Becker & Jacob, 1998). The math wars led to the implementation of a balanced curriculum that would allow for traditional and reform approaches involving mathematics instruction among numerous districts across the United States.

National Research Council: Adding It Up

Adding It Up: Helping Children Learn Mathematics, a widely esteemed report, was published by the National Research Council et al. in 2001. The report offers a comprehensive appraisal of mathematics learning and teaching research, furnishing guidance for ameliorating mathematics education throughout the United States (National Research Council et al., 2001). The council presents multiple components such as conceptual understanding, procedural fluency, strategic competence, adaptive reasoning, and productive disposition (Suh, 2007).

The report proclaimed the importance of effective mathematics instruction, which involves elevated levels of problem-solving, reasoning, communication, and the purposeful use of technology to foster learning (National Research Council et al., 2001). The report is founded upon three goals that would use research in K-8 mathematics instruction, teacher quality, and curriculum improvements or recommendations, and a tool to guide educational stakeholders in the decision-making process (National Research

Council et al., 2009). The notion is that teachers have completed course requirements and may have a general understanding of how mathematics education looks; however, some may lack the skills necessary to teach their students how to connect to math (American Federation of Teachers, 2023).

National Principles and Standards for School Mathematics

In 2000, NCTM released the Principles and Standards for School Mathematics, which included recommendations for improving mathematics education. The document shifted the thinking in how math was taught and focused on numbers and operations, data analysis, geometry, algebra, probability, and measurement (Allen, 1963). It further delineated process standards, including connections, representation, communication, reasoning, and problem-solving, which comprise the foundation of effective mathematics instruction (Ferrini-Mundy, 2001). NCTM (2000) recognized a need for a foundation of basic and conceptual skills paired with technology to create a more balanced approach to mathematics instruction. This document created major shifts in mathematical teaching and learning.

2006 Curriculum Focal Points

The 2006 Curriculum Focal Points were developed by NCTM (2006) as a framework to guide mathematics education in K-8 classrooms in the United States. These focal points represent critical mathematical concepts and skills that students should master at each grade level. They serve as a foundational document in the field of mathematics education and have influenced curriculum development and teaching practices (Schielack & Seeley, 2007). The 2006 Curriculum Focal Points are designed to provide a coherent and logical progression of mathematical topics from kindergarten through eighth grade. They emphasize the development of deep mathematical understanding, critical-thinking skills, and mathematical reasoning level (Fennell, 2007).

Overall, the 2006 Curriculum Focal Points represent a comprehensive and rigorous framework for mathematics education, promoting a deep understanding of mathematical concepts and their application in various contexts (NCTM, 2006). They have played a pivotal role in shaping mathematics curriculum development and guiding educators to provide high-quality mathematics instruction to students. These focal points are continued resources for educators and curriculum designers striving to improve mathematics education at the K-8 classroom level (Cozza et al., 2009).

NCLB

NCLB, a federal law, was passed in 2001 to improve educational practices and provide equitable outcomes for all students in the United States (U.S. Department of Education, 2005). To that end, it became mandatory to administer annual mathematics and reading standardized assessments for students in grades 3-8, for which schools would be responsible for student scores (Sclafani, 2002). NCLB developed learning or proficiency targets for student achievement. Schools would be labeled as failing if overall student targets were not met.

NCLB requires states to establish teacher qualification standards and develop systems for measuring teacher effectiveness. NCLB provided funding for programs geared toward academic improvements for disadvantaged students. NCLB was widely criticized as focusing more on standardized testing than providing adequate support for schools and teachers (Dee & Jacob, 2011).

National Mathematics Advisory Panel Report

The *National Mathematics Advisory Panel Report*, a publication that surfaced in 2008, was the brainchild of a council of luminaries chosen by the president of the United States to delve into the state of mathematics education in America and to furnish recommendations for uplifting mathematics instruction (Kelly, 2008). The council consisted of experts from diverse backgrounds, including mathematics education, cognitive science, psychology, and neuroscience. The report, which stemmed from a comprehensive scrutiny of research on mathematics education, delineated strategies for enhancing mathematics education in several crucial areas, including teacher education, curriculum and instruction, assessment, and research (Katz, n.d.).

One of the report's pivotal discoveries was the significance of early mathematics education and the pressing need for developing a sturdy foundation in fundamental mathematical concepts and skills (Greeno & Collins, 2008). The report also stressed the importance of effective instruction and teacher training and espoused the creation of high-quality instructional materials and assessments. The *National Mathematics Advisory Panel Report* played a key role in shaping mathematics education policy and practice in the United States, including the Common Core State Standards for Mathematics (Benbow & Faulkner, 2008).

SCCCR Mathematics Standards

The South Carolina Educational Accountability Act of 1998 purported that academic standards are to provide a baseline for curriculum and standardized statewide assessments (South Carolina Code of Laws, 2017). The Education Oversight Committee wrote the SCCCR Math Standards with references to the 2005 NAEP Mathematics

Framework, the 2021 PISA Mathematics Framework, and recommendations from NCTM (South Carolina Department of Education, 2023a).

The SCCCR Mathematics Standards represent a meticulously designed set of guidelines that define the expectations and outcomes for mathematics education in South Carolina (Southern Regional Education Board, 2020). These standards have been developed to align with national and international benchmarks, ensuring that students in South Carolina receive a comprehensive and competitive mathematics education that equips them for success in their academic pursuits and future careers (South Carolina Department of Education, 2015).

Organized by grade levels from kindergarten through 12th grade, the SCCCR Mathematics Standards demonstrate a meticulously structured progression of mathematical concepts and skills. This progression is purposefully designed to promote mathematical proficiency and the cultivation of critical thinking, advanced problem-solving abilities, and a profound comprehension of mathematical principles (Friedberg et al., 2018). An essential feature of the SCCCR Mathematics Standards is their deliberate alignment with the Common Core State Standards for Mathematics, which has gained nationwide acceptance and adoption. This alignment guarantees consistency and comparability in mathematics education, facilitating seamless transitions for students who may relocate to or from South Carolina (South Carolina Department of Education, 2015).

The SCCCR Mathematics Standards encompass a comprehensive array of mathematical domains, spanning from numbers and operations, data analysis, geometry, measurement, functions, and probability. Within each domain, they articulate specific standards that articulate the precise skills, concepts, and knowledge students should master at each grade level (Anderson, 2022). Beyond content standards, the SCCCR Mathematics Standards emphasize mathematical practices, encouraging students to actively engage in mathematical reasoning, problem-solving, modeling, and effective communication of their mathematical insights. This focus on practices underscores the importance of not merely solving mathematical problems but also articulating the rationale behind one's approach coherently and persuasively (South Carolina Department of Education, 2015).

The SCCCR Mathematics Standards prioritize the development of mathematical fluency, fostering a deep conceptual grasp of mathematical concepts rather than rote memorization of procedures (Loveless, 2021). Furthermore, they accentuate real-world applications, preparing students to effectively apply their mathematical knowledge in diverse contexts, including future academic endeavors and careers, especially in the science, technology, engineering, and mathematics (STEM) fields. In addition, the SCCCR Mathematics Standards offer valuable guidance to educators, curriculum developers, and assessment designers within South Carolina (Dell'Erba, 2019). These standards serve as a solid foundation for crafting curriculum materials, instructional strategies, and assessments that align seamlessly with the SCCCR Mathematics Standards. By doing so, they promote uniformity and logical coherence in mathematics education across the state (South Carolina Department of Education, 2015).

In summary, the SCCCR Mathematics Standards are a rigorously developed and scholarly framework. They establish demanding expectations for mathematics education in South Carolina, align with national standards, emphasize the cultivation of mathematical practices, and effectively prepare students for academic and career accomplishments by nurturing mathematical proficiency and profound comprehension of mathematical principles (South Carolina Department of Education, 2015). These standards play a pivotal role in shaping mathematics education in the state, guaranteeing that South Carolina students are exceptionally well-prepared for success and competence in the 21st century.

Specifically, third-grade standards were created to provide students with critical-thinking skills and skills necessary for college and career readiness. The third-grade academic standards encompass a variety of strands, including probability, statistical reasoning, measurement, data analysis, geometry, spatial awareness, algebra, patterns, and numeracy (South Carolina Department of Education, 2023a). The third-grade student standards focus on fractions, mathematical representations, division, multiplication, collecting and analyzing data through charts and graphs, and solving real-world mathematical problems using area and perimeter (Opfer et al., 2016).

Assessment Adoption

In 2007, South Carolina developed an ELA and math formative assessment adoption list that was updated in 2017 to incorporate testing for students in kindergarten through ninth grade (South Carolina Department of Education, 2022a). Formative assessments must align with the state's academic standards. District leaders are responsible for allocating funds and administering selected formative assessments that aim to improve student academic success (South Carolina Department of Education, 2022a). Table 1 includes the names and descriptions of the formative assessments that are a part of the state-approved list.

Table 1

State-Adopted Formative (Interim) Assessments

Assessment	Assessment overview
STAR Reading/Mathematics	Published by Renaissance
i-Ready Diagnostic	Published by Curriculum Associates
Measures of Academic Progress (MAP)	Published by NWEA
Mastery View Predictive Assessments	Published by Instructure
I station's Indicators of Progress (ISIP)	Published by I station

To determine the formative assessment alignment with the SCCCR Standards, a study was completed to discover the extent to which selected assessment items correlate with the skills and processes embedded in the South Carolina academic standards (Moses & Nanna, 2007). Alignment is based on numbers and percentages of standard-aligned items, non-aligned test items, and items that do not represent specific standards or indicators (South Carolina Department of Education, 2022a).

The assessment publishers must undergo a two-stage evaluation process that includes a review of submitted research by a professional panel of experts who will complete the evaluation criteria (Dawson et al., 2013). The second part of the adoption is for reading and mathematics content specialists to evaluate items submitted by publishers for standard alignment. Funding for these assessments is obtained by the completion of a survey that indicates the name of the assessment purchased and how many students were evaluated with the assessment. The survey and invoice will include the total required for the desired test materials along with the required training for teachers. Allocation of funds is dependent upon the survey responses. There is a funding formula that includes the total number of students evaluated in reading or math, and the district's poverty level (South Carolina Department of Education, 2022a).

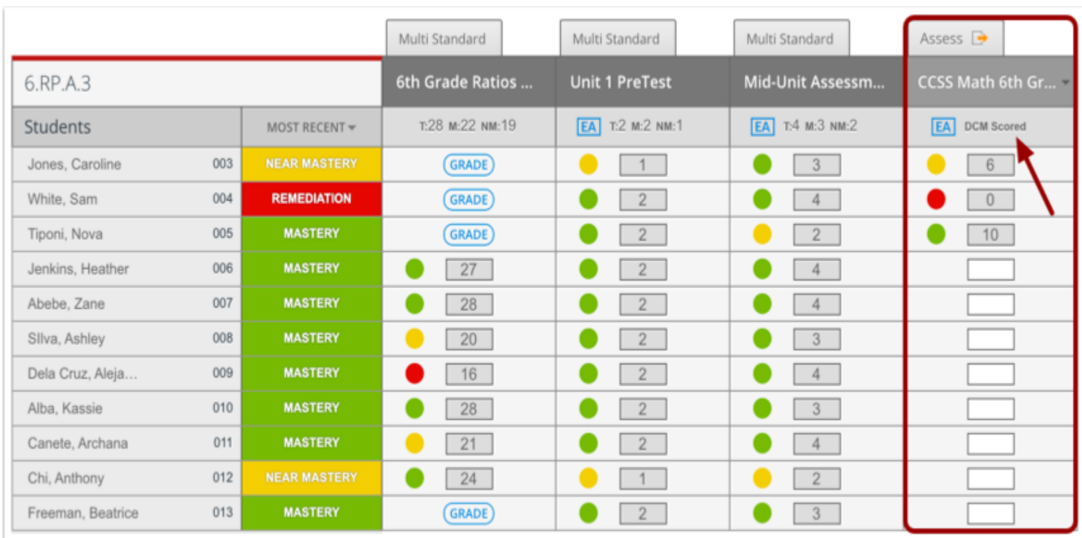
Mastery View Assessments

The use of routine, standards-based formative assessments is believed to impact student outcomes on standardized state assessments (Stiggins & DuFour, 2009). Formative assessments, also known as interim assessments or benchmarks, provide data that are used to drive instruction and improve student achievement (Abrams et al., 2015). The scores from benchmarks help teachers differentiate instruction and provide individual assistance that addresses specific academic gaps. Through interventions, teachers can improve student learning by using benchmark data (Instructure, 2023. Benchmarks are typically administered in the fall, winter, and spring to give students more exposure to questions that mirror those on standardized tests and indicate a predictive measure of how students would perform on standardized assessments based on benchmark performance.

Mastery View Predictive Assessments are predesigned formative assessments designed by Instructure, an education technology company whose mission is to facilitate student success, enhance teaching, and promote community learning (Instructure, 2023). A tool called the Diagnostic Classification Model is used to score assessments and determine proficiency levels. Mastery View assessments are aligned with state standards and focus more on the types of questions students answered versus the number of correct answers. Formative assessments that are aligned with state standards provide teachers with data to support student learning (Roskos & Neuman, 2012). Standards-based predictions are devised to inform teachers about how well students mastered skills and standards within a grade level and at the district level, and how well students may score on the end-of-year standardized test. Figure 18 shows an example of assessment data for Indicator 6.RP.A.3, which is a sixth-grade common core standard that uses ratio and rate reasoning to solve real-world and mathematical problems (Illustrative Mathematics, n.d.).

Figure 18

Sample Assessment Report



6.RP.A.3			Multi Standard 6th Grade Ratios ...	Multi Standard Unit 1 PreTest	Multi Standard Mid-Unit Assessm...	Assess CCSS Math 6th Gr...
Students		MOST RECENT	T:28 M:22 NM:19	EA T:2 M:2 NM:1	EA T:4 M:3 NM:2	EA DCM Scored
Jones, Caroline	003	NEAR MASTERY	GRADE	1	3	6
White, Sam	004	REMEDIATION	GRADE	2	4	0
Tiponi, Nova	005	MASTERY	GRADE	2	2	10
Jenkins, Heather	006	MASTERY	27	2	4	
Abebe, Zane	007	MASTERY	28	2	4	
Silva, Ashley	008	MASTERY	20	2	3	
Dela Cruz, Aleja...	009	MASTERY	16	2	4	
Alba, Kassie	010	MASTERY	28	2	3	
Canete, Archana	011	MASTERY	21	2	4	
Chi, Anthony	012	NEAR MASTERY	24	1	2	
Freeman, Beatrice	013	MASTERY	GRADE	2	3	

In Figure 18, the last assessment shows that of 11 students, three have tested. The first student has a yellow dot, which represents near mastery. The red dot for the second student shows a student needing remediation, and the green dot for the third student represents a student showing mastery for the tested indicator.

MAP

The Northwest Evaluation Association (NWEA, 2023a) developed the MAP assessment. MAP is a computer-based adaptive assessment designed to measure student academic progress and growth in math and reading over time. Unlike traditional standardized tests that employ a fixed set of questions for all test-takers, MAP employs a computer-adaptive methodology (NWEA, 2023a). This means that the difficulty of the questions presented to each student dynamically adjusts based on their performance. MAP provides a personalized assessment experience that caters to individual student abilities and knowledge levels (Cordray et al., 2012). This adaptability results in more accurate measurements of student abilities and, in turn, affords educators a granular understanding of student strengths and areas requiring improvement.

MAP assessments are administered multiple times throughout the academic year, enabling educators to comprehensively track student progress over time. This longitudinal approach facilitates the identification of growth patterns, enabling educators to evaluate the effectiveness of their instructional strategies and interventions (Herman et al., 2010). Furthermore, MAP assessments are aligned with rigorous academic standards, ensuring that the assessed content is relevant and appropriate for student grade levels.

MAP predicts outcomes for the SC READY assessment using students' Rasch Unit (RIT) cut scores, which are generated for every grade from Grades 2-8 for fall, winter, and spring administrations in math and reading (NWEA, 2023b). Figure 19 shows a sample cut score report for students in second through eighth grades.

Figure 19

MAP Growth RIT Cut Scores for SC READY Proficiency

Table E.1. MAP Growth RIT Cut Scores for SC READY Proficiency

Assessment		*Meets Expectations* Cut Scores by Grade						
		2	3	4	5	6	7	8
Mathematics								
SC READY Spring		–	438	482	536	543	578	615
MAP Growth Mathematics	Fall	172	186	200	210	216	225	232
	Winter	182	194	207	216	221	229	235
	Spring	187	199	211	220	224	232	237
ELA/Reading								
SC READY Spring		–	452	509	558	576	615	643
MAP Growth Reading	Fall	175	189	198	208	212	217	221
	Winter	184	196	204	212	216	220	223
	Spring	188	199	206	214	217	221	224

Based on Figure 19, a student in third grade would need to score 186 in the fall, 194 in the winter, and 199 in the spring to show a high probability that they would meet expectations on the SC READY assessment at the end of the year. One distinctive feature of MAP is its ability to generate a wealth of actionable data (NWEA, 2023b). After completing the assessment, educators are provided with detailed reports that offer insights into student proficiency levels, growth percentiles, and projected academic trajectories (NWEA, 2023b). This information serves as a valuable tool for educators in crafting targeted instructional plans and interventions to meet the diverse learning needs of their students. The data-driven approach to MAP facilitates evidence-based decision-making at the classroom, school, and district levels (Vázquez, 2024).

The application of MAP extends beyond individual student assessment; it also serves as a valuable tool for educators to measure the effectiveness of instructional programs, evaluate curriculum materials, and inform policy decisions (NWEA, 2023a).

Additionally, MAP results are instrumental in fostering parent-teacher communication, as they provide clear and data-driven means for educators to convey student academic progress to parents and guardians.

MAP represents a scholarly and robust educational assessment tool that allows educators to gain insight into student academic abilities, growth trends, and areas necessitating targeted intervention (NWEA, 2023b). Its adaptive, computer-based approach, alignment with academic standards, and data-rich reporting make it a valuable resource for educators and educational institutions striving to enhance the quality of instruction and student outcomes in today's dynamic educational landscape (NWEA, 2023b). MAP is administered online and adjusts the questions based on difficulty. If a student answers a high-level question correctly, the next question will increase in difficulty. If a student answers a high-level question incorrectly, the next question will automatically decrease rigor (Militello & Heffernan, n.d.). This process continues until the test determines the student's instructional level with a high degree of accuracy.

MAP assessments are typically given three times a year, in September, December, and April. Teachers and curriculum leaders use the results of the MAP assessment to identify specific areas where students may need additional support, monitor progress toward learning goals, and inform instructional decisions (Dyer, 2024). Additionally, MAP assessments can help schools and districts track student growth over time. They assist with evaluating the effectiveness of instructional programs and adjusting instruction and materials according to research to enhance student performance (NWEA, 2023a).

SC READY

The SC READY assessment is the summative assessment administered to students in Grades 3-8 to assess student proficiency in ELA and mathematics (South Carolina Department of Education, 2024c). The math test has two sections, including a calculator and no calculator section, to be completed in the order presented in the test booklets. Students are expected to complete the math assessment in 1 day. Third-grade students must answer questions in categories such as number sense and Base 10, fractions, algebraic thinking and operations, geometry, and measurement and data analysis (South Carolina Department of Education, 2024c). Students in grades 4 and 8 take the science assessment in addition to math and reading.

SC READY scores are used to identify the levels of proficiency based on the skills embedded in the state's standards (South Carolina Department of Education, 2024c). Such proficiency is called performance level. There are four categories of performance levels: does not meet expectations, approaches expectations, meets expectations, and exceeds expectations. According to the South Carolina Department of Education (2024c), students not meeting expectations are identified as having a critical need for support for future academic success. A student approaching expectations has demonstrated an understanding of academic standards but would benefit from additional support. Meeting expectations shows that the student is prepared and on track for the next level of learning. Any student exceeding expectations is well prepared for future learning. Districts across the state, administrators, educators, and professional developers use SC READY data to inform their decisions about instructional practices and decisions.

State Report Card

Annually, the South Carolina Department of Education provides school report cards for every public school and district in the state (Sunderman, 2022). The report card includes information about student performance on standardized testing in math and reading, student and teacher climate survey responses, and parent satisfaction with school and home relationships (South Carolina Department of Education, 2022b). This information is broken down by grade level, race/ethnicity, and other demographics. Schools and districts are rated from 0 to 100 based on factors such as student achievement, progress, and readiness.

Schools and districts can receive a performance classification. A 0- to 100-point scale is used to rate schools throughout the state. Schools receive scores or classifications based on overall performance that range from excellent to at-risk (SC Education Oversight Committee, 2018). In addition, the report card summarizes information regarding teacher quality and student growth (South Carolina Department of Education, 2022b). Student growth is determined by proficiency rates on the SC READY assessment. The math proficiency rate is one of the factors used to calculate this rating (South Carolina Department of Education, 2024c). Math achievement is measured using the SC READY assessment, which is administered statewide to all students between third and eighth grades to measure their levels of proficiency. Student proficiency levels are based on vertical scale scores provided by the state.

Mathematics Instruction Barriers

Mathematical barriers can present challenges for individuals learning mathematics or solving mathematical problems (Ma & Kishor, 1997). Such barriers can arise from cognitive, emotional, or social issues. By addressing and overcoming these barriers, educational stakeholders must ensure that all students have equal access and academic opportunities (Roicki, 2020). Strategies for addressing these barriers may include customized instruction, accommodations for those with disabilities, increased exposure to math concepts and real-world applications, and interventions to reduce math anxiety.

Situational

Situational barriers can hinder the effectiveness of mathematics instruction and learning (Hernández de la Hera et al., 2023). These barriers include a lack of instructional time due to competing demands, inadequate resources, large class sizes, and limited teacher training and support. Student motivation and engagement, language barriers, and learning disabilities or special needs can exacerbate these challenges (Cerezci, 2019). Addressing situational barriers is crucial in providing equitable access to high-quality mathematics instruction and ensuring all students succeed in mathematics and related fields. Strategies for overcoming situational barriers may include providing additional resources and support, offering personalized instruction and accommodations, and implementing effective pedagogical strategies to engage and motivate students (Ankita & Richma, 2017).

Attitudinal

Attitudinal barriers to mathematical instruction are beliefs, attitudes, and perceptions that can affect students' abilities to learn mathematics effectively. Some common examples of attitudinal barriers include negative self-perceptions, fear of failure, stereotypes and biases, lack of interest or relevance, perceptions of math, and previous negative experiences (Kovac, 2021). These barriers can impact student motivation, engagement, and performance in mathematics. To address attitudinal barriers, educators can create a positive and supportive classroom environment that emphasizes a growth mindset, fosters a sense of belonging, and highlights the relevance and applicability of mathematics to students' lives (Mazana et al., 2018).

Structural

Structural barriers in mathematics instruction can be a major hurdle for learners, as they refer to institutional and systemic factors that may restrict their access to quality learning (Larson, 2018). Some examples include classrooms and schools with limited resources, which could mean textbooks, technology, and other materials are not suitable for learning. This makes it challenging for students to get involved in the subject and develop their mathematical skills. Inequitable distribution of resources also plays a role, with some schools or districts having greater access to resources, giving students unfair advantages and further limiting opportunities for mathematical learning (Wiles & Levesque-Bristol, 2018).

Large class sizes can add to the difficulties, as teachers struggle to provide individualized instruction to those who need extra help with math (Adelman & Taylor, 2006). Teacher qualifications and training are also important, as those who lack specialized training or qualifications in math instruction may struggle to teach the subject effectively. Curriculum constraints, such as mandated standardized testing, can stifle teacher creativity and flexibility in designing engaging and effective mathematics instruction (Li et al., 2024). Policies and practices that create inequitable opportunities for students to engage in math instruction, such as tracking or ability grouping, are also problematic. Structural barriers require systemic change at the institutional level, including advocacy for equitable funding and resource allocation, continuous professional development, support for teachers, and revising policies and practices that create inequitable opportunities for learning mathematics (Sullivan, 2019).

Academics

Academic barriers to mathematical instruction refer to the obstacles students may encounter when trying to learn and understand mathematics. Some common academic barriers students may face include math anxiety, critical-thinking skills, an understanding of basic concepts, and additional support. Math anxiety is an issue that many students experience, which may present challenges when learning new concepts in mathematics (Nerheim, 2018).

There are often feelings of anxiousness or worry relating to learning or applying mathematical skills, which may affect comprehension. Math anxiety may contribute to students' inadequacies in prior knowledge, and the lack of or limited prior knowledge can create academic barriers and impede students' abilities to learn new material (Balt et al., 2022). This is particularly challenging as many mathematical skills build upon one another as students move to higher grade levels (Pia, 2015). Problem-solving skills are necessary when learning and applying mathematics to real-world situations. Students may require additional support to experience success in the mathematics classroom. Support may come by way of tutoring, practice assignments, online platforms geared towards improving math skills, and manipulatives (Weir, 2023).

The Matthew Effect

Sociologist Robert Merton described the Matthew Effect. The name was derived from a New Testament verse of the Bible. The exact notation is Matthew 25:29, which states, “For unto everyone that hath shall be given, and he shall have abundance: but from him that hath not shall be taken away even that which he hath.” A paraphrase of this information can be summarized as, “Those who are successful are most likely to be given the special opportunities that lead to further success, and those who aren’t successful are most likely to be deprived of such opportunities.” Another translation is that when a student starts school with any advantage over another student, they continue to make gains, while the student who has any disadvantage tends to experience a decline in performance.

In addition to education, authors have described the Matthew Effect in fields such as politics, reading and literacy, math, and economics (Kempe et al., 2011). Specifically, Stanovich (1986) reported that weaknesses in language-based skills such as general vocabulary, syntax, and reading may initially seem small and minor but gradually become significant due to the Matthew Effect. A child who struggles with these skills in Grade 1 is likely to exhibit a more substantial lag in performance by Grade 4. In the area of math, Morgan et al. (2011) found the Matthew Effect, but they did not report similar trends in reading. It is important to note that well-timed interventions can reverse the direction of the Matthew Effect, such that the performance of students who initially displayed a downward trajectory can be reversed, with the lags and delays reducing in severity over time (Chubb, 2018).

Program Evaluation

A program evaluation is a rigorous inquiry into the efficacy of a particular initiative, strategy, or scheme (Havens, 1981). It entails employing empirical approaches to assemble and scrutinize data, aiming to gauge whether the program is successfully realizing its aspirations and objectives, while also unearthing areas that may require further development (National Center for Biotechnology Information, 2009). Program evaluations can be conducted in various domains, ranging from academia to healthcare, welfare, and public policy. These assessments serve the crucial purpose of providing concrete feedback that can be utilized to enhance the program in question and to make informed decisions regarding the allocation of resources, based on data analyses (RAND Corporation, n.d.). When completed properly, potential outcomes are cost-benefit analyses, measures of the effects on student learning, and recommendations for improving program design and implementation.

According to Sanders and Sullins (2005), program evaluations direct everything involved with changing and improving school programs. It is the process used to identify student needs, determine priorities, establish objectives, and decide on educational approaches (Aguila et al., 2013). Further, materials, staff assignments, and schedules are all developed based on program evaluation outcomes. Program evaluation processes also lead to monitoring and adjusting programs as needed. Individuals and organizations who observe programs as outsiders use program evaluation to determine whether a program needs to continue, be modified, or be terminated (Mertens & Wilson, 2012). In summary, much rests on the evaluation process and the outcomes it reveals.

Previous Studies

Over the years, there have not been many studies that evaluated the effectiveness of the *BIM* curriculum; however, there have been studies conducted that evaluated various mathematics programs in different settings and populations. Minimal information about *BIM* contributed to the limitations and further promoted the need for this study.

Innovative Middle School Program

The researchers evaluated the efficacy of the Innovative Middle School Program initiated by the Clark County School District throughout 3 years (Marianno & Spinrad, 2023). Designed to bolster student achievement and teacher retention in schools earmarked for improvement by Nevada's educational authorities, the program allocated funding to eight middle schools (Innovations International Charter School, n.d.). This financial support facilitated enriched instruction, dedicated time for teacher collaboration, and incentivized bonuses linked to teacher recruitment, retention, and student outcomes (South Carolina Department of Education, 2023b).

To assess the program's effectiveness, the study addressed three evaluation questions: the impact on student achievement in ELA and math, student attendance, and staff retention. Data from the Clark County School District administrative systems, including Smarter Balance Assessment Consortium exam scores, attendance records, and staff retention rates, were analyzed using quasi-experimental event study models with propensity score-matched comparison groups (Marianno & Spinrad, 2023).

The findings indicated that while the Innovative Middle School Program was successful in improving student achievement outcomes, particularly in math, the effects were delayed, becoming noticeable in Years 2 and 3 of the program (Marianno & Spinrad, 2023). Additionally, improvements in ELA and math achievement were observed across all student demographic groups; however, the program did not have a significant impact on student attendance (Marianno & Spinrad, 2023). Regarding staff retention, the study found a short-term improvement of over 1 percentage point in the first year of implementation, attributed to retention bonuses; however, staff retention declined after the initial year, indicating the gains were not sustained throughout the program. Surveys suggest that teacher burnout, unrelated to workload but associated with the teaching profession, may have contributed to this decline (Marianno & Spinrad, 2023).

Overall, the Innovative Middle School Program showed promise in improving student achievement, but challenges remained in sustaining staff retention gains beyond the initial year. Addressing teacher burnout and developing strategies for long-term staff retention could enhance the school's effectiveness in the future (Marianno & Spinrad, 2023).

Elevate Math Program

This study explored the effect of the Elevate program, a summer math intervention that targets low-performing middle school students in Silicon Valley (Jaquet et al., 2022). In 2014, researchers examined the program's effectiveness during two summers on math grades and standardized test scores. It was observed that students who participated in the Elevate program showed significant improvement in math performance compared to their peers who did not participate. It also reported that students who participated in the Elevate program year after year increased their chances of succeeding in later math courses. Such findings suggest that continued guidance and instruction during the summer might contribute to an overall math proficiency and confidence level in students (Jaquet et al., 2022).

Other than the academic results, it dealt with various issues that directly related to student engagement and motivation, pointing out that students as part of this program developed interests and positive attitudes toward math (Jaquet et al., 2022). This shift in mindset is very important for long-term academic success and interest in the field of STEM. It also examined outcome differences for the various student subgroups involved in this research, highlighting areas where the program may need adjustment to better represent these groups. For instance, while the program appeared to work generally, it showed that its impact differed according to variables such as socioeconomic status, English language proficiency, and initial math skill levels. These insights suggest the need for intervention strategies, accompanied by required resources, to address challenges that emanate from diverse demographic student populations (Jaquet et al., 2022).

The report provided further recommendations to top policymakers, education policymakers, and program administrators on the best ways to improve the services of the Elevate program. This includes increasing access to the program by underrepresented and disadvantaged students, personalization of learning approaches, and further professional development for teachers, which would help in providing support for diverse learning profiles (Jaquet et al., 2022).

These findings suggest that targeted summer programs like Elevate have the potential to make a large impact on how struggling students learn. Bridging gaps in mathematics skills during very critical transitional periods may very well be the way to make up for lost time and give more equity in education (Switzer, 2010).

Mathematics Support for At-Risk Students

The study focused on the role facing teachers in helping learners experiencing learning deficits with mathematics. In this respect, the identification was on formative assessment as an intervention tool in effectively guiding and supporting students in the subject of mathematics (Van den Ham & Heinze, 2022). The researchers identified a need for intervention programs to be practical and easily integrated into everyday classroom routines. Although such intervention programs should target at-risk students early in their academic paths, such programs would be of universal benefit to all students in the classroom.

The study discussed various formative assessment strategies through which the teacher can determine students' particular needs in learning and, correspondingly, shape teaching (Van den Ham & Heinze, 2022). Strategies include regular quizzes, student reflections, peer reviews, and interactive activities through immediate feedback. Through the integration of these methods, educators can help ensure a more responsive, adaptive learning environment that caters to human diversity (Guido, 2021).

This study proved the case for a formative assessment program regarding its impacts on arithmetic achievement by using a turbulence model analysis of an effectiveness trial conducted in the first 2 years of elementary school. On a comprehensive approach, the trial undertook training teachers properly to implement formative assessments and integrate them into daily teaching practices (Van den Ham & Heinze, 2022).

Results of the longitudinal analysis from first to third grade indicated further program effects, thus showing positive influences on both the at-risk student population and the whole class (Van den Ham & Heinze, 2022). The results showed that students who attended the formative assessment program had significant improvements in arithmetic skills compared with those who did not participate. These improvements were maintained over time, thus indicating that the advantages of formative assessment are long-lasting. In addition, the study found that extreme changes in curriculum or in the way teachers teach were not necessary. It was reported by teachers that the program was easy to fit into their existing routines and that it aided them in their ability to provide more specifically targeted support to their students (Van den Ham & Heinze, 2022). This ease of integration could help promote the wide diffusion of such programs by minimizing disruption and maximizing the potential for sustained use.

The study pointed out broader implications for educational equity of formative assessment. According to formative assessment programs, mathematics students facing difficulties are given very early and continuous support, therefore closing achievement gaps and putting all students at a point where they have a fair chance of succeeding (Ozan & Kincal, 2018). The authors argued that this kind of program is important in setting up learning environments that are inclusive, yet effective, to meet the needs of all students despite their initial skill levels (Van den Ham & Heinze, 2022).

The findings of this study underscore again the effectiveness of formative assessment as one of the most powerful levers by which arithmetic aptitude may be increased and, thereby, students at risk are much better supported (Van den Ham & Heinze, 2022). There is evidence from the article that formative assessment programs in mathematics strongly influence the mathematical potential of students, hence improving their education prospects for everyone involved (NCTM, 2022).

Espark and iXL

In 2022, Swan completed a comprehensive program evaluation to fulfill a dissertation requirement. This was a study of the effectiveness of two of the more commonly used educational software programs, Espark and iXL, that fifth, seventh, and eighth-grade students use in a Maine school district. It evaluated how effective these programs were in impacting academic performance and overall student engagement in a school system, mostly at the levels of mathematics and literacy (Swan, 2022). High performance by students was analyzed over a stipulated time, thereby making comparisons of progress before and after the introduction of Espark and iXL. Quantitative assessments were made based on standardized test score reports and teacher feedback in terms of experiences with the running of the program and those of the students (Swan, 2022).

The findings show that all students' grades indicated growth if they were allowed adequate instructional time weekly with both Espark and iXL materials. These improvements were measured in gains in mathematics and literacy (Swan, 2022). Continued use of digital tools, therefore, bolsters learning outcomes in students. Gains showed problem-solving skills, comprehension, and an increase in overall academic confidence for students in both programs used regularly.

In the review, there were main factors identified to have contributed to the success of both Espark and iXL. First and foremost, the programs applied an adaptive mechanism in which the learning experience was tailored as an adjustment for different students based on needs. Such adjustment helped gain interest in learning due to the customization aspect through which they were neither bored by easy stuff nor frustrated by very hard materials but always found a balanced challenge to encourage its motivational power to learn more effectively (Swan, 2022).

It also highlighted that the facilitation by the teacher and integration of the software in everyday activities within the classroom was important. The teachers who worked Espark and iXL into their lesson plans and guided efforts were found to be instrumental in ensuring that such programs reaped maximum benefits. Professional development of teachers in using better tools, the research suggested, could further enhance student outcomes (Regional Educational Laboratory, 2019).

This review also evaluated whether differentially strong effects existed within different types of students for the two interventions, Espark and iXL. Students with learning disabilities and English language learners experienced success and improvement, thus showing that digital learning tools can do wonders for educational diversity and equity (Swan, 2022). The study included recommendations for school administrators and policymakers. Some of Swan's (2022) recommended practices included ensuring enough instructional time was allocated to using educational software and investing in continual teacher training.

Finally, the program evaluation Swan (2022) conducted established strong evidence that Espark and iXL are working toward positive effects on student achievement. In particular, the importance of consistent use, teacher involvement, and tailoring of individual learner experiences in using educational technology to its fullest potential was emphasized (Swan, 2022). These findings set a platform for the further integration and optimization of various digital tools for learning within schools with continued support for the improvement of educational outcomes and meeting diverse learner needs.

Basic Math Curriculum

In 2021, a study was employed to evaluate the effectiveness of the 11th-grade basic mathematics curriculum implemented at the Vocational and Technical Anatolian

High School, specifically in the tourism and hotel management field, using the Stake's Responsive Evaluation Model (Avci et al., 2021). The study aimed to assess the curriculum's alignment with the needs and career aspirations of the students. Employing a qualitative study design and criterion sampling methods, data were collected through observation schedules, document analysis, and semi-structured interviews involving 43 participants (Avci et al., 2021). The analysis involved systematic content analysis, inductive coding, and thematizing techniques.

Findings revealed that the implementation of the 11th-grade basic mathematics curriculum failed to meet the specific needs of the school and students struggled to apply their math skills across other subjects (Avci et al., 2021). Although students demonstrated the use of math skills in their daily lives, their application of mathematics within their vocational fields was notably limited. The study suggested implications such as fostering interdisciplinary collaboration among teachers at the school level, establishing performance standards tailored to vocational high schools at the district level, and developing and implementing curricula relevant to vocational high schools at the state level (Avci et al., 2021).

Sixth-Grade Mathematics Curriculum

This study aimed to assess how effective the sixth-grade mathematics curriculum introduced in Turkey in 2018 was using Tyler's curriculum evaluation model (Başar, 2021). It involved 266 students from schools categorized into three success levels: upper, middle, and lower. The evaluation utilized the Middle-School 6th Grade Mathematics Course Achievement Test to measure students' curriculum-related achievements and the Attitude Towards Mathematics Scale to gauge their feelings about the math course

(Başar, 2021). Results indicated that students in the upper group schools performed better in meeting curriculum objectives and held more positive attitudes toward the mathematics course compared to their counterparts in the middle and lower group schools. Additionally, middle group students demonstrated more positive attitudes than those in the lower group (Başar, 2021).

Effective Programs in Elementary Mathematics

This article presented a comprehensive review of 87 experimental studies that evaluated 66 elementary mathematics programs in Grades K–5. It categorized these programs into six categories and analyzed their achievement outcomes (Pellegrini et al., 2021). The study found tutoring programs to yield particularly positive outcomes, with an effect size (ES) of +0.20 across 22 studies. Additionally, professional development initiatives focusing on classroom organization and management, such as cooperative learning, show positive effects (ES = +0.19, k = 7); however, professional development aimed at enhancing teacher understanding of mathematics content and pedagogy demonstrates a minor impact on student achievement (Pellegrini et al., 2021). The article also noted a significant impact of professional development on the adoption of traditional curricula (ES = +0.12, k = 7) but not for digital curricula. Programs with limited professional development, both traditional and digital curricula, as well as benchmark assessment programs, exhibited few positive effects (Pellegrini et al., 2021).

Evaluation and Eisner's Model

This study was done to assess the eighth-grade mathematics curriculum rolled out during the 2017 and 2018 academic years using Eisner's educational connoisseurship and criticism model (Nordin & Wahlström, 2019). Eisner's model is esteemed as among various qualitative and interpretative approaches that emphasize an in-depth understanding of educational practices vis-à-vis expertise judgment and critical analysis. This work followed the case study design in applying a qualitative method, wherein mathematics teachers teaching in secondary schools were chosen by a process of purposeful sampling (Priya, 2021). In this case, data collected were obtained through a semi-structured interview form, while data analysis was descriptive.

Overall, teachers who returned feedback on the renewed curriculum were very positive about its updated content and structure designed to improve student understanding and engagement with mathematical knowledge (Darling-Hammond et al., 2017). Several compelling points were raised, including the integration of interactive, student-centered learning activities that foster a deeper understanding of mathematics concepts. Additionally, proponents endorse the use of tools and technological advancements to enhance student engagement and interest in learning (Yazici & Tasgin, 2021). However, some teachers expressed criticisms about certain aspects of the program, particularly regarding its failure to align with curriculum goals in mathematics. This suggests that even in its revised state, some material did not fulfill the requirements for which such mathematical skills and knowledge are prerequisites. Teachers also reported overcrowded classrooms that limited their use of the constructivist approach. Interactive and hands-on activities were difficult to deal with in crowded classrooms, which forms an important component of a constructivist learning environment wherein students build their understanding through active exploration and problem-solving (Camahalan, 2024).

Another problem was that the curriculum did not provide enough of a spiral format for learning, wherein concepts are revisited at higher and more advanced levels to ensure that students fundamentally grasp the material and retain the information (Yazici & Tasgin, 2021). The committee pointed out that some topics are covered only once in the entire secondary school career, which made it very difficult for pupils to build upon previous knowledge and to provide a coherent set of mathematical ideas.

Some educators have also commented that the quality of instructional questions in the Education Information Network textbook and question bank is unsatisfactory in allowing students to acquire correlation skills, reasoning, and problem-solving. Such questions are too simplistic, unrelated, or irrelevant to real life; are not challenging enough for students; and encourage rather directive thought (Yazici & Tasgin, 2021).

The study exposed the fact that some teachers did not keep pace with the changes in the curriculum, since such changes happened at a fast rate, and more importantly, teachers were not guided on these transitions at the professional level (Yazici & Tasgin, 2021). The teachers expressed the need for comprehensive training and resources to enable them to effectively teach the new curriculum and to help review its deficiencies.

Although the new eighth-grade math curriculum received praise for its new, innovative methods and improvement in content, it did not come without its criticisms. Further remediation of issues related to better tailoring to constructivist principles, readiness-appropriate material, and enhancing the quality of educational resources should play an important role in maximizing curriculum effectiveness. These insights again underline the continuous process of assessing and changing to meet student/teacher demands that change over time (Yazici & Tasgin, 2021).

Evaluating Elementary Math Textbooks

This study aimed to discover if changing textbooks or curriculum materials led to improved student achievement. Conducted in the context of the Common Core State Standards adoption, the research offered insights into the efficacy of different math textbooks across six diverse U.S. states (Blazar et al., 2020). By analyzing student test score data alongside textbook adoption, the study revealed that switching to higher-quality textbooks alone did not significantly impact student achievement. It suggested that the variations in achievement gains among schools using different textbooks, especially those from pre-Common Core State Standards editions, are minimal (Blazar et al., 2020). Despite the widespread belief in textbooks as a cost-effective solution for enhancing student outcomes, the study's findings caution against viewing them as a quick and easy intervention for improving achievement (Blazar et al., 2020).

ACT Aspire and Math Curriculums

Cook (2020) studied the effects of various mathematics curricula on third and fourth-grade standardized test scores in Arkansas. The research sought to determine how these instructional approaches impacted elementary school students' performance in state-administered mathematics assessments, highlighting the effectiveness of specific curricula in enhancing mathematical skills at this educational level (Cook, 2020).

Cook (2020) compared math curricula against each other based on their efficiency in improving student achievements. The research methods are sound since they considered statistical breakdowns from test scores for a large sample of students from several schools. This way, the researcher identified how each curriculum impinged upon student outcomes. The results showed low scores by the My Math students compared to students who had been using the Go Math and Investigations curricula (Cook, 2020).

Cook (2020) discussed, in detail, plausible reasons for the effectiveness differences as well as reported these findings. The issues were followed up with an in-depth discussion on the content aspect of curriculum alignment to state standards, the quality and comprehensiveness of instructional materials, and the extent of professional development and support given to teachers (Cook, 2020). It was found that a more integrated and exploratory curriculum like Go Math and Investigations would work much better for building deep understanding and developing problem-solving skills underlying success in standardized test performance (Cook, 2020).

Cook (2020) pointed out that no other major differences among these other curricula were noted. This could imply that although there are exceptional curricula, such as Go Math and Investigations, that stand out in terms of their effectiveness, many others might essentially be similar and only bring out different results if applied within the most appropriate instructional needs and contexts of individual schools (Cook, 2020).

Cook (2020) also addressed the implications of these findings on educational policy and practice. Some of the major recommendations included careful evaluation and selection of math curriculum materials by school districts, which are founded on empirical proof of their effectiveness not solely based on some marketing claims or cost considerations. This study has also underlined the need for continuous professional development of teachers so they have the proper competencies to implement the chosen curriculum to the very best (Cook, 2020).

Cook (2020) recommended further research to determine the effect of various mathematics curricula taken by students on their long-term learning trajectories. This kind of information would be useful for teaching practitioners and public policymakers who strive to make continuous improvements in mathematics education at all levels by showing how early instructional strategies bear on later academic achievement in mathematics.

In summary, Cook's (2020) dissertation is a contribution to educational pedagogy, whereby the main contribution includes an in-depth analysis of how different mathematics curricula impact student achievement. In this regard, principal findings underscore the evidence-based curriculum selection and possible gain from those that focus on conceptual understanding and problem-solving. Such insights have the potential to inform such initiatives as efforts placed on improving math instructions, with the ultimate goal of improving student mathematics outcomes.

Prodigy

The findings presented in this report were derived from data collected during two site visits in the fall of 2019 and from student achievement data spanning the 2017-2018 and 2018-2019 academic years (Morrison et al., 2020). During each site visit, researchers conducted various activities, including classroom observations; interviews with principals, teacher coaches, and teaching specialists; and focus groups with teachers and students. Additionally, one district-level mathematics curriculum specialist was interviewed (Morrison et al., 2020).

This study employed a post hoc design to explore the quantitative impact of the Prodigy program on student achievement outcomes in mathematics. It compared the achievement gains of fourth-grade students who used the Prodigy program for varying durations while controlling for demographic factors (Morrison et al., 2020). The research design utilized a correlational mixed methods evaluation approach with a case study framework for presenting qualitative findings. The aim was to collect evidence to elucidate outcomes such as teacher and student attitudes, experiences, and fidelity of implementation across different schools. Data collection involved site visits to two elementary schools in the district, each for 1 day, to gain firsthand impressions of program implementation and application context. The evaluation design addressed both summative and formative needs by providing evidence of implementation and recommendations for program improvement (Morrison et al., 2020).

The case study school district serves approximately 11,000 students across 13 schools, including elementary, middle, and high schools. The student population is Hispanic and White, with a substantial portion deemed economically disadvantaged (Morrison et al., 2020). Between 61% and 83% of students met grade-level standards in all subjects in state testing in 2018. The district employs approximately 1,500 teachers with over 5 years of teaching experience and without advanced degrees (Morrison et al., 2020). Data sources for the evaluation included classroom observations, interviews with school personnel, focus groups with teachers and students, and student achievement on standardized assessments.

Teachers and principals expressed hesitancy in directly attributing student achievement to the Prodigy program, focusing instead on increased student engagement and additional mathematics practice; however, students unanimously reported that Prodigy made learning mathematics easier and more enjoyable, citing motivation to defeat challenges and a sense of accomplishment when progressing in the game (Morrison et al., 2020). They particularly enjoyed the social aspects of the program, such as competing with friends and interacting in a virtual classroom environment. This positive student attitude towards mathematics, fostered by Prodigy, is believed to correlate with achievement (Morrison et al., 2020).

Math Intervention Program Via AmeriCorps

This study examined the practical challenges schools face in delivering evidence-based interventions to improve fundamental math competencies among students (Parker et al., 2019). It emphasized the importance of fidelity and a data-driven, tiered framework in implementing such interventions effectively. Through an evaluation of a math intervention program delivered in collaboration with AmeriCorps and utilizing community-based resources, the study investigated its impact on students in Grades 4–8 (Parker et al., 2019).

By randomly assigning students to receive math support via the program or to a waitlist control group, the study measured outcomes using a comprehensive assessment of math achievement (Parker et al., 2019). Results from intent-to-treat analyses revealed a positive effect of the program on math achievement, with even greater improvements observed under optimal dosage conditions. The study noted the relationship between math interventions and the potential for partnerships between community-based organizations and schools to enhance outcomes for at-risk students (Parker et al., 2019).

Intensive Math

Dery (2019) reported on a curriculum used in the state of Florida called Intensive Math. The participants in that study were in the sixth grade. The results indicated that fewer than one-fourth of the students made enough progress to advance to the next level on the school district’s report; however, positive outcomes were identified, leading to the conclusion that some aspects of the curriculum had utility and could be considered for future instruction.

i-Ready

This study sought to evaluate the efficacy of the i-Ready® online program, specifically designed to customize math instruction for students in Grades 6-8. Leveraging diagnostic data collected during the 2018-2019 academic period, researchers adopted a quasi-experimental design (Swain et al., 2019). The underlying hypothesis suggested that students utilizing the program would exhibit greater academic proficiency compared to their peers who did not partake in it (Swain et al., 2019).

To facilitate the evaluation process, matching methodologies were employed to pinpoint a comparison cohort of students possessing comparable demographic characteristics to those benefiting from i-Ready instruction across each grade level (Swain et al., 2019). Propensity score matching was utilized to create analytic samples of i-Ready instruction and compare students matched on baseline mathematics achievement. The study used a hierarchical-linear model to assess student outcomes in math while using the i-Ready curriculum (Swain et al., 2019). It was found that when implemented with fidelity, students using i-Ready performed better in mathematics than those who did not. The effect sizes observed were at the upper end of the range typically found in educational interventions, as noted in recent research (Swain et al., 2019). These findings suggest that when used consistently, i-Ready instruction for mathematics is associated with higher student mathematics achievement, providing support for its efficacy as a supplemental instructional tool (Swain et al., 2019).

BIM

The Educational Research Institute of America (ERIA, 2012) conducted a study of the effectiveness of *BIM* in 2012, solely focusing on Grade 7. The research questions aimed to discover if *BIM* was effective in improving student knowledge and skills in mathematics, particularly when compared to a control group. Two teachers in the same school participated in this study (ERIA, 2012). Teacher A used *BIM* as the primary source of math instruction for three classes in 1 school year. Before this study, the teacher did not have any exposure or experience with the *BIM* curriculum. The control group was led by Teacher B who continued to use a previous mathematics program used at the school for many years. This teacher also taught three seventh-grade classes. Both teachers administered a pretest in mid-September 2011 and a posttest in June 2012 (ERIA, 2012). The school's demographics are provided in Figure 20.

Figure 20

School Demographics

Demographic Characteristics of the School Included in the Study

Location	*Grades*	*Students Enrolled*	% Minority	% Free/ Reduced Lunch	% Special Needs
Rural	6 to 8	630	48%	24%	N/A

ERIA (2012) researchers developed the outcome measures for the pre- and post-assessments. Both tests included six open-ended questions and 24 multiple-choice questions. Figure 21 shows the results, reliability estimates, mean scores, and standard error of measurement for both assessments (ERIA, 2012).

Figure 21

Pre and Posttest Results for Both Groups

Reliability Estimates, Mean Scores and Reliability for the Mathematics Assessments Control and *Big Ideas Math* Groups

Test	Standard Deviation	Reliability*	SEM**
Control Group Pretest	3.53	.60	2.3
Control Group Post-Test	4.18	.75	2.1
Big Ideas Math Group Pretest	3.19	.62	2.0
Big Ideas Math Group Post-Test	4.24	.77	2.0

**Reliability computed using the Kuder-Richardson 20 formula.*

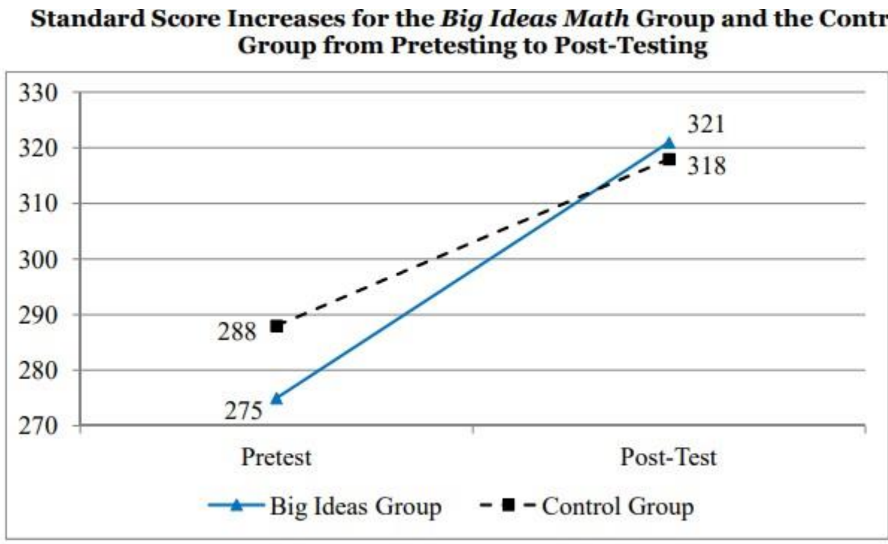
*** SEM stands for Standard Error of Measurement.*

Based on the reliability rates for the pretest, the researchers found that students were guessing for many of the questions. The reliability increase indicated a decrease in guessing responses, therefore showing the effect of mathematics instruction. There were four analyses conducted. Repeated measures analyses of variance (ANOVA) were used to identify changes in scores between the two groups, to determine if there was a significant difference between pre- and post-assessments, and to show if one group experienced more of an increase from pre- to post-testing (ERIA, 2012). Independent sample *t-tests* were used to determine significant differences in the pre- or post-assessments between the two groups (ERIA, 2012). Paired comparison *t-tests* were used to determine levels of increase from pre- to post-testing for both groups (ERIA, 2012). Control group students and *BIM* students were placed into two groups based on the results of the pretest. The paired comparison *t-tests* were conducted to identify whether both mathematics instructional programs were equally effective (ERIA, 2012).

In addition, an effect-size analysis was conducted using Cohen's *d* statistic, which provides an indicator of the strength of the treatment's effect apart from statistical significance. The guidelines for the interpretation of Cohen's *d* statistic are .2 = small effect, .5 = medium effect, and .8 = large effect (ERIA, 2012). Figure 22 shows both groups' standard score increases from pre- to post-testing.

Figure 22

Two Group Score Increases From Pre- to Post-Testing



The *BIM* group started with a lower overall score of 275 but showed a higher increase by the end of the year. Based on the findings of the study, it was determined that the *BIM* curriculum was effective in relating to the improvement of mathematical skills and knowledge for students in Grade 7 (ERIA, 2012). As this study was conducted in 2012, there is a need to evaluate the *BIM* curriculum due to evolving standards and policy changes. In addition, the study was conducted using a seventh-grade sample. It is important to expand this study to include elementary-level classes, specifically third grade.

The *BIM* program strongly emphasizes connecting mathematical concepts to authentic real-life situations. Students work with realistic scenarios and problems that require specific mathematical skills to solve, which has the potential to help students strengthen critical-thinking skills, mathematical concepts, and the application of new learning. The program encourages students to reflect on their thinking and learning processes. Through such reflection, students become more in tune with their strengths and weaknesses in mathematics.

By adopting the constructivist learning theory as the theoretical framework, this dissertation acknowledges that learning in the *BIM* program involves active student engagement, collaborative interactions, authentic applications, and metacognitive reflection (Big Ideas Learning, 2022). This framework enables the evaluation of the program's effectiveness in fostering deep conceptual understanding, critical-thinking skills, and real-world connections. By exploring the alignment between the program's design and constructivist principles, this research contributes to enhancing elementary math education and informs instructional practices that promote meaningful and effective learning experiences for students using the *BIM* program.

Summary

The topic of mathematics reform has been a highly debated issue in education, with the emergence of multiple initiatives and standards over time. According to the literature, rote memorization and critical thinking skills have a place in mathematics education. The Mathematics Curriculum Leadership Board was established to provide South Carolina teachers with support and guidance when implementing the new math standards. Although recent South Carolina math results have shown improvements in student performance, significant achievement gaps persist among different student subgroups. Educators are still challenged by the task of being able to render math instruction that is of ideal quality but also accessible and engaging for all students. Another level of challenge simultaneously addresses the broader social and cultural factors that impact student success.

Chapter 3: Methodology

Chapter 3 includes information about the methodology, data collection, instruments, and data analysis procedures used in this study to determine the effectiveness of the *BIM* curriculum. The study used a program evaluation design guided by the logic model framework.

Statement of the Problem

Mathematics education plays a crucial role in developing students' abilities to derive solutions and increase reasoning and analytical skills and overall academic achievement. *BIM* is a widely adopted instructional program that emphasizes conceptual understanding and real-world applications of mathematical concepts. Polston School District began the math textbook adoption process during the 2019-2020 school year. According to district policy, teacher representatives from kindergarten through 12th grade were included on the textbook adoption committee. The schools received a set of books from vendors, and a math content specialist developed a tool to evaluate the textbooks; however, the traditional adoption process was disrupted because of the pandemic (COVID-19) and the associated closing of schools. Nonetheless, teachers participated in a virtual vote, and the chosen textbook was *BIM*. Training for teachers on implementing the *BIM* curriculum was scheduled to be conducted online during the summer of 2020. Although the *BIM* curriculum has been used for 3 years, an evaluation of this program or its impact on district goals or mission has yet to be conducted or measured. An evaluation of this math program is important for critiquing the instructional modules. Evaluation can aid in the determination of whether the curriculum facilitates students' abilities to meet math standards.

Despite its popularity, there is a need for rigorous quantitative research to assess the effectiveness of *BIM* instruction in improving student achievement. The schools that were sampled in the qualitative study will focus on whether the *BIM* program has impacted student achievement over 3 years.

Research Design

Repeated measures are a common research design used in longitudinal studies to track changes in variables or evaluate interventions. This design involves measuring the same participants on the same variables at multiple time points or under different conditions (Laerd Statistics, 2018). By using the same participants across conditions, repeated measures can help reduce variability in data. Analyzing repeated measures data requires specific statistical techniques, including repeated measures ANOVA, mixed-effects models, and structural equation modeling (Kent State University, 2023). These methods account for the dependency among observations and can provide more accurate estimates of the effects of independent variables. The repeated measures design has advantages, including increased statistical power and reduced costs compared to using different participants for each condition; however, it is important to consider potential carryover effects and participant dropout when planning and interpreting results from repeated measures studies.

This ex post facto study focused on the effectiveness of the *BIM* curriculum and its impact on student achievement in Title I schools in a single suburban school district. Students were assessed throughout the 2019-2023 school years through quarterly benchmarks and the SC READY summative assessment. The participants for this study were drawn from a single school district.

Research Questions

1. What are the variations in student achievement among third-grade students in Polston School District Title I schools?
2. How did the *BIM* program influence SC READY third-grade student proficiency during 2019-2023 in Polston School District Title I schools?

Participants

The Polston School District has a population of 28,544 students. The sample for this research included 13 elementary schools selected from a pool of 20 schools in the district. The 13 schools were selected based on the criterion of diversity in terms of their demographic characteristics, location, and academic performance. Of that population, the study used data from third-grade students in the selected 13 schools. Table 2 shows the student population by location for 2019-2023.

Table 2

Third-Grade Student Population by Location

	A	B	C	D	E	F	G	H	I	J	K	L	M
2019-2020	110	90	94	78	104	83	92	113	107	93	132	99	91
2020-2021	95	104	84	83	125	84	95	119	97	89	114	94	83
2021-2022	80	96	79	65	110	76	84	88	89	109	121	99	77
2022-2023	87	104	85	62	145	83	87	115	100	108	105	106	95

School E experienced a noticeable increase in student population in 2022, while School C consistently dwindled in numbers. Table 2 shows a fluctuation in numbers across the board. These changes may be attributed to the number of transient students. Transferring within the Polston School District is allowed if the student is moving, returning to the school in which they are zoned, or participating in the Choice program, or by the approval of district-level personnel (South Carolina Department of Education, 2022b).

The study focused on Title I schools, which are designated to improve academic outcomes for students from economically disadvantaged backgrounds (South Carolina Department of Education, 2023b). Title I schools for this study were selected based on the criteria of poverty and academic risk. To ensure the reliability and validity of the data collected, the study utilized the math Mastery View benchmarks, and math SC READY scores from 2019-2023. These measures provide a comprehensive assessment of academic progress in mathematics guided by the *BIM* curriculum. Figure 23 shows the total number of third-grade students in all locations by year.

Figure 23

2019-2020 Third-Grade Ethnicities by Location

	Asian		African American		Hispanic		Other		White		PIP	
	#	%	#	%	#	%	#	%	#	%	#	%
A	7	1.2	388	69	64	11.4	46	8.2	57	10.1	382	67.97
B	21	3.5	325	54.3	87	14.5	31	5.2	135	22.5	385	64.27
C	28	4.5	457	72.8	85	13.5	36	5.7	22	3.5	526	83.76
D	9	1.8	431	85.7	43	8.5	14	2.8	6	1.2	459	91.25
E	1	0.1	569	80.8	59	8.4	39	5.5	36	5.1	535	75.99
F	6	1.1	297	53.1	212	38.3	16	2.9	26	4.7	472	85.2
G	16	2.6	427	68.2	47	7.5	43	6.9	93	14.9	404	64.54
H	20	2.8	527	72.9	52	7.2	45	6.2	79	10.9	464	64.18
I	23	3.4	320	48	246	36.9	25	3.7	53	7.9	457	68.52
J	17	2.5	390	56.6	107	15.5	37	5.4	138	20	436	63.28
K	12	1.6	571	75.9	63	8.4	56	7.4	50	6.6	511	67.95
L	16	2.4	506	75.2	54	8	39	5.8	58	8.6	433	64.34
M	5	0.99	354	64.7	124	22.7	25	4.6	39	7.1	451	82.45

Schools D and E have the highest African American population. Schools D and F have the highest percentage of pupils in poverty. Schools B and C have the highest Asian population. Figure 24 aggregates third-grade student demographics from the 2021-2022 academic school year.

Figure 24

2021-2022 Third-Grade Ethnicities by Location

	Asian		African American		Hispanic		Other		White		PIP	
	#	%	#	%	#	%	#	%	#	%	#	%
A	6	1.1	356	63.9	81	14.5	49	8.8	65	11.7	370	66.4
B	20	3.3	313	52.1	101	16.8	30	5	137	22.8	391	65.1
C	0	0.6	402	77.6	69	13.3	38	7.3	6	1.2	457	87.6
D	10	2.1	394	84	41	8.7	17	3.6	7	1.5	430	91.7
E	0	0.4	605	83.8	47	6.5	50	6.9	17	2.4	568	78.7
F	0	0.4	282	55.5	182	35.8	20	3.9	22	4.3	440	86.6
G	20	3.7	350	64.2	56	10.3	52	9.5	67	12.3	371	68.1
H	20	2.9	510	74.9	54	7.9	39	5.7	58	8.5	461	67.7
I	22	3.6	280	45.7	235	38.3	31	5.1	45	7.3	423	69
J	19	2.8	406	59.3	97	14.2	41	6	122	17.8	428	62.5
K	16	2.1	562	75.4	49	6.6	62	8.3	56	7.5	501	67.2
L	17	2.6	505	76.5	48	7.3	46	7	44	6.7	423	64.1
M	8	1.5	329	61.3	130	24.2	32	6	38	7.1	441	82.1

Although School D does not have the highest student population, the pupils in poverty percentage is the highest among the sample at 91.7% and higher than the district average of 58.9% (InformEdSC, 2023).

Instruments

An ex post facto research design required requisite authorization to be obtained from the executive director of accountability, research, and evaluation, in tandem with the student data coordinators affiliated with Title I schools, to procure the essential data sets to analyze the necessary documents for the study at hand (Pell Institute, 2023). The data sets, which encompassed an array of mathematical aptitude scores gauged through the utilization of Mastery View Predictive Assessments and SC READY, were selected from the district's research department and the South Carolina Department of Education.

The data procured were securely deposited in an encrypted digital repository designed to catalog benchmark scores, summative assessment projections, true scores on

SC READY, and assorted demographic data points. The anonymity and confidentiality of the subjects involved in the research were safeguarded, with no data set being collected that would divulge students' identities, and no information was shared with any other stakeholders outside of me.

Procedures

Research questions that served as the guide for the evaluation were outlined. The questions addressed the specific aspects of the *BIM* program. The target population was based on factors such as age, grade level, and prior math proficiency. Using ex post facto data, I collected data from multiple assessments over 3 years of program implementation. I conducted a repeated measures analysis to analyze the collected data. Repeated measures examine score or performance level changes over time. I completed an ANOVA to determine if differences are deemed significant over time regarding the 13 participating schools in the study. Through analysis and data interpretation, I concluded the effectiveness of the *BIM* program. Based on the evaluation results, recommendations have been made for program improvement or future interventions.

A comprehensive report documented the evaluation process, which included research questions, selected methodology, data analysis procedures, findings, conclusions, and recommendations. Information was shared with stakeholders such as district-level personnel, program administrators, and teachers. The results will be communicated through visual representations deemed appropriate for the intended audience to make informed decisions to promote evidence-based practice.

Limitations

Limitations have the propensity to affect the findings from research conducted for a given study and are outside of the researcher's control (Research Guides at the University of Southern California, 2022). This study focused on analyzing data for third-grade students in Title I schools within the Polston School District. The findings of this study may not be generalizable to non-Title I schools or future studies conducted among higher grade levels. Additionally, the results obtained may only apply to other Title I schools that are specific to the Polston School District. The study's sample size was limited to 13 of 20 elementary schools in the district. Broadly, research conducted among larger sample sizes can be better generalized. When conducting research, I found evaluative studies for other academic programs, but there was limited information specific to the effective implementation of the *BIM* curriculum.

Delimitations

I focused solely on third-grade data, as this grade level is the baseline for most students' standardized testing. The third-grade level has the least number of interventions and data manipulation, increasing the study's reliability and validity; however, this approach may limit the generalizability of the findings to other grade levels or student populations. Furthermore, the study's scope was limited to examining whether the implementation of the *BIM* curriculum achieves its program goals and influences student achievement. Another delimitation was the decision to analyze the math scores.

Ethical Considerations

As a standard protocol, the anonymity of all participants was implemented while the investigation was in progress. Data were collected from the appropriate assessment folders, and confidentiality was maintained to ensure that no personal identifying information about participants was revealed. Access to the data was limited to authorized personnel. The study did not cause harm or distress to students, and the data collection process did not interfere with classroom instruction or cause undue stress or anxiety for students.

Data Analysis

The data analysis consisted of the fall and spring scores from the Mastery View Predictive Assessment benchmarks and the SC READY assessment. Data from the assessments for 2019-2023 were analyzed. A program evaluation requires the use of organized data to identify and describe variable relationships within a given sample (Kaur et al., 2018). Descriptive statistics was used as the methodology to provide a comprehensive overview of the students' demographic traits and math achievement data. A repeated measures design was used to determine change over time within a single population. Additionally, to discern any variations in math achievement over 3 years across schools, the ANOVA statistical analysis tool was employed.

Summary

The problem addressed in this dissertation is the lack of evaluation and measurement of the *BIM* program's impact on student achievement in the Polston School District. There was a need for quantitative research to assess the effectiveness of the program in improving student outcomes. Using repeated measures as the research design allowed me to track changes over time. The design involves measuring the same participants on the same variables at multiple time points. As many students are transient, it was shown that some participants did not have comparative data as they may have moved to another school district or did not take all the required assessments.

The study focused on third-grade students in Title I schools within the Polston

School District. Data were collected from MasteryConnect benchmarks and SC READY assessments over 3 years. The study aimed to draw conclusions about the effectiveness of the *BIM* program and make recommendations for program improvement or future interventions based on the evaluation results. The findings and recommendations were documented in a comprehensive report and shared with relevant stakeholders. The study had limitations, including its focus on a specific grade level, sample size, and delimitations, such as excluding non-Title I schools and analyzing math scores only. Ethical considerations were followed to ensure the confidentiality and privacy of participants. The data analysis involved descriptive statistics and an ANOVA to provide a comprehensive overview of student achievement and identify variations across schools over the 3 years.

Chapter 4: Results

The literature review underscored the difficulties inherent in effective mathematics instruction and the quest to identify developmentally appropriate and standards-based educational tools and programs. Historically, educational policymakers have sought to refine math pedagogy, transitioning from a paradigm centered on rote memorization to one emphasizing conceptual comprehension and practical application. In South Carolina, this journey included the development of the SCCCR Mathematics Standards, a framework aligning with both national and international benchmarks. The SCCCR Mathematics Standards prioritize the cultivation of mathematical proficiency, critical thinking, problem-solving acumen, and real-world applicability. Educational stakeholders have introduced formative assessments aligned with state standards to gauge student progress and inform decision-making regarding instruction and remediation.

The adoption of the *BIM* curriculum occurred in 2020. The math program seeks to infuse mathematical learning with practical relevance and real-world applicability. Empirical investigations into *BIM's* effectiveness, notably within the context of seventh-grade education, have demonstrated positive outcomes in terms of enhancing student mathematical skills and knowledge; however, given the dynamic nature of educational standards and policies, there exists a compelling imperative to subject such programs to ongoing analysis and evaluation to determine their continued relevance and efficacy.

This study sought to conduct a comprehensive evaluation of the *BIM* program, with a particular emphasis on its implementation at the elementary level, particularly within third-grade classrooms. Adopting a theoretical lens informed by the constructivist learning theory, this research appraises the extent to which the *BIM* program affects student achievement in math. In addition, the literature review highlighted the need for ongoing program evaluations within the field of mathematics education to ensure the fidelity and efficacy of educational initiatives, mitigate achievement disparities, and produce meaningful learning experiences conducive to holistic student development.

This study aimed to determine if Grade 3 students were making academic gains and improvements on formative and summative assessments. Upon entering the third grade, students receive formal instruction in multiplication after having more than 2 years of practice with addition and subtraction. As students progress to higher grades, they must be comfortable and skilled in addition, subtraction, multiplication, and division. Such skill is defined as automaticity, which is providing a correct response from memory. Many researchers use automaticity as a performance predictor for high-stakes assessments (McGee et al., 2017). Having a solid foundation in basic math skills affects how students respond to higher-level or multi-step mathematical problems. When automaticity is achieved at the appropriate developmental level, there is a higher chance of students experiencing continued mathematical success (Baker & Cuevas, 2018). For these reasons, assessing the math skills of third-grade students was crucial in helping educational stakeholders estimate student readiness for more advanced math functions or the need for academic assistance.

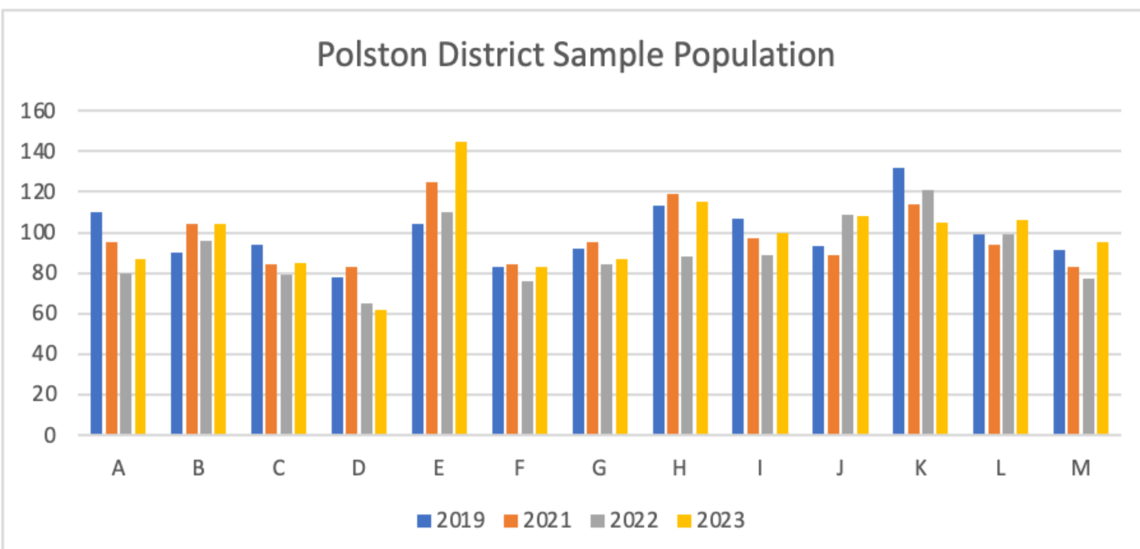
This study used the logic model to evaluate the effectiveness of the *BIM* curriculum on student achievement for students in Grade 3. The evaluation focused on Title I elementary schools in the Polston School District. I analyzed *BIM* curriculum quality and resource appropriateness. In the Polston School District, students take two Mastery View predictive assessments every year. These formative assessments help teachers make data-informed instructional decisions to meet the needs of all learners and clarify misconceptions in mathematical data. SC READY is the summative assessment issued by the state of South Carolina to be given at the end of the year to students in Grades 3-8. I analyzed data from Mastery Connect and SC READY to determine the impact of the *BIM* curriculum on student achievement. This program evaluation sought to provide information about the effectiveness of the *BIM* curriculum and to determine if the program aligns with the school's goals and objectives.

Description of Participant Data

The sample population included 3,741 students. Figure 25 shows a 4-year population span for all schools.

Figure 25

Polston School District Sample Population



School E has the highest population for 2023 with 145 third graders, and School K has the second highest with 132 third graders. School D trends with the lowest third-grade enrollment from 2019-2023. This study used historical data for the 13 elementary schools that receive Title I funding to improve academic outcomes for attending students. Schools were selected based on the similarity in the criterion of diversity in terms of their demographic characteristics, location, criteria of poverty, and academic performance. Figure 26 shows a breakdown of student numbers and ethnicities by school.

Figure 26

Demographic Information of Sample Population

	Asian		African American		Hispanic		Other		White		PIP	
	#	%	#	%	#	%	#	%	#	%	#	%
A	7	1.2	388	69	64	11.4	46	8.2	57	10.1	382	67.97
B	21	3.5	325	54.3	87	14.5	31	5.2	135	22.5	385	64.27
C	28	4.5	457	72.8	85	13.5	36	5.7	22	3.5	526	83.76
D	9	1.8	431	85.7	43	8.5	14	2.8	6	1.2	459	91.25
E	1	0.1	569	80.8	59	8.4	39	5.5	36	5.1	535	75.99
F	6	1.1	297	53.1	212	38.3	16	2.9	26	4.7	472	85.2
G	16	2.6	427	68.2	47	7.5	43	6.9	93	14.9	404	64.54
H	20	2.8	527	72.9	52	7.2	45	6.2	79	10.9	464	64.18
I	23	3.4	320	48	246	36.9	25	3.7	53	7.9	457	68.52
J	17	2.5	390	56.6	107	15.5	37	5.4	138	20	436	63.28
K	12	1.6	571	75.9	63	8.4	56	7.4	50	6.6	511	67.95
L	16	2.4	506	75.2	54	8	39	5.8	58	8.6	433	64.34
M	5	0.99	354	64.7	124	22.7	25	4.6	39	7.1	451	82.45

Figure 26 shows that all schools have a higher African American population. In addition, all schools have at least a 60% or higher number of pupils in poverty. All schools in this study participate in district-wide benchmark and summative assessments in the fall and spring. The study used 2019-2023 third-grade assessment data from math Mastery View benchmarks and math SC READY. There were no data to report for 2020 due to the COVID-19 pandemic. On March 20, 2020, the former superintendent of education submitted a waiver that would allow assessments in South Carolina to be suspended (South Carolina Department of Education, n.d.-a).

Research Questions

1. What are the variations in student achievement among third-grade students in Polston School District Title I schools?

To determine variations in student achievement, a repeated measures design was used. A repeated measures design assesses a single sample on multiple variables over time (Rana et al., 2013). School K was used as the sample population. Data were collected for attending students from 2019-2023, except for 2020. Student identification numbers were removed from the spreadsheet. The repeated measures included fall and spring benchmark suggested scores. The score provided for the SC READY assessment was multiplied by 0.137931 to get a score that would be on the same 100-point scale as the suggested scores on the quarterly benchmarks. Figure 27 shows an excerpt of School K's compiled data for 2022, which includes benchmark and SC READY scores.

Figure 27

Repeated Measures

A	B	C	D	E
Student ID	Winter	Spring	SC READY	
[redacted]	86	63	478	65.931018
[redacted]	57	53	325	44.827575
[redacted]	64	87	419	57.793089
[redacted]	62	67	381	52.551711
[redacted]	97	96	743	102.482733
[redacted]	60	53	316	43.586196
[redacted]	62	59	373	51.448263
[redacted]	92	92	593	81.793083
[redacted]	62	72	373	51.448263
[redacted]	89	96	544	75.034464
[redacted]	67	59	419	57.793089
[redacted]	95	96	487	67.172397
[redacted]	99	65	365	50.344815
[redacted]	72	80	460	63.44826
[redacted]	67	65	460	63.44826
[redacted]	55	54	333	45.931023
[redacted]	60	58	333	45.931023
[redacted]	95	94	642	88.551702
[redacted]	55	53	325	44.827575
[redacted]	58	59	365	50.344815
[redacted]	77	60	451	62.206881
[redacted]	55	57	289	39.862059
[redacted]	62	68	419	57.793089
[redacted]	62	57	350	48.27585
[redacted]	55	61	404	55.724124
[redacted]	64		325	44.827575
[redacted]	81	65	443	61.103433
[redacted]	64	80	451	62.206881
[redacted]	86	67	411	56.689641
[redacted]	83	60	451	62.206881
[redacted]	89	88	574	79.172394
[redacted]	64	60	316	43.586196
[redacted]	59	57	316	43.586196
[redacted]	98	97	574	79.172394
[redacted]	62	61	404	55.724124
[redacted]	72	63	381	52.551711

2019 | 2020 | 2021 | 2022 | 2023 | +

In 2022, the first student earned a suggested score of 86 for the fall benchmark and 63 for the spring benchmark. The student received a 478 on the SC READY assessment which was converted to a scaled score of 65.931. Interpreting these data shows that the student dropped from fall to spring on the quarterly assessments and continued to score within the same range on SC READY as the spring benchmark. Table 3 depicts the averages for 2019, 2022, and 2023 for fall and spring benchmarks, SC

READY, and the scaled SC READY scores.

Table 3

Yearly Test Score Averages

	Fall	Spring	SC READY	Scaled SC READY
2019			429.949	59.303
2022	70.053	68.805	412.588	54.518
2023	72.255	67.412	433.75	57.833

Benchmark data were unavailable for 2019 for any schools in the Polston School District. Averages for 2021 were not included in Table 3 due to discrepancies with student identification numbers. Only one student number aligned with the benchmark and SC READY data. Based on the information provided, an average was calculated as 71.16 for the fall benchmark, 68.11 for the spring benchmark, 425.43 for SC READY, and 57.22 for the scaled SC READY score.

2. How did the *BIM* program influence SC READY third-grade student math proficiency during 2019-2023 in Polston School District Title I schools?

To analyze how *BIM* may affect third-grade students' math proficiency on SC READY, I conducted a one-way ANOVA. An ANOVA is a powerful statistical method that helps to compare multiple groups effectively. Using this approach allowed me to thoroughly examine if there were any significant differences among the groups (Laerd Statistics, n.d.). By calculating the *F* statistic, along with its accompanying *p-value*, the ANOVA helped to make sense of the differences observed, which made it easier to spot meaningful patterns and trends in the data (Andrade, 2019). Figure 28 depicts the scaled score averages of SC READY scores for the 13 schools selected for this study. The years where schools had the highest average are identified in bold font.

Figure 28

Scaled Score Averages by School

School ID	2019	2021	2022	2023
A (Group 1)	501.688	410.881	**503.699**	479.953
B (Group 2)	455.3	417.568	**471.031**	453.612
C (Group 3)	390.899	413.409	**452.909**	362.247
D (Group 4)	**471.172**	391.638	417.492	431.246
E (Group 5)	**455.191**	365.474	403.362	409.399
F (Group 6)	**460.474**	353.21	396.853	373.288
G (Group 7)	**489.167**	412.346	477.361	424.106
H (Group 8)	448.485	425.44	468.079	435.847
I (Group 9)	420.544	397.844	448.125	417.685
J (Group 10)	442.24	411.013	424.028	424.056
K (Group 11)	432.078	421.2	410.767	432.145
L (Group 12)	438.533	386.012	437.394	459.559
M (Group 13)	446.413	368.52	387.118	402

BIM was not adopted until the 2020-2021 school year. In 2022, Schools A, B, and C experienced an increase. The following year, the scores at the same schools experienced a decrease that was lower than the 2019 averages. School C had the highest decline with a 28-point loss over 4 years. Schools C and I scored the lowest for 2019. In 2021, Schools E and F scored the lowest. In 2022, Schools F and M were among the lowest performing, and Schools C and F scored the lowest in 2023. In 2019, Schools A and G had the highest average. In 2021, Schools H and B received the highest scores. Schools A and B had the highest average in 2022, and in 2023, Schools A and L received the higher averages. From 2021-2023, School F has continued to show a decline in SC READY averages. School A was the top-scoring school in the Polston School District in

2019, 2022, and 2023. School B was among the highest averages in 2021 and 2022. Figure 29 represents a visual depiction of SC READY average scores by school.

Figure 29

Line Graph of Yearly Averages by School

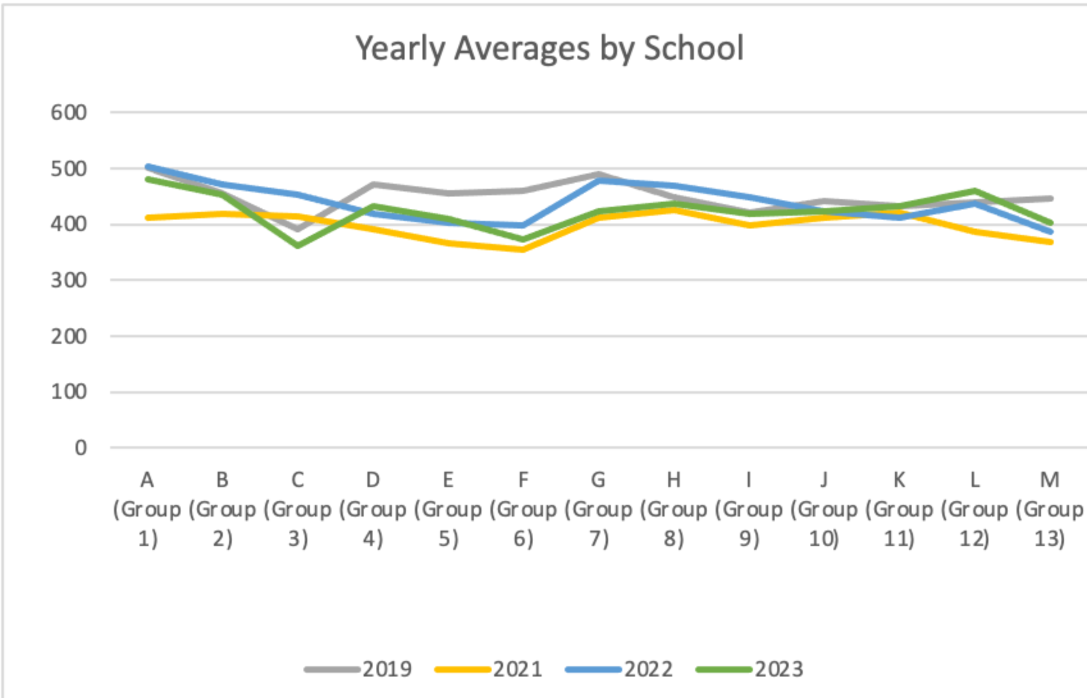
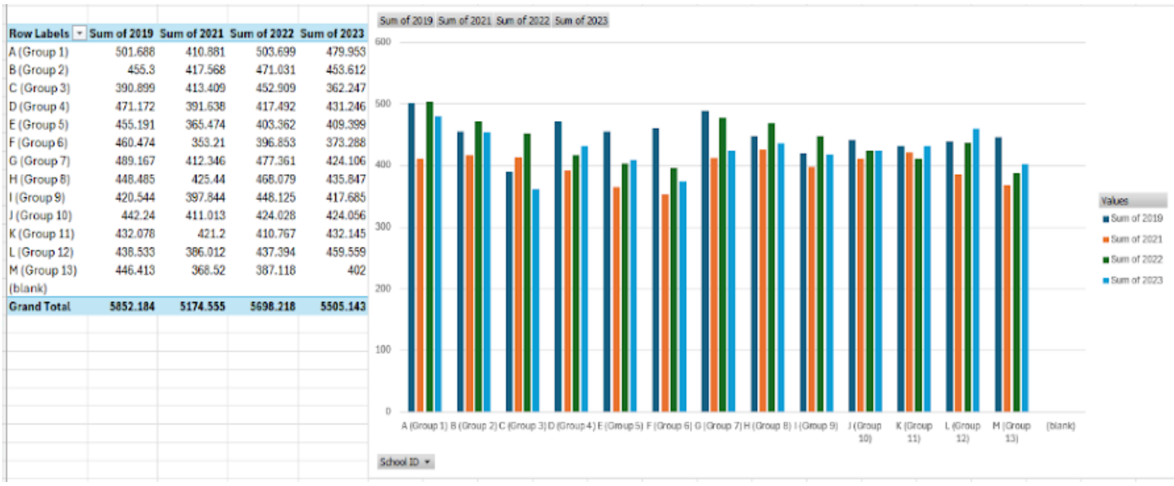


Figure 29 shows a visual depiction of averaged scores from 2019-2023 for all schools. The 2019 school year is included in the analysis to represent the starting point for the schools before *BIM* was implemented in the 2020-2021 school year. The 2021 school year had the lowest scores of all 4 years. Figure 30 shows the annual scores for all schools represented in this study.

Figure 30

Annual Scores Chart



Row Labels	Sum of 2019	Sum of 2021	Sum of 2022	Sum of 2023
A (Group 1)	501.688	410.881	503.699	479.953
B (Group 2)	455.3	417.568	471.031	453.612
C (Group 3)	390.899	413.409	452.909	362.247
D (Group 4)	471.172	391.638	417.492	431.246
E (Group 5)	455.191	365.474	403.362	409.399
F (Group 6)	460.474	353.21	396.853	373.288
G (Group 7)	489.167	412.346	477.361	424.106
H (Group 8)	448.485	425.44	468.079	435.847
I (Group 9)	420.544	397.844	448.125	417.685
J (Group 10)	442.24	411.013	424.028	424.056
K (Group 11)	432.078	421.2	410.767	432.145
L (Group 12)	438.533	386.012	437.394	459.559
M (Group 13)	446.413	368.52	387.118	402
(blank)				
Grand Total	**5852.184**	**5174.555**	**5698.218**	**5505.143**

Figure 30 shows that all schools experienced a decline in 2021 but showed an increase the following year. In 2023, the schools in this study declined, which was estimated to be a 193.075 loss. Schools K, L, and M were the only schools to receive higher averages in 2023 than the previous school year. Figure 31 shows the findings of the one-way ANOVA.

Figure 31

One-Way ANOVA

Analysis of Variance Results

F-statistic value = 2.02925

P-value = 0.04776

Data Summary				
Groups	**N**	**Mean**	**Std. Dev.**	**Std. Error**
Group 1	4	474.0553	43.4668	21.7334
Group 2	4	449.3778	22.6107	11.3053
Group 3	4	404.866	38.2647	19.1324
Group 4	4	427.8868	33.2006	16.6003
Group 5	4	408.3565	36.7805	18.3902
Group 6	4	395.9563	46.5633	23.2817
Group 7	4	450.745	38.161	19.0805
Group 8	4	444.4625	18.3488	9.1744
Group 9	4	421.0495	20.6813	10.3407
Group 10	4	425.3343	12.8354	6.4177
Group 11	4	424.0475	10.2394	5.1197
Group 12	4	430.3745	31.2815	15.6408
Group 13	4	401.0128	33.2215	16.6107

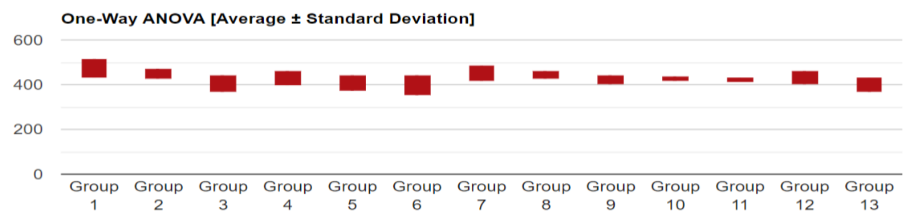
The mean values represent the average of the SC READY totals taken from Figure 28. The standard deviation depicts the span of data within each group's mean, and the standard error estimates the accuracy and variability of the sample mean as a representation of the population mean. Figure 31 shows that Schools H, J, and K, also labeled as Groups 8, 10, and 11, have a standard error of less than 10. Group 6, or School F, has the highest standard error of 23.281. The schools closest to the mean are H, I, J, and K. Figure 31 depicts the one-way ANOVA summary, which includes degrees of freedom, averages, standard deviations, *f* statistic, and *p* value. Figure 32 shows the SC

READY averages for all schools along with the standard deviation.

Figure 32

One-Way ANOVA Average and Standard Deviation

ANOVA Summary					
Source	Degrees of Freedom DF	Sum of Squares SS	Mean Square MS	F-Stat	P-Value
Between Groups	12	24464.2805	2038.69	2.0293	0.0478
Within Groups	39	39181.4079	1004.6515		
Total:	51	63645.6884			



The degree of freedom between groups is 12. That number was acquired by subtracting 1 from the total number of groups. Within groups, the degree of freedom is 39. To calculate the degree of freedom within groups, the total number of groups would be subtracted from the total number of observations. The observations are the total amount of entries from every year represented in Figure 29. The *f* statistic of 2.0293 was calculated by dividing the between-group mean square total by the within-group mean square total (Di Leo & Sardanelli, 2020). The *p value*, or probability, identifies the likelihood that noted differences are due to chance. The *p-value* for this ANOVA is 0.0478. The second part of Figure 32 shows that the means for Schools C, E, F, and M fall below 400.

Summary of Outcomes

This study aimed to assess the academic gains and improvements of third-grade students in the Polston School District, particularly focusing on the impact of the *BIM* curriculum. Third grade is a crucial juncture where students transition from basic arithmetic to more complex mathematical operations, emphasizing the importance of assessing their math skills for readiness in higher-level mathematics. Using a logic model approach, the study evaluated *BIM*'s effectiveness in Title I elementary schools within the district, analyzing curriculum quality and resource appropriateness. Data from formative Mastery View benchmarks and summative SC READY assessments were utilized, covering the period from 2019 to 2023, excluding 2020 due to the COVID-19 pandemic.

Participant data comprised 13 elementary schools selected based on criteria such as diversity in demographics, poverty, and academic performance. All schools participated in district-wide benchmark assessments, providing a comprehensive dataset for analysis. The research questions focused on variations in student achievement among third-grade students and the influence of the *BIM* program on SC READY math proficiency. A repeated measures design was employed to assess student achievement on quarterly benchmarks and SC READY over time, revealing fluctuations in scores across schools and years.

Analysis through a one-way ANOVA indicated notable differences among schools, suggesting an impact of *BIM* on student math proficiency; however, it also highlighted areas of concern, such as declining scores in certain schools over time. While the ANOVA yielded statistically significant results, it is unclear as to whether *BIM* is the sole reason for the decline in math scores over time. Overall, the findings underscore the importance of ongoing evaluation of educational programs like *BIM* to ensure alignment with district goals and objectives. While *BIM* shows potential for enhancing student math proficiency, continued monitoring and improvement are essential to address any disparities and maximize its effectiveness in promoting mathematical success among third-grade students in Title I schools.

Chapter 5: Discussion

Chapter 4 of this study examined how the *BIM* curriculum impacts the mathematical skills of third-grade students attending Title I elementary schools in the Polston School District. Chapter 4 highlighted the reasons why it is essential to evaluate the math proficiency of third graders, particularly as they navigate the critical transition to more complex mathematical concepts, and underscored the foundational role of basic math skills in fostering ongoing success in mathematics.

Through the utilization of a logic model framework, the study examined the impact of *BIM* on student achievement, leveraging data from both formative Mastery View benchmarks and summative SC READY assessments spanning from 2019 to 2023. The analysis encompassed an exploration of variations in student achievement over time and the influence of *BIM* on third-grade math proficiency, interpreted through a one-way ANOVA approach. The findings revealed statistically significant differences among schools, indicating the potential influence of *BIM* on student math proficiency, although there have been fluctuations observed across schools and years. This discussion unraveled the complexities underlying the implementation of *BIM* and its implications for fostering mathematical success.

Chapter 5 summarizes the findings from the research and analysis conducted in Chapter 4 and includes study conclusions, implications of practice, and ideas for further study or further research. The goal is to explore the practical implications of the discoveries made in Chapter 4, particularly for individuals directly involved in the educational process of elementary students. The examination encompasses educators, policymakers, and other influential figures who actively contribute to shaping the realm of math education. By examining the real-world implications derived from the research, the goal is to offer actionable insights into how the adoption and execution of the *BIM* curriculum can be refined to generate enhanced math learning outcomes for third-grade students attending Title I schools.

This chapter acts as a conduit between academic research and its application in practice to provide valuable guidance to those entrusted with improving the quality of math education. The goal is to equip decision-makers with evidence-based strategies and recommendations that can be readily implemented in educational contexts. By aligning this study's findings with the practical needs and hurdles faced by educators and policymakers, the goal is to instigate positive transformations in math education methodologies, nurturing a more supportive and enriching learning atmosphere for third-grade students enrolled in Title I schools.

Conceptual Framework

In the realm of educational research, understanding the complex dynamics of learning interventions and their impact on student outcomes has always been important. I sought to identify the factors contributing to successful educational programs such as *BIM,* seeking effective frameworks to guide investigations. This study aimed to address this need by exploring the interplay between two frameworks: the logic model and constructivism. The logic model provided a systematic approach to program planning, implementation, and evaluation, offering a coherent structure for understanding educational intervention, underlying mechanisms, and outcomes. By delineating the logical relationships between program inputs, activities, outputs, and outcomes, the logic model served as a valuable tool for designing and assessing the effectiveness of educational initiatives.

The situation included third-grade students in Title I schools receiving mathematics instruction through *BIM*, which is a curriculum adopted by the district in 2020. Based on district needs, test scores, and the implementation of a new math curriculum, a program evaluation was needed to determine whether *BIM* was meeting the needs of the students throughout the district. This study focused on the short-term outcomes, which included students demonstrating improved performance on math assessments. In addition, this study relied on the assumption that district personnel and program representatives have formally trained all teachers and teachers and students have access to all components of the program.

Constructivism presented an alternative philosophical lens, emphasizing the active construction of knowledge through experiences, social interactions, and reflective thinking. By embedding constructivist principles within the logic model for program evaluation, educators can gauge the school's efficacy in fostering substantive learning outcomes and achieving a culture of continuous improvement (Western Governors University, 2020). This study sought to bridge the gap between the two frameworks, harnessing the collective strength to enrich the understanding of educational interventions. By integrating the logic model's systematic approach with the constructivist principles of active engagement and learner-centeredness, a comprehensive conceptual framework guided the study.

Limitations

This study focused on analyzing math data for third-grade students in Title I schools within the Polston School District; therefore, the findings of this study may not be generalizable to non-Title I schools or future studies conducted among grade levels other than third grade. Generalizability is important as it allows researchers to make inferences based on observations in research (Polit & Beck, 2010). Additionally, the results obtained may only apply to other Title I schools that are specific to the Polston School District. The study's sample size was limited to 13 of 20 elementary schools in the district. Broadly, research conducted among larger sample sizes can be better generalized. While conducting the literature review, there was limited information specific to the effective implementation of the *BIM* curriculum.

It is unclear how much of an impact COVID-19 had on student assessment scores from 2021 to 2023. Relating to the logic model, some of the external factors also presented limitations. For example, neither the district nor schools have control over transient students. There were many pieces of data missing from the repeated measure data sets due to students moving from one school to another or transferring out of the district. Another limitation was teacher and student absences. It is impossible to control the number of absences for teachers or students and that has a direct impact on the delivery of *BIM* instruction from teachers and student academic experiences in math. According to Hansen and Quintero (2022), teacher absenteeism has a direct impact on student learning. Coupled with absenteeism would be the nationwide teacher shortage schools are experiencing. Students in many schools are receiving instruction from substitute teachers, or the learning environment is overcrowded.

Due to these limitations, this study relied on the assumptions in the logic model that all teachers have been formally trained through the district or company, teachers and students have access to all components of the program, and teachers are using the program with fidelity.

Recommendations for Practice

Practice recommendations provide practical advice based on what the researcher learned from conducting the study. These recommendations act as guidelines to which stakeholders can adhere to address and overcome identified problems or challenges. By offering these concrete suggestions, stakeholders can bridge the gap between theory and real-world action; therefore, recommendations show just how important research findings are, as they demonstrate how they can be put into action to make a real difference in how things are done.

Practice recommendations identify newly founded gaps in the literature (Moran, 2021). They also serve as valuable tools for stakeholders, offering concrete steps for implementation based on practical evidence while guiding future research efforts by identifying areas for further exploration.

Continued Monitoring

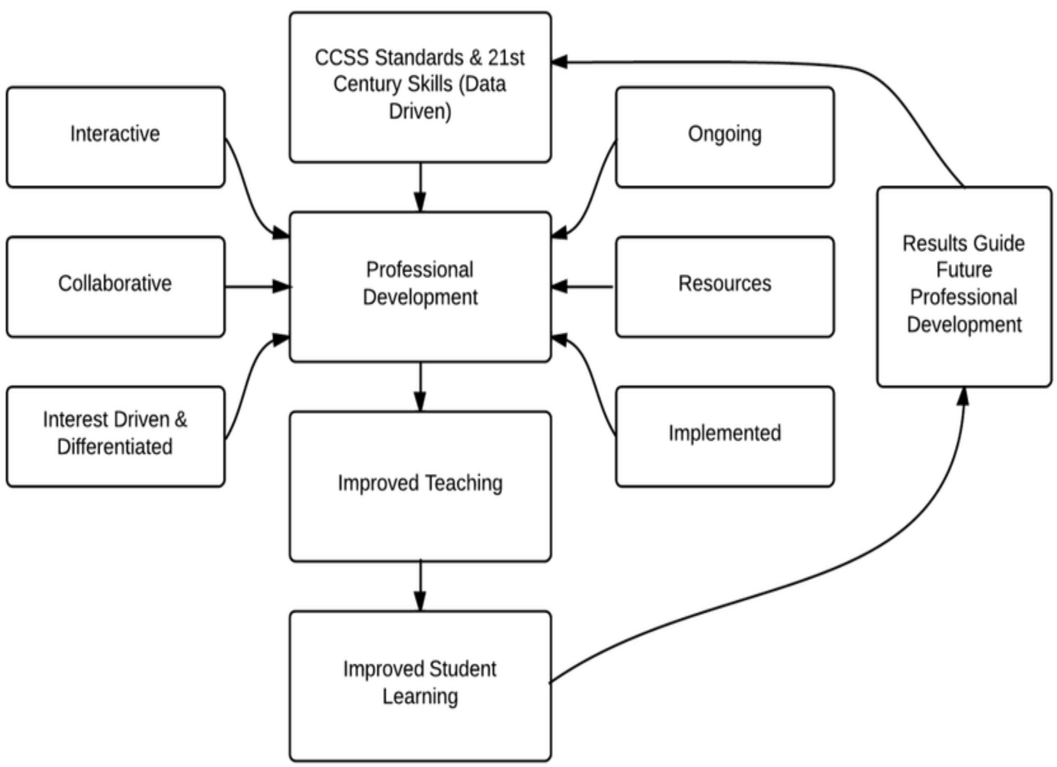
Continued monitoring helps teachers and decision-makers see how well the curriculum is working over time. Monitoring allows stakeholders to track progress over time using a series of data collection to measure student performance and improve program implementation (Centers for Disease Control and Prevention, 2023). By regularly checking how students are doing in math, educational stakeholders can identify any areas where things could be better or where students might be struggling. This ongoing check-up means that changes to improve how students learn can be more frequent and intentional. Monitoring would also provide insight into how the program is improving long-term success in math comprehension and computation. In addition, teachers would be able to make more informed decisions about how to provide more meaningful and personalized instruction.

Educator Professional Development

Professional development is one of the sole strategies educators have for improving current teaching practices and building their knowledge base in a particular content area. If stakeholders want to ensure that teachers are getting the most out of such opportunities, school and district leaders should make sure that professional development sessions are tailored or structured (Germuth, 2020). Figure 33 shows an example of a criterion used for professional development selection by teachers and administrators (Elliott, 2014).

Figure 33

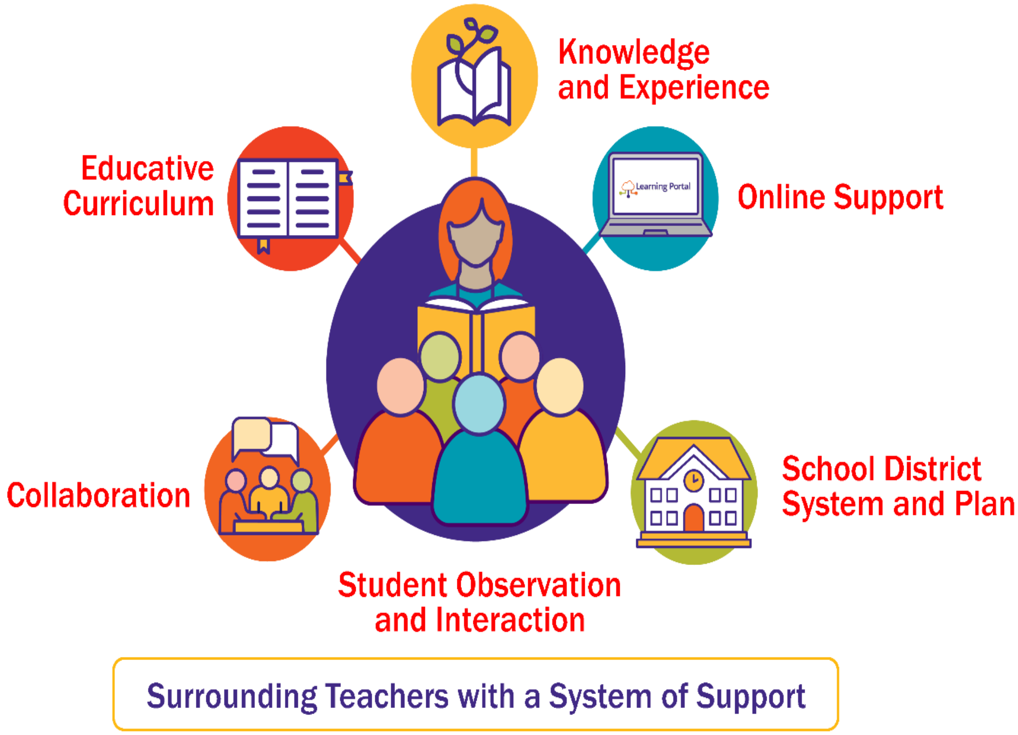
Online Professional Development



For this study, the Common Core State Standards and 21st century skills in Figure 33 will be replaced with SCCCR mathematical standards. Although Figure 33 focuses on online professional development selection, it takes on a relevant approach for teachers in physical education settings. Professional development in *BIM* would serve as a toolkit for educators, giving them the tools and techniques they need to confidently deliver mathematics instruction. Such training sessions would equip teachers with suggested activities, manipulatives, and instructional strategies where teachers learn the best ways to teach math effectively. Professional development would be ongoing and not just specific to analyzing assessment data. Teachers who participate in professional development sessions stay abreast of best practices and learn alternative ways to teach content (Creech, 2023). Professional development would need to align with district mathematical goals that are centered around student outcomes on state testing. To ensure that teachers are planning lessons and analyzing data in a manner that would support district goals, Figure 34 shows an example of a teacher's system of support.

Figure 34

Teacher System of Support



Providing professional development that is collaborative, educative, supportive, interactive, and inclusive is key to meeting educators' professional needs. This level of support would help teachers meet the needs of their students, specifically with *BIM*.

Tailored Support for Schools

Tailored support for individual schools means giving each school the help it needs, customized to its specific situation. Support would mirror the accommodations and interventions used when helping students individually but on a larger scale as each school faces its challenges and strengths. According to Straus and Miller (2016), teachers may feel supported by receiving more time to plan lessons, having district leaders reallocate funds to address student needs, hiring more teachers, and assisting with data analysis. By offering tailored support, schools are more equipped with the tools needed to overcome their unique obstacles and build on their strengths. Tailored support means understanding each school's situation and providing practical solutions that fit. It is about giving schools the support they need to support the *BIM* curriculum and ensure that every student gets a quality math education.

Addressing Score Fluctuations

The results of this study show score fluctuations among groups and across years. Delving deeper into the root causes of such changes would be beneficial for educators and students alike. When educational stakeholders identify and address score fluctuations, the process becomes more consistent and reliable when determining student outcomes and *BIM* program implementation efficiency. By tackling these fluctuations, educators can pinpoint underlying factors contributing to score variability and proactively address them.

Managing score fluctuations enables educators to maintain a clear, longitudinal view of student achievement. This ensures timely identification of areas for improvement and facilitates targeted interventions to support students effectively. By attending to score fluctuations, educators can ensure assessments yield meaningful insights into student learning and the curriculum's effectiveness. This, in turn, elevates the overall quality of math education for students.

To address test score fluctuations properly, teachers and administrators must be knowledgeable regarding data analysis. By collaborating with other educational stakeholders while having data conversations, teachers can identify positive or negative trends, predict student outcomes on high-stakes assessments, address achievement gaps, and find specific indicators or standards by which they can provide reteaching or remediation opportunities (American University, 2023).

Expanding Research

Expanding research in a study evaluating the *BIM* program is important for many reasons. Doing so will allow stakeholders to dig deeper into how well the program works. By expanding the research to other schools or districts, leaders could learn things about the program that would have otherwise been missed if only one place had been studied. A bigger picture gives teachers and policymakers ideas on how to improve mathematics instruction.

More research provides a deeper understanding of the program. When new concepts are brought forth regarding *BIM*, more strategies can be discovered that would help teachers meet the academic needs of their students when providing mathematics instruction. This would help students learn in ways that make more sense to them and help them succeed. Also, doing more research has the potential to foster collaboration among educators. Teachers, researchers, and policymakers all work together to learn more about *BIM*. This teamwork makes the research more useful for classrooms and helps to make math teaching even better. In doing more research on *BIM*, studying it closely, and working together, ways to make math education better for all students can be identified.

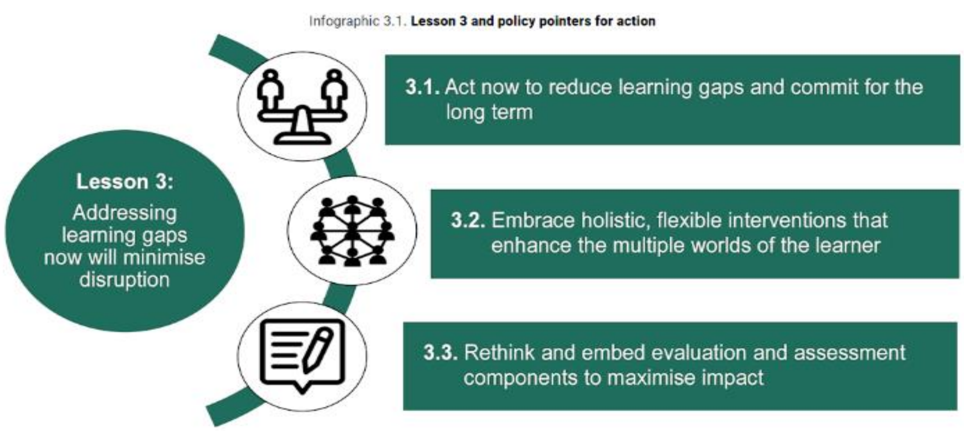
Addressing Academic Gaps

Addressing academic gaps provides students with opportunities to receive the support needed to experience success in the classroom and encourages students to become more autonomous learners. In addition, students within and among schools will have more equitable learning experiences. Through continuous monitoring and analysis, educators can make more informed decisions about the types of support and resources their students need.

The Organisation for Economic Cooperation and Development (OECD, 2020) noted that since the COVID-19 pandemic, there have been efforts to increase student achievement and retention by allocating additional tangible and monetary resources to students with such needs while helping educators build capacity to meet the needs of all learners. Figure 35 shows an action plan that will minimize disruption in the learning process while addressing academic gaps.

Figure 35

Policy Pointers for Action Infographic



Classroom disruptions have a greater effect on students with academic challenges, and the implications can last for years. The action steps in Figure 35 include taking initiative, providing useful interventions, and making better use of time by embedding assessments to reduce disruptions to close the achievement gap (OECD, 2020). The Polston School District has intervention time embedded in the daily schedule as part of the required instructional minutes. The model in Figure 35 may serve as a guide to provide structure and give teachers more opportunities to work with students with varying needs.

Suggestions for Future Research

It is important to reflect on the outcomes of this study as the research emphasized the need for a *BIM* program. There are many avenues relating to this topic that have not been explored. In this section, suggestions will be provided that address the limitations and outcomes of this study and the need for professional development and opportunities to incorporate student voice into planned lessons. The suggestions mentioned in this section are designed to extend the research, identify remaining questions or wonderings, and discover ways to continue the program evaluation through monitoring.

Conducting a long-term, or longitudinal, study would provide more insight and data to make more informed decisions about the program and student achievement in math. This study analyzed student data over 4 years. A future study could identify potential trends in data, gains or losses in SC READY mean scores, and comparisons of data as interventions are implemented over time.

A future study may consider following the same group of third-grade students through fifth grade to determine whether students gained, maintained, or lost mathematical aptitude. This type of study would also give more insight into whether other factors such as COVID-19, teacher retention, class size, or teacher training were the actual causes of the decline in SC READY scores.

BIM is just one of many math programs available for K-12 education. A future study may compare *BIM* with other programs such as Eureka Math, HMH, Everyday Mathematics, or Envision Mathematics. The researcher may consider analyzing the standards alignment chart to make comparisons as to how other programs align with

South Carolina standards.

A future researcher may want to conduct a mixed methods study, as this one only took on a quantitative approach. Stakeholders may benefit from getting teacher or student perceptions about the programs being evaluated. Qualitative data would add more insight into how the program could be improved or the kinds of support teachers may need to provide quality mathematics instruction with confidence. A study of this magnitude may provide valuable information regarding the need and impact of teacher training and potential intervention strategies needed for student success. A qualitative or mixed-methods approach would also be a good opportunity to get student perspectives about their experiences with *BIM* and how district and school leaders can implement more opportunities within the curriculum for student agency.

The sample size for this study was limited to third-grade students attending Title I schools in a single school district. A recommendation for extending the study may be to discover how the data from this study compare to surrounding school districts or wider student populations. A study could focus on how talented and gifted students faired with *BIM* over the same 4-year span. Another possibility would be to compare non-Title I schools to the remaining elementary schools in the same district. Instead of focusing on third-grade students, future researchers may want to consider analyzing data for fourth- or fifth-grade students. Conducting this study with diverse populations can help stakeholders identify if students' needs are the same regardless of learning abilities or socioeconomic backgrounds.

Another recommendation would be to investigate technology integration within the *BIM* curriculum. The researcher may explore how online platforms and interactive tools could impact student learning. It may be beneficial to explore how parental involvement and support affect student success with the *BIM* program. School leaders would benefit from learning more about building more positive school-home relationships to give parents the support they need to reinforce what children are learning.

One can also be interested in analyzing the different levels of achievements using gender. Historically, research across time has always proved that males perform poorly in reading in comparison to high-stakes testing females, while females have been found to score poorly in math in comparison with males. Such gaps in performance based on gender can be indicators of hidden factors that can be explored. The researcher may examine areas where each gender has strengths or needs improvement based on the analysis of scores obtained from SC READY score reports. Such an analysis may be useful in designing interventions that can help reduce this gap and strive toward gender equity in education. Future researchers may consider longitudinal analysis to identify trends over time and whether specified interventions can reduce gender disparities in academic achievement. Data could be used to determine strengths and weaknesses in key concepts such as number sense and Base 10, fractions, algebraic thinking and operations, geometry, and measurement and data analysis. These concepts are identified by grade level, and the ones provided are associated with third graders. The researcher may want to consider how those key concepts change from grade to grade and their possible impact on student outcomes.

Conclusion

Chapter 5 aimed to bridge academic research with practical application, offering actionable insights into how the adoption and execution of the *BIM* curriculum can be refined to generate enhanced math learning outcomes for third-grade students attending Title I schools. Suggestions for future research encompassed longitudinal studies, comparative analyses with other math programs, a mixed methods approach, and an extension of the study to broader student populations and grade levels.

This study sought to provide valuable insights and recommendations to stakeholders involved in elementary math education, bridging the gap between academic research and practical application to foster positive transformations in math education methodologies. By leveraging evidence-based strategies and recommendations, decision-makers can strive to create a supportive and enriching learning environment for third-grade students enrolled in Title I schools, nurturing their mathematical proficiency and academic success.

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