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A Study of the Implementation of a Middle School Math Program and Student Achievement

Carla Simmons White

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By
Carla Simmons White

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

Mary Roth, Ed.D. Committee Chair	Date
Jennifer Putnam, Ed.D. Committee Member	Date
Tonya Belton, Ed.D. Committee Member	Date
Sydney K. Brown, Ph.D. Dean of the Gayle Bolt Price School of Graduate Studies	Date

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Abstract

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Students who are entering the workplace are required to have middle or high school level skills. Graduates must develop skills in problem -solving and real-world mathematics. The purpose of this study was to determine (a) the extent to which teachers are using Carnegie Learning® for instructional planning, direct instruction, and assessment of students; (b) the extent to which there a statistically significant difference in spring MAP scores of students from spring 2016 to spring 2017 with teachers indicating they frequently use Carnegie Learning®; and (c) the impact of Carnegie Learning® on student achievement in Grades 6, 7, and 8. The theory of Gagne (1985) formed the theoretical foundation for this study. The school district in this study is a suburban school district that includes 27 schools with nearly 18,000 students. Fifty-four percent are Caucasian, 35% are African-American, 6% are Hispanic, 1.5% are Asian, 1.5% are American Indian, and 2% are other. The five middle schools within the school district were included in this study. Thirty middle school mathematics teachers participated in this mixed-method study. There were two phases of this study. Phase 1 included survey Likert scale question responses, and open-end questions were analyzed descriptively. Phase 2 included a paired *t* test implemented by the researcher using SPSS Statistics software. The final results verified positive correlations and the increased academic achievement of students measured by spring 2016 to spring 2017 MAP scores with teachers indicating they frequently use Carnegie Learning® for instructional planning, direct instruction in the classroom, and assessment of students. This study provides insight to school administrators, policy makers, and mathematics educators in choosing a mathematics program that will enhance student academic performance.

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Chapter 1: Background

Introduction

Jobs for the 21st century global learner will require some degree of postsecondary education. The educational foundations students receive in math will assist them in STEM careers such as accounting, engineering, computer science, technology, and healthcare (U.S. Department of Education, 2016a). Students need proficient reading and mathematics skills and knowledge to compete for jobs in the global economy. In 1950, 60% of jobs were classified as unskilled and available by young people with high school diplomas or less. Today, less than 20% of jobs are considered unskilled (Achieve, 2016). Seventy-nine percent of South Carolina's jobs require skills needing some postsecondary education or training. Despite these high percentages, only 35% of South Carolina's adults have some postsecondary education with an associate's or higher degree (Achieve, 2016).

South Carolina adopted Common Core in July 2013, which ultimately led South Carolina to the March 2015 adoption of South Carolina College and Career Ready (SCCCR) standards. The SCCCR standards were aligned to the Common Core State Standards to make certain all students were prepared and suitable for entry into college and skilled careers (South Carolina Department of Education, 2016).

The school district in this study is a suburban school district that includes 27 schools with nearly 18,000 students. Fifty-four percent are Caucasian, 35% are African-American, 6% are Hispanic, 1.5% are Asian, 1.5% are American Indian, and 2% are other. Forty-four percent have free lunch, 48% pay full lunch, and 8% have reduced lunch. There are 14% of students with disabilities. The five middle schools within the school district were included in this study.

In 2013, the school district in this proposed study adopted the Carnegie Learning® curriculum for math to support the need for a viable curriculum that would support middle school students as 21st century learners. In addition, it corresponded with the availability of new careers requiring a certain caliber of math knowledge. The school district adopted resources such as Carnegie Learning® curriculum to accommodate the new standards adopted by the state. Carnegie Learning® (2014-15) curriculum provides research-based and engaging instruction to ensure all students are college and career ready.

Statement of the Problem

In reflection on the proficiency of math skill sets in students who are entering the work force, 79% of likely jobs require them to have obtained middle level or high school skills. To meet the profile of the 21st century graduate, students need to further develop algebraic thinking, problem-solving, and real-world application in math (Achieve, 2016). In selecting the Carnegie Learning® curriculum, the district sought to increase the proficiency level in mathematics. This selection of curriculum is to ensure students will be well equipped with the foundational math skills for eligible entry into college and skilled careers.

The SCCCR standards focus on a clear set of math skills and concepts. Students are meant to learn concepts in a more organized way both during the school year and across grades. The standards encourage students to solve real-world problems (Common Core State Standards Initiative, 2016). With past math adoptions, the resources did not provide sufficient support to help prepare students to solve real-world problems at the depth and complexity needed. Carnegie Learning® uses problem-based lessons to challenge students to construct and interpret mathematical models. The students can

explain their reasoning as they complete problems along with providing real-world scenarios that help them see how math is relevant to their daily lives (Carnegie Learning, Inc.®, 2015-16).

Differences in standards between Common Core and SCCCR were most evident at the high school level. Knowledge and skills students need are more rigorous at the secondary level in order to prepare them for college and careers beyond high school graduation.

> The mathematics standards development process was designed to develop clear, rigorous, and coherent standards for mathematics that will prepare students for success in their intended career paths that will either lead directly to the workforce or further education in post-secondary institutions. (SCCCR Standards for Mathematics, 2015, p. 4)

Regarding the middle school level and the changing of standards, the state of South Carolina opted to approve new standards on February 11, 2015 with final approval on March 9, 2015. Because of this approval of standards, school districts were then met with the challenge of identifying resources that would align with the SCCCR standards. In doing so, the school district continued using Carnegie Learning® curriculum in 2015 after its initial 2013 adoption, allowing flexibility with individual schools as to how the resource would be implemented and used for mathematics instruction.

Purpose of the Study

To implement the common core standards, the South Carolina school district in this study approved a new math textbook in 2013. The math textbook *Carnegie Learning® Math Series 6th-8th Grades: Courses 1-3*, written for the Common Core State Standards and standards for mathematical practice, will be in place for the next 5 years.

According to SCCCR Standards for Mathematics (2015), those key concepts are

1. The Number System.
2. Ratios and Proportional Relationships.
3. Functions.
4. Expressions, Equations, and Inequalities.
5. Geometry and Measurement.
6. Data Analysis, Statistics, and Probability.

The purpose of the study was to determine the extent to which (a) teachers are using Carnegie Learning® for instructional planning; (b) teachers are using Carnegie Learning® for direct instruction in the classroom; (c) teachers are using Carnegie Learning® for assessment of students; and (d) there a statistically significant difference in the spring 2016 Measures of Academic Progress (MAP) scores to spring 2017 MAP scores of students with teachers indicating they frequently use Carnegie Learning® in each of the three areas: instructional planning, direct instruction in the classroom, and assessment of students. The study also determined the teacher perceptions regarding the use of Carnegie Learning® in each of the three areas.

Carnegie Learning® math for Grades 6, 7, and 8 provides research-based instruction to help all students master math concepts and skills. Additionally, it is coupled with online resources with teachers having access to the Implementation Guide, Skills Practices, Warm-ups & Chapter Follow-Ups (CFU's) for reteaching all Tier 2 instruction (Carnegie Learning, Inc.®, 2014-15). Tier 2 instruction involves reteaching students who have not yet shown to master specific skills as they were originally taught. Tier 2 instruction is more intense allowing for smaller groups and direct instruction with different methods of content delivery instruction. The school district has had a full

implementation of Carnegie Learning® for 4 years. The degree to which middle schools within the school district have implemented and used the Carnegie Learning® program ranges from non-use, to partial use of certain lessons, to full implementation. The district and schools allow for flexibility with the use of Carnegie Learning® and can be coupled with direct instruction, intensive support, and/or tiered instruction. Furthermore, schools can choose to allow students to use the interactive textbook for assessment or guided practice. The usage of the interactive notebook will provide concrete data for administrators to determine how effective the use of Carnegie Learning® curriculum is for Grades 6, 7, and 8.

Through the state adoption process, the school district chose the Carnegie Learning® math textbook that included the skills practice and assignment textbook. The web-based software which provides feedback as students work through problems was not provided to the district during the state adoption process. With having the textbook materials only, the teacher is still able to give feedback as students work through math problems. The textbook helps guide the students through problems when working to complete the answers. Teachers have access to the exam view test generator to generate more assessment problems for the students to complete (Carnegie Learning, Inc.®, 2015-16).

Math instruction is developed to equip students with skills and concepts that allow them to use math in their everyday lives and future careers (Belton, 2016). The purpose of this study was to determine the impact of the Carnegie Learning® middle school math curriculum on student achievement in Grades 6, 7, and 8. The extent to which teachers and students implement and utilize Carnegie Learning® was analyzed using descriptive data.

The school district's goals are to increase student achievement in mathematics which is measured by the state's testing program. The curriculum at every grade level is based on the SCCCR standards in mathematics. Table 1 represents key concepts taught at the middle school level.

Table 1

Key Concepts by Grade Band

Grade 6	Grade 7	Grade 8
Number System	Number System	Number System
Ratios and Proportional Relationships	Ratios and Proportional Relationships	Ratios and Proportional Relationships
Expressions, Equations, and Inequalities	Expressions, Equations, and Inequalities	Expressions, Equations, and Inequalities
Geometry and Measurement	Geometry and Measurement	Geometry and Measurement
Data Analysis and Statistics	Data Analysis, Statistics and Probability	Data Analysis, Statistics and Probability

(SCCCR Standards for Mathematics, 2015, p. 38).

The level of depth and complexity, based on the SCCCR standards, are increasing each year. Students should also receive instruction in the processes of problem-solving, reasoning, connections, communication, and representation. The district's math program provides direct instruction through a variety of strategies and interventions to reach all students at their capacity of learning. According to the school district, the level of instruction teachers provide should be engaging and relevant (Belton, 2016). There is an emphasis on problem-solving (with real-world application) and using math in diverse ways so students at every level can comprehend; hence, the problem is whether the textbook adoption of Carnegie Learning® is increasing student achievement. Math for

students in Grades 6, 7, and 8 continues to build, making it essential for students to have a sound foundation of math skills. Ultimately, the goal is to prepare students to be well equipped for Algebra 1 and beyond.

> Young learners' future understanding of mathematics requires an early foundation based on a high-quality, challenging, and accessible mathematics education. Young children in every setting should experience mathematics through effective, research-based curricula and teaching practices. Such practices in turn require that teachers have the support of policies, organizational structures, and resources that enable them to succeed in this challenging and important work. (National Council of Teachers of Mathematics [NCTM], 2013, p. 1)

Significance of the Study

The study provided the school district essential information as to whether or not Carnegie Learning® should be used as a continued resource. Equally important, the study determined that if students have the necessary foundational skills in middle school mathematics to be successful in secondary education, specifically high school and beyond.

This study provided decision makers at the district level information that may be utilized in determining future mathematics programs for middle school students. The flexibility of using Carnegie Learning® is left entirely up to the five middle schools in the school district.

Research Questions

This mixed-methods research study was completed in two phases. The first phase used descriptive survey statistics. The second phase of the survey included a quantitative analysis of student achievement data based on teacher survey responses. The research

questions were as follows.

Phase 1.

1. To what extent are teachers using Carnegie Learning® for instructional planning?
2. To what extent are teachers using Carnegie Learning® for direct instruction in the classroom?
3. To what extent are teachers using Carnegie Learning® for assessment of students?
4. What are teacher perceptions regarding the use of Carnegie Learning® for instructional planning, direct instruction, and assessment of students?

Phase 2.

5. To what extent is there a statistically significant difference in spring 2016 to spring 2017 MAP scores of students with teachers indicating they frequently use Carnegie Learning® for instructional planning?
6. To what extent is there a statistically significant difference in spring 2016 to spring 2017 MAP scores of students with teachers indicating they frequently use Carnegie Learning® for direct instruction?
7. To what extent is there a statistically significant difference in spring 2016 to spring 2017 MAP scores of students with teachers indicating they frequently use Carnegie Learning® for assessment of students?

Carnegie Learning® Program

The school district adopted the consumable student textbooks along with the assignment and skills practice textbooks. The school district did not receive during the adoption process the software that could be used as extra online practice for the students.

Carnegie Learning® is a math curriculum which blends inquiry learning with technology to provide students with opportunities for investigative learning and individualized practice. Carnegie Learning® provides students with a consumable textbook in which they can write. Within the text are inquiry-based questions and activities (Carnegie Learning, Inc.®, 2014-15).

In each of the five middle schools across the school district, teachers have access to Carnegie Learning® math curriculum for use of instruction to utilize for direct instruction and intervention as well as enrichment, which varies for each school. Teachers within the school utilize Carnegie Learning® math curriculum to pace planning and instruction for each class while meeting with their professional learning community (PLC). Each math teacher and PLC has an opportunity to implement assessment questions from the Carnegie Learning® math curriculum question bank. Use of the questions to assess students further allows for meaningful discussions regarding current student data to analyze student achievement and or proficiency, progress, or nonmastery. Even though the Carnegie Learning® program was adopted, this does not signify full implementation or pace of mathematics instruction. The teachers have flexibility in use of the Carnegie Learning® math curriculum.

Theoretical Framework

The Carnegie Learning®, Inc. (2014-15) program provides continuing opportunities for students to engage as active contributors in the learning process by articulating their knowledge and ideas to the teacher, their peers, and themselves by creating opportunities for students to succeed and building on student strength. Some strategies are collaboration, extension, and reflection. Carnegie Learning® curriculum is based on over 20 years of scientific research as to how students think, learn, and apply

new knowledge in mathematics. Carnegie Learning® uses student intuitive problem-solving abilities as a strong connection to more formal and sophisticated mathematical understanding. The three extensive ideas that Carnegie Learning® encompasses are (a) engage and motivate students to reflect about and converse the usefulness of mathematics in a variety of real-world contexts that are related to each student; (2) promote deep conceptual understanding to help students see the connection between different topics; and (c) powerful, ongoing formative assessment to provide opportunities to monitor student knowledge and progress. Carnegie Learning® is based on cognitive science research (Carnegie Learning, Inc.®, 2015-16).

"Cognitive Learning Theory explains why the brain is the most incredible network of information processing and interpretation in the body as one learns things" (Explorable, 2016, p. 1). The Cognitive Learning Theory founded by Gagne (1985) is based on how people think (Ormrod, 2008). In the 1940s, Gagne was considered an educational pioneer regarding the science of instruction. Gagne's model of learning reflects the five categories of learning which include verbal information, intellectual skills, cognitive strategies, motor skills, and attitudes. Gagne's theory conveys the variations in internal and external conditions. Relative to Gagne's theory, acquisition of cognitive strategies requires opportunities to practice creating solutions to various problems as well as exposure to credible models and arguments (Gagne, 1985). For example, for cognitive strategies to be learned, there must be a chance to practice developing innovative solutions to problems.

According to Gagne (1985), there are nine events that provide a framework for an effective learning process: "gain attention, identify objective, recall prior learning, present stimulus, guided learning, elicit performance, provide feedback, assess

performance, and enhance retention/transfer" (p. 243).

> Gagne's nine steps are general considerations to be considered when designing instruction. Although some steps might need to be rearranged (or might be unnecessary) for certain types of lessons, the general set of considerations provide a good checklist of key design steps. (Good & Brophy, 1977, p. 200)

Assumptions

During the study, the researcher recognized the role to which basic assumptions hold true as part of the research. With this in regard, the teachers within the PLC in the five middle schools across the school district varied in their use of Carnegie Learning® curriculum. Although the degree to which each teacher, PLC, and schools use Carnegie Learning® curriculum varied, it is assumed that math will continue to be an important part of curriculum, through the use of materials and/or resources that align with SCCCR standards. All classrooms spent approximately the same amount of time during mathematics instruction. Moreover, with teacher communication through professional learning, teachers who are instructing without the use of Carnegie Learning® utilized instructional tools and resources that will align to the SCCCR standards for math, despite not using Carnegie Learning®. The sample population was reflective of the entire school district in which there are concerns regarding the use of Carnegie Learning® curriculum to improve student achievement.

Hypotheses

This study was completed to determine if there is a statistically significant difference in spring 2016 to spring 2017 MAP scores of students with teachers indicating they frequently use Carnegie Learning® for instructional planning, direct instruction, and assessment of students. Because of whether the Carnegie Learning® math curriculum

will impact student achievement, the null hypotheses are as stated:

Null Hypothesis 1: There will be no significant difference in spring 2016 to spring 2017 MAP scores of students with teachers indicating they frequently use Carnegie Learning® for instructional planning.

Null Hypothesis 2: There will be no significant difference in spring 2016 to spring 2017 MAP scores of students with teachers indicating they frequently use Carnegie Learning® for direct instruction.

Null Hypothesis 3: There will be no significant difference in spring 2016 to spring 2017 MAP scores of students with teachers indicating they frequently use Carnegie Learning® for assessment of students.

Population

The study included five middle schools in a large suburban school district and is classified as having a mid-socioeconomic status with each school having Grades 6, 7, and 8. There are approximately 3,543 sixth, seventh, and eighth grade math students within the five middle schools across the school district.

The demographics for 2016-2017 reflected male and female students of varied races including American Indian, Asian, Black or African-American, Hispanic or Latino, White, Hawaiian or other Pacific Islander, and Two or More Races. Eighth-grade students who took Algebra 1 have been excluded. The population for each middle school is as follows: School A has 740 students, School B has 840 students, School C has 552 students, School D has 742 students, and School E has 669 students.

Limitations

A limitation is the pace of mathematics instruction, as this varied based on the teacher's pace as well as the needs and academic levels of students. The quality of the

instruction could influence the academic gains of the students. The study is based on one academic school year, 2016-2017. The spring 2016 to spring 2017 MAP data represent a brief time frame, but provide a concrete basis for schools and ultimately the district to determine whether additional research is needed for continuing with textbook adoption and resources.

Delimitation

The study included testing data from sixth-, seventh-, and eighth-grade students across five middle schools within the district, but was limited to students in math and excluded eighth grade Algebra I students.

Deficiencies in the Literature Review

There are no studies for Carnegie Learning® found separate from the Carnegie website. The only research that was found was endorsed by Carnegie Learning® (Carnegie Learning, Inc.®, 2015-16). Therefore, the research is an independent study.

Definitions of Terms

Assessment. In education, assessment refers to the wide variety of methods or tools that educators use to evaluate, measure, and document the academic readiness, learning progress, skill acquisition, or educational needs of students (Great Schools Partnership, 2014).

Carnegie Learning®. A curriculum published by Carnegie Learning®. It is a secondary math curriculum that offers textbooks and interactive software to provide individualized, self-paced instruction based on student needs. The Carnegie Learning® Math Series: Courses 1-3 meet the rigor of the most recent math content standards and the Standards for Mathematical Practice for Grades 6-8 (What Works Clearinghouse, 2013).

Collaborative learning. The instructional use of small groups so that students work together to maximize their own and each other's learning (Cooperative Learning, 2016).

Common Core Standards for Mathematics. Concentrates on a clear set of math skills and concepts. Students will learn concepts in a more organized way both during the school year and across grades. The standards encourage students to solve real-world problems (Common Core State Standards Initiative, 2016).

Direct instruction. The use of straightforward, explicit teaching techniques, usually to teach a specific skill (Study.com, 2017).

Every Student Succeeds Act of 2015 (ESSA). Reauthorizes the 50-year old Elementary and Secondary Education Act (ESEA) which is the federal law affecting education from kindergarten through high school. According to the U.S. Department of Education (2016b), "ESSA builds on key areas of progress in the recent years, made possible by the efforts of educators, communities, parents, and students across the country" (para. 2).

Implementation fidelity. "The degree to which programs are implemented as intended by the program developers" (Carroll, 2007, p. 1). This idea is sometimes also termed "integrity."

Instructional planning. A plan of teaching and learning activities in which learning is organized. This instructional plan motivates students to learn. The aim of instruction is to make the learning process take place (Isman, 2011).

Learning target (curriculum focal point). Helps students grasp the lesson's purpose and why it is important to learn the information on this day and in this way (Fairfield-Suisun Unified School District, 2016).

MAP. Creates a personalized assessment experience by adapting to each student's learning level. Assessment data and essential information about what each student knows and is ready to learn are provided (Northwest Evaluation Association [NWEA], 2016).

National Assessment of Educational Progress (NAEP). The largest nationally representative and continuing assessment of what America's students know and can do in various subject areas (National Center for Education Statistics, 2016).

NCTM. An international professional association organized for the purpose of promoting mathematics teaching and learning for all students (NCTM, 2015).

Nation's Report Card. The only ongoing assessment of what U.S. students know and can do in different subjects (Nation's Report Card, 2016).

No Child Left Behind Act of 2001 (NCLB). A previous version of the law and reauthorized the ESEA, which was the main federal law affecting education from kindergarten through high school. According to the U.S. Department of Education (2016b),

> NCLB represented a significant step forward for our nation's children in many respects, particularly as it shined a light on where students were making progress and where they needed additional support, regardless of race, income, zip code, disability, home language, or background. (para. 4)

Response to Intervention (RTI). A multi-tier approach to the early identification and support of students with learning and behavior needs. There are three tiers. Within Tier 1, the students will receive high quality classroom instruction, screening, and group intervention. Within Tier 2, the students will receive targeted interventions. Within Tier 3, the students receive intensive interventions and

comprehensive evaluation (National Center for Learning Disabilities, 2016).

Rigor. A "level of difficulty and the ways in which students apply their knowledge through higher-order thinking skills; it also implies *the reaching for a higher level of quality in both effort and outcome"* (Ainsworth, 2010, p. 6).

Rigorous curriculum. The challenging curriculum that pushes students to think in different ways, to develop and utilize new skills, and to be encouraged to move forward to even more difficult problems (District School Board of Madison County, n.d.).

RIT (Rasch Unit) scale. A stable equal-interval vertical scale. It can compare the performance of students and school/district to national norms (NWEA, 2016).

SCCCR standards for mathematics. Standards that contain SCCCR content standards for mathematics that represent a balance of conceptual and procedural knowledge and specify the mathematics that students will master in each grade level and high school course (South Carolina Department of Education, 2016).

South Carolina National Center and State Collaborative (SC-NCSC). An alternate assessment in English language arts (ELA) and math based on alternate achievement standards (AA-AAS) linked to the state college- and career-readiness standards; SCCCR in ELA and mathematics for students with significant cognitive disabilities (South Carolina Department of Education, 2016).

Summary

In summary, students who are entering the workplace are required to have middle level or high school skills. Graduates need to develop more skills in math, like problem-solving, and real-world mathematics. The Carnegie Learning® program was adopted by the school district to help all students master math concepts and skills that will allow

them to use math in their everyday lives and future careers. The Carnegie Learning® curriculum is designed to provide students with opportunities for investigative learning and individualized practice. The curriculum provides ongoing opportunities for students to engage as active participants in the learning process.

The researcher determined there was a statistically significant difference in spring 2016 to spring 2017 MAP scores of students with teachers indicating they frequently use Carnegie Learning® for instructional planning, direct instruction, and assessment of students.

The results of the study gave the school district valuable information on the extent to which Carnegie Learning® is used across the school district and the impact Carnegie Learning® has on student math achievement.

Chapter 2 reviews the literature related to the important components of the study as well as discusses the theoretical framework in depth.

Chapter 2: Literature Review

Introduction

The following chapter presents and examines research related to mathematics education. Information included are changes in mathematics standards, the importance of teacher preparation regarding student achievement success, national and state concerns, research intervention models, and specific math problems.

The literature review consists of topics that are current and relevant to this study. The theoretical framework is based on Carnegie Learning®, Inc. (2014-15); comprehending how students think is essential to obtaining an effective education. Carnegie Learning® curriculum is founded upon scientific research that extends 20 years. The research seeks to identify how students think, learn, and apply their knowledge toward mathematics. The chapter is divided into 10 sections. Research related to factors that impact student achievement in the middle school classroom is also reviewed.

The South Carolina Department of Education (2016) will continue to increase the level of accountability for teachers and students respectively. The importance of proficiency for students at school, district, and state levels has become increasingly clear. Because of the necessity to ensure that all students are meeting proficiency, it is extremely vital to provide a curriculum that will allow for teachers to teach effectively and students to learn in such a capacity that is to their level of skill.

Overview

Evidenced by ESSA, previously known as NCLB, there have been major changes with respect to how student achievement is measured. There has been increased emphasis on testing due to increased focus on accountability for public schools. Middle schools have begun implementation of MAP to assess school-wide progress. Testing

windows allow for assessment during fall and spring with additional options for winter and summer based on the needs of certain students. The results of these assessments are used to determine the success of individual schools and programs (South Carolina Department of Education, 2016).

Understanding the Mathematics Classroom

Mathematics, as it relates to the classroom environment, should focus on communication, collaboration, and choice; all of which seek to create a positive environment in which students feel comfortable to ascertain the knowledge being imparted (NCTM, 2000).

Communication is essential to students learning math. Effective communication skills also start with the teacher. According to NTCM (2000), variations in the workplace progressively demand teamwork, collaboration, and communication. Understanding the vocabulary in mathematics can aid students to become better communicators. Consequently, ensuring that students understand key terms when navigating through a variety of concepts and skills will allow them to be effective in conveying their needs. "Teachers can stimulate students' growth of mathematical knowledge through the ways they ask and respond to questions" (Piccolo, Harbaugh, Carter, Capraro, & Capraro, 2008, p. 380). This can be achieved using Marzano's question stems, which allow for differentiated questioning on the depth and complexity level as well to assess student factual and conceptual knowledge (Marzano & Simms, 2014).

Students given the opportunity to work as a group or within a team represents student collaboration. This classroom collaboration affords students the ability to learn essential skills needed to work collectively toward specific goals. Collaboration is a powerful tool that assists in intention decisions to develop strategies. Providing the

opportunity to work in collaborative settings allows students to peak at higher caliber levels (Vygotsky, 1978). According to Vygotsky (1978), varied diverse groups in knowledge and experience give credence toward the process of learning.

Supporters of collaborative learning operate under the belief that it represents the active dialogue of ideas within small groups not only elevates interest among students but establishes critical thinking. "There is persuasive evidence that cooperative teams achieve at higher levels of thought and retain information longer than students who work quietly as individuals" (Johnson & Johnson, 1986, p. 31).

Students should be provided with the opportunity to actively participate in discussions, be accountable for self-learning, and develop critical-thinking skills through shared learning (Totten, 1991). Methods involving cooperative learning and peer support are critical for learners. The impact of cooperative learning increases problem-solving skills because of students being faced with different perspectives of a given situation. Additionally, over time, students internalize needed critical-thinking skills as well as prior knowledge and develop them in such a way that allows for increased academic functioning (Bruner, 1985).

Many students in the middle school setting struggle with low motivation to succeed in academics. "By the time students reach middle school, lack of interest in schoolwork becomes increasingly apparent in more and more students" (Lumsden, 1996, p. 9). A student who is limited in extrinsic motivation has the potential to be impacted by social issues. In contrast, teachers can have a tremendous impact on students by creating low motivation because of lack of enthusiasm by way of instructing limited choice for students in any capacity or failure to build rapport with students (Brewter & Fager, 2000).

Research from both cognitive science (Bransford, Brown, & Cocking, 2000;

Mayer, 2002; National Research Council, 2012) and mathematics education (Donovan & Bransford, 2005; Lester, 2007) and encourages the characterization of learning mathematics active process, in which students develop their own mathematical sense using their own interpretations and prior individual experiences coupled with formative feedback from other students, teachers, and other adults. "According to this research, there are a number of principles of learning that provide the foundation for effective mathematics teaching. Learners should have experiences that enable them to" (NCTM, 2015, p. 9)

1. Engage with challenging tasks that involve active meaning making and support meaningful learning;
2. Connect new learning with prior knowledge and informal reasoning and, the process, address preconceptions and misconceptions;
3. Acquire conceptual knowledge as well as procedural knowledge, so they can meaningfully organize their knowledge, acquire new knowledge, and transfer and apply knowledge to new situations;
4. Construct knowledge socially, through discourse, activity, and interaction related to meaningful problems;
5. Receive descriptive and timely feedback so they can reflect on and revise their work, thinking, and understandings; and
6. Develop metacognitive awareness of themselves as learners, thinkers, and problem solvers, and learn to monitor their learning and performance, (NCTM, 2015, p. 9).

Students learning mathematics "depends fundamentally on what happens inside the classroom as teachers and learners interact over the curriculum" (Ball & Forzanni,

2011, p. 17).

"Many students have difficulty in school not because they are incapable of performing successfully but because they are incapable of believing they can perform successfully" (Pajares & Schunk, 2002, p. 1). According to Pajares and Schunk (2002), "parents and teachers do well to take seriously their share of the responsibility in nurturing the self-beliefs of their children and students, for these beliefs can have beneficial or destructive influences" (p. 1). The National Council of Supervisors of Mathematics (2008) supported the idea that students should be challenged by promoting a positive classroom environment, supporting appropriate mathematics standards, and supporting positive self-beliefs about intelligence and academic ability. Being self-confident and having a good understanding in mathematics increase student motivation and engagement (National Council of Supervisors of Mathematics, 2008).

Algebra Readiness

How well students perform in mathematics throughout middle school ultimately illustrates success in high school and beyond. Lacking the appropriate foundational skills, many students are inadequately equipped to be successful in algebra. Consequently, the students fail the course during their first attempt (Balfanz, McPartland, & Shaw, 2002; Finkelstein, Fong, Tiffany-Morales, Shields, & Hauang, 2012). To prepare for success in algebra, the National Mathematics Advisory Panel (2008) recommended specific procedures to obtain fluency in mathematics concepts such as whole number operations, conceptual understanding of rational number systems, and proficiency operating with rational numbers. Algebra requires students to further generalize the arithmetic principles to solve abstract problems involving symbolic notation. Building on the foundational components of algebra "students' conceptual

understanding of number systems, facility with basic number properties, and understanding and application" (Ketterlin-Geller & Chard, 2011, p. 65) of operations are the bases of student algebra readiness in middle school mathematics.

SCCCR Standards in Mathematics

According to the American Educational Research Association (2014), "The purpose of *Standards* is to provide criteria for the development and evaluation of tests and testing practices and to provide guidelines for assessing the validity of interpretations of test scores for the intended test uses" (p. 1).

Because of South Carolina navigating from South Carolina Common Core to SCCCR standards, the criteria has changed slightly but still allow for a degree of rigor and complexity, such that students can compete with students globally.

The dire need for educators, districts, and state departments to focus on standards is manifested in President Barack Obama's beliefs as to the importance of education for each child.

> Every child in America deserves a world-class education. Today, more than ever, a world-class education is prerequisite for success. America was once the best educated nation in the world. A generation ago, we led all nations in the college completion, but today, 10 countries have passed us. It is not that their students are smarter than ours. It is that these countries are being smarter about how to educate their students. And the countries that out-educate us today will out-compete us tomorrow. We must do better. Together, we must achieve a new goal, that by 2020, the United States will once again lead the world in college completion. We must raise the expectations for our students, for our schools, and for ourselves – this must be a national priority. We must ensure that every student

> graduates from high school well prepared for college and a career. (U.S. Department of Education, 2010, p. 1)

The goal is for all students in the United States to be ready and prepared for college and careers when they graduate from high school. For the future, there is a plan through the authorization of ESEA (U.S. Department of Education, 2010). ESEA will include

a) Raising standards for all students in English language arts and mathematics;
b) Developing better assessments aligned with college-and career-ready standards; and
c) Implementing a complete education through improved professional development and evidence-based instructional models and supports (U.S. Department of Education, 2010, p. 1)

Throughout the realm of education, it is recognized as essential to provide standards for students to be clear on what they should be able to do because of the learning that takes place within a given subject. Research has shown that when students can apply the knowledge they have learned in real life, they are more likely to retain the information and be more receptive in the need of learning the content. There is deep solidarity as to the need to ensure students are prepared with the basic skills that will provide the necessary foundation in the world in which they will compete (U.S. Department of Education, 2016a).

The SCCCR standards for mathematics provide a map of the knowledge and skill sets in which students need to be proficient; so as high school graduates, students have the necessary skills to be successful in any capacity beyond high school. The standards also “provide a set of grade-level standards based on the previous grade standards which

serve as the foundation for the next grade" (SCCCR Standards for Mathematics, 2015, p. 5). This would "ensure that no matter where a student lives in South Carolina, the expectations for learning are the same" (SCCCR Standards for Mathematics, 2015, p. 5).

SCCCR standards assist students in learning how to process a growing wealth of information by not only giving attention to specific mathematic concept knowledge but by conveying specific skills in reasoning and understanding how to analyze data as well as the ability to apply learned information to evaluate and provide solutions to certain situations (SCCCR Standards for Mathematics, 2015).

The South Carolina Department of Education illustrated a portrait of the expectations a South Carolina student who is college and career ready in mathematics will meet and thus demonstrate.

1. *Academic Success and Employability:* The students will have the tools and skills to model and solve problems.
2. *Interdependent Thinking and Collaborative Spirit:* The students will be able to work effectively with others and respectfully analyze and assess different point of views.
3. *Intellectual Integrity and Curiosity:* The students will explore mathematical situations to grow and form opinions.
4. *Logical Reasoning:* The students will examine and form ideas in a comprehensive and knowing manner and form opinions based on evidence using logic and reason.
5. *Self-Reliance and Autonomy:* The students will clearly show qualities of an innovative, creative and independent learner and contributor to society.
6. *Effective Communication:* The students will communicate appropriately,

> fluently, and with precision in a variety of written and oral modes, including appropriate technologies (SCCCR Standards for Mathematics, 2015, p. 15).

The most important challenge middle school teachers must conquer is how to provide an appropriate foundation for students, so they are ready for algebra. Providing this basis has been proven true, through extensive research, as the needed foundation for success (Horn & Nunez, 2000).

Mathematics Curriculum

"A curriculum is more than a collection of activities; it must be coherent, focused on important mathematics, and well-articulated across the grades" (NCTM, 2000, p. 14). For some educators, curriculum is simply all planned occurrences in the classroom (Wiles & Bondi, 2007). For others, curriculum is more specifically defined as the information taught daily. Eisner (2002) mentioned that curriculum is germane to instruction that is intentionally planned with anticipation in mind. It is necessary to consider other possibilities with learning that may occur and to also ensure that learning within the classroom creates meaning for students and is relevant, so students might be able to make connections. Hosp, Hosp, and Howell (2007) "viewed curriculum as the course or path embarked on, reflecting what is taught in the classroom" (p. 8). Hoover and Patton (2005) stated that teachers, despite the curriculum taught, must consider the classroom environment, specific or extended strategies, and how the teaching and learning will be managed. The successful implementation of a math curriculum relies heavily on how well teachers can plan, implement, and evaluate it.

To successfully adhere to and teach the standards for mathematics, it is important to focus on what Fennell (2006) called curriculum focal points. These points reflect important topics that will serve as instructional targets. When instruction is geared

toward these focal points, students tend to obtain deep levels of understanding. What is also important to note about curriculum is that it is cumulative. Grade level targets for mathematics allow for students to learn through a process centered around "problem solving, reasoning and proof, and connections" (Fennell, 2006, p. 150).

"An excellent mathematics program requires effective teaching that engages students in meaningful learning through individual and collaborative experiences that promote their ability to make sense of mathematical ideas and reason mathematically" (NCTM, 2014b, p. 7). "The learning of mathematics has been defined to include the development of five interrelated strands that, together, constitute mathematical proficiency" (NCTM, 2014b, p. 7):

1. Conceptual understanding
2. Procedural fluency
3. Strategic competence
4. Adaptive reasoning
5. Productive disposition (NCTM, 2014b, p. 7)

Conceptual understanding forms the foundation for developing procedural fluency. Strategic competence and adaptive reasoning reflect the need for students to develop mathematical ways of thinking logically as a basis for solving mathematics problems that students may encounter in real life as well as within mathematics and other disciplines. These ways of thinking are described as "processes" (NCTM, 2000), "reasoning habits" (NCTM, 2009), or "mathematical practices" (National Governors Association Center for Best Practices and Council of Chief State School Officers, 2010).

As it relates to the mathematics program pertaining to the research, Carnegie Learning® curriculum is a math series that consists of Courses 1-3 for middle students,

Grades 6, 7, and 8. The curricula are aligned to help middle school students master math concepts and skills. The curricula are also available to meet the needs of all students, including modifiable RTI modules (Carnegie Learning, Inc.®, 2015-16). According to Carnegie Learning®, Course 3 (Grade 8) focuses on algebraic thinking, geometry, and statistical thinking and probability.

Components of Carnegie Learning®: Each grade level, from sixth grade through eighth grade, has several components. According to Carnegie Learning, Inc.®, (2015-16),

a) Teacher's Work-text Materials contains *Teacher's Assessments, Teacher's Assignments, Teacher's Implementation Guide, Teacher's Skill Practice, Warm-Ups & CFUs (Chapter Follow-Ups), and See It Try It video*, and a copy of all student material, (Carnegie Learning, Inc.®, 2015-16).

b) The Student's Work-text contains *Student Textbook Edition, Student Skills Practice, and Student Assignments,* and online resource center "home connection" (Carnegie Learning, Inc.®, 2015-16).

The Teacher Work-text Materials provide the educator with the information needed to effectively implement the curricula and meet the needs of each student in the classroom. The Teacher's Implementation Guide provides a powerful resource for planning, guiding, and facilitating student learning. The Teacher's Resources & Assessments is a planning resource that contains pretests, posttests, mid-chapter tests, end-of-chapter tests, and standardized test practice. There is also a Test Generator Powered by Exam View Assessment Suite that gives educators access to edit textbook items and customize tests using content from assignments, skill practice, and assessment questions (Carnegie Learning, Inc.®, 2014-15, 2015-16).

The Instructional Process

Figure 1 shows three basic steps of the instructional process.

> The first is *planning instruction*, which includes identifying specific expectations or learning outcomes, selecting materials to foster these expectations or outcomes, and organizing learning experiences into a coherent, reinforcing sequence. The second step involves *delivering the planned instruction* to students, that is, teaching them. The third step involves *assessing how well students learn or achieve the expectations or outcomes.* (Critical Social Educator, 2016, p. 40)

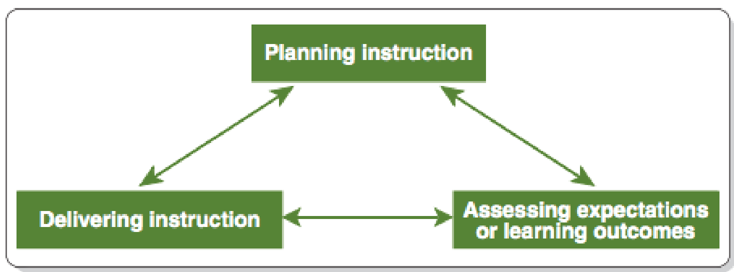

Figure 1. The Instructional Process (Critical Social Educator, 2016).

Instructional Planning

According to Jackson and Davis (2000), the national and state standards and the school district curriculum are influenced by what students should learn, but the teacher must establish how students should learn it. Planning is a process that causes teachers to be well prepared before entering the classroom each day (Pressley, Wharton-McDonald, Allington, Block, & Morrow, 1998). Organizing time and preparing materials for instruction are key features of effective teaching.

Organizing time coupled with preparing materials, both reflect specific pieces of a larger practice of planning. "Evidence suggests that effective teachers follow the instructional or lesson plan while continuously adjusting it to fit the needs of different

students" (Jackson & Davis, 2000, p. 61).

Instruction of Mathematics

Shellard and Moyer-Packenham (2002) identified three critical components of what effective mathematics instruction should look like: "Teaching for conceptual understanding, developing children's procedural literacy, and promoting strategic competence through meaningful problem-solving investigations" (p. 52). Topics should be presented in a sequence and manner appropriate for the developmental level of the students (Reys, Suydam, Lindquist, & Smith, 1999, p. 52).

An integral component needed to develop appropriate instruction in mathematics is creating a balance between "teaching for conceptual understanding and teaching for procedural fluency" (Protheroe, 2007, p. 52) .

> When students learn procedures without meaning, they are only memorizing discrete pieces of information that are difficult for them to remember. Students should develop an understanding of the concepts they are studying before they apply these ideas to procedural strategies. (Protheroe, 2007, p. 52)

Cognitive Learning Theory. Based on Carnegie Learning®, Inc. (2014-15, understanding student thinking is important to effective education. Carnegie Learning® curriculum is based on over 20 years of scientific research as to how students think, learn, and apply new knowledge in mathematics. Carnegie Learning® uses student intuitive problem-solving abilities as a powerful connection to more formal and sophisticated mathematical understanding. The three extensive ideas that Carnegie Learning® (2015-16) encompasses are

1. Engage and Motivate.
2. Promote Deep Conceptual Understanding.

3. Powerful, Ongoing Formative Assessment.

According to Carnegie Learning®, one of the key areas of their math curriculum is Cognitive Theory. This is how students learn, retain, and apply new mathematical knowledge. Gagne's (1985) theory instructs that there are several diverse types or stages of learning. According to Gagne, the significance of these classifications is that each different type requires diverse types of instruction. The five major categories of learning:

1. Describe what the learner will be expected to state, intellectual skills;
2. Demonstrate the activity to which the concept, rule, or procedure applies, cognitive strategies;
3. Describe or demonstrate the strategy, motor skills;
4. Demonstrate the expected performance and attitude;
5. Inform learner later (Gagne, 1985, p. 247).

Gagne (1985, p. 243) provided examples of events for each category of learning outcomes.

Gagne's Nine Events of Instruction

Internal Processes and Their Corresponding Instructional Events, with Action Examples

Internal Process	*Instructional Event*	*Action Example*
Reception	1. Gaining Attention	Use abrupt stimulus change
Expectancy	2. Informing learners of the objectives	Tell learners what they will be able to do after learning
Retrieval to Working Memory	3. Stimulating recall of prior learning	Ask for recall of previously learned knowledge or skills
Selective Perception	4. Presenting the stimulus	Display the content with distinctive features
Semantic Encoding	5. Providing "learning guidance"	Suggest a meaningful organization
Responding	6. Eliciting performance	Ask learner to perform
Reinforcement	7. Provide feedback	Give informative feedback
Retrieval and Reinforcement	8. Assessing performance	Require additional learner performance with feedback
Retrieval and Generalization	9. Enhancing retention and transfer	Provide varied practice and spaced reviews

Figure 2. Gagne's (1985) Nine Events of Instruction (p. 243).

Gagne's (1985) Nine Events of Instruction assist with the development of the framework needed to prepare and deliver content for instruction. Goals of the course along with student objectives help to provide credence to events in proper context. The nine events of instruction allow for modification to coincide with student level or content (Gagne, Briggs, & Wager, 1992).

Carnegie Learning, Inc.® was founded in 1999 by cognitive and computer scientists from Carnegie Mellon University in conjunction with veteran mathematics teachers from the public schools in Pittsburgh. The company's founders include Dr. John R. Anderson

and Benjamin Franklin Medal. Currently, there are well over 50,000 school districts and middle schools that utilize the Carnegie Learning® program (Carnegie Learning, Inc.®, 2015-16).

According to Carnegie Learning®, Carnegie Learning® is innovative and leads other publishers in curriculum. The program provides math curriculum for middle school, high school, and beyond. Carnegie Learning® seeks to provide differentiated instruction throughout schools in the United States. The goal of Carnegie Learning® is to assist in reinventing how students think about math as well as how it is taught. In doing so, Carnegie Learning® seeks to support students and teachers to see a vast improvement in math scores across a wide spectrum of students across the nation. By constantly innovating and developing new ways for students to learn mathematics, Carnegie Learning® is ensuring schools, teachers, and students see a greater increase in achievement and ultimately success.

Carnegie Learning® curriculum can be incorporated into instruction using the textbook, interactive software, or in contrast using blended implementation that includes use of the software or the textbook. The textbook seeks to initiate a collaborative classroom setting allowing students to collaborate with peers to develop skills and solve complex problems. Further, students look to investigate purpose and promote comparisons of solutions (What Works Clearinghouse, 2013). Carnegie Learning® is built on research. According to Carnegie Learning® (2015-16), understanding student thinking is key to effective education. The curriculum is based on 20 plus years of scientific research into how students reason, acquire, and apply new information in mathematics (Carnegie Learning, Inc.®, 2015-16).

According to Carnegie Learning®, one of the components of the Carnegie

Learning® school improvement model is student-centered instruction with the textbooks. The math courses are vertically aligned and research based; and proven effectiveness is that there is 85% better performance on tests measuring problem-solving and 70% better preparation for advanced math classes.

Instructional Methods

Carnegie Learning® materials are founded upon "an over-arching questioning strategy" that seeks to promote analysis and/or higher order thinking in lieu of simplified *yes* or *no* questions. Students conceptualize the process and reasoning behind mathematics using specific strategies. Lessons are also created to give students many opportunities to reason, model, and elaborate on details about mathematical ideas (Carnegie Learning, Inc.®, 2015-16).

The traditional model for Carnegie Learning® allows each instructional lesson to entail the students being provided with

(a) Warm-up to review previous concepts needed to start the new lesson;

(b) Work on real-world examples to help students make connections with math and its relevancy. The students will have models showing real-world connections that prove substantial examples of mathematics. The scenarios in the lessons will help students understand the quantitative correlations seen in the real-world are no different than the quantitative correlations in mathematics;

(c) Students will match, sort, and explore. Students will experience many different hands-on activities that match or sort verbal descriptions, tables, and graphs. These activities will assist in developing skills in diagnosing and identifying patterns in mathematics;

(d) Grouping/Peer Analysis for students share responses with each other and the class; and

(e) Talk the Talk for students describe the strategies used to solve each problem. With Talk the Talk, the students will organize concepts and have open-ended questions that require students to explain and establish mathematical understandings and key concepts. Despite following the same instructional agenda, the variations between the two groups will be based on the resources utilized (Carnegie Learning, Inc.®, 2015-16).

Assessment of Mathematics in the Classroom

Assessment is an important part of mathematics instruction that supplements teaching and learning. An important characteristic of instructional decision-making is the alignment of standards, curriculum, instruction, and assessment (NCTM, 2015).

Credibility of Implementation in Mathematics Programs

Fidelity of implementation is the transfer of instruction in the way in which it was intended to be delivered (Gresham, MacMillan, Beebe-Franken-Berger, & Bocian, 2000). Various studies support the significance of reliability of implementation to maximize program success (e.g., Foorman & Moats, 2004; Foorman & Schatschneider, 2003; Gresham et al., 2000; Kovaleski, Gickling, & Marrow, 1999; Telzrow, McNamera, & Hollinger, 2000; Vaughn, Hughes, Schumm, & Klingner, 1998).

The degree to which textbook adoption and implementation of the textbook within the classroom as technology initiatives increase continues to be a topic of discussion. Cebulla and Grouws (2000) readily acknowledged the need to have access to and utilize textbooks within the classroom as well as to use a wealth of resources germane to the topics and skills covered within a traditional textbook. Research highly

suggests that regardless of the math program implemented, students not only have the opportunity for additional practice but invention as well. When students are allowed the opportunity to invent and discover, they tend to move from factual to conceptual understanding, which increases the depth of complexity for students. The Carnegie Learning® math program allows for multiple ways to solve a problem as well as to develop a solution based in part or whole from the knowledge that has been ascertained through various skills practice.

Another important facet when considering implementation of a given math program is the level to which it allows for tiered learning of steps to master and maintain a skill. Providing tiered learning allows for the teacher to further scaffold the level of support. What is essentially most important is finding a program that can be implemented with a balance between skill practice and discovering innovative ideas and extension. Emphasis should also be given to ensuring that implementation is "proportioned and appropriate" (Cebulla & Grouws, 2000, p. 18).

Teacher Preparation and Effectiveness for Mathematics (Efficacy)

The importance of teacher preparation has been well documented and continues to be a recurring topic of discussion in education across districts. Results from numerous studies, along with research methodologies (Cebulla & Grouws, 2000), illustrate the complexity of both teaching and learning math for teachers and students. If we are to provide a well-founded possibility for which student learning can truly grow, schools and teachers must be willing to implement instructional changes and practices that will evoke success and positively impact the instructional needs and learning for students.

According to Graham and Fennell (2001), there are three areas that illustrate effective teaching. They include "Effective teaching requires knowing and understanding

mathematics, students as learners, and pedagogical strategies; Effective teaching requires a challenging and supportive classroom learning environment; and Effective teaching requires continually seeking improvement" (Graham & Fennell, 2001, p. 17). These facets are key in teacher preparation, whether they be through preservice or professional development. Teachers should have or continue to develop an appropriate skill set that allows for them to create meaningful, rigorous, and engaging tasks.

Additionally, findings reflect that often, approaches show small systematic gains for students. Consequently, it is important to couple practices and strategies carefully to maximize gains for all students. Although developing curriculum practices encompasses many complexities, it is invaluable that we acknowledge its role in increasing student achievement in mathematics.

Another key component of factoring in teacher preparedness is reflecting on the practices we utilize, and "as teachers seek to improve their teaching effectiveness by changing their instructional practices, they should carefully consider the teaching context, giving special consideration to the types of students they teach" (Cebulla & Grouws, 2000, p. 1).

What is most enlightening is the awareness in the importance of creating professional development that allocates opportunities for teachers to review the work of their peers, which allows for meaningful conversations centered around strategies, content, pedagogy, and student learning. For the implementation of varied programs to be successful, we as educators must be willing to maintain preparedness and take advantage of the professional development opportunities that will allow for successful implementation and needed change within the math curriculum.

Equity in Mathematics and Education

Equity, according to Secada (1989), is a judgment as to whether or not a given state of affairs is just. Equity in education means providing students with what they need and deserve to succeed academically, regardless of their racial, ethnic, cultural, or socioeconomic backgrounds.

As it relates to equity in mathematics, Cooper, Crosnoe, Suizzo, and Pituich (2009) wrote, "Although poverty cuts across racial lines, the likelihood of growing up in an impoverished family is much higher for racial-minority children than for white children" (p. 861). Consequently, children living in poverty should receive more support to be successful in academics than their counterparts. It is important to recognize the difference between equity and equality; and as such, the nature of equity lies in our potential to recognize that the effects of action, even if adhering to a set of rules, can possibly be unjust.

Additionally, collaboration is another necessary component of ensuring equity within the classroom. "Collaboration is essential to ensure that all students have the necessary support to maximize their success in the mathematics classroom" (NCTM, 2014b, para. 5). NCTM (2014b) further elaborated on the importance of collaboration since collaboration with peers is necessary to implement best practices in mathematics that allow for a growth mindset.

Summary

In brief, there is a wealth of literature that illustrates the importance of providing a solid foundation for sixth-, seventh-, and eighth-grade students in math. The success of each student depends largely on the aforementioned components, such as the understanding of the mathematics classroom, SCCCR standards in mathematics, the

credibility of implementation in mathematics programs, the academic achievement gap, and the equity of mathematics education along with the utilization of technology in math curriculum, teacher preparation and effectiveness in mathematics, and the math curriculum itself (NCTM, 2014a).

The mathematics classroom plays an integral role in how comfortable students are in learning the content. As an educator, one must be willing to communicate effectively with students and all stakeholders pertaining to the success of students and provide opportunities for collaboration among students as well as work toward projects. Last, within the mathematics classroom, it is important to provide students with choice. Choice in the classroom may come from a variety of sources, such as choice in creating rules and procedures, choice in who the students work with on given assignments, choice about potential assignments, and choice in how activities are created (Carnegie Learning, Inc.®, 2015-16).

The SCCCR standards, which are 85% aligned with Common Core standards, illustrate the necessary rigor needed for students to successfully master them. Moreover, the standards allow credence as to what students across the state of South Carolina should be mastering to be successful upon entering a higher education setting (U.S. Department of Education, 2016a).

When one thinks of the importance of the environment of the mathematics classroom and the standards to which they are held to be successful, it is vital to understand that students will often need additional support, which is why a credible curriculum is so valuable.

The success of students in mathematics often relies heavily on the credibility of implementation. When one seeks to validate the program utilized, it is important that

implementation allows for guided and independent practice and opportunity for exploration and invention (e.g., Foorman & Moats, 2004; Foorman & Schatschneider, 2003; Gresham et al., 2000; Kovaleski et al., 1999; Telzrow et al., 2000; Vaughn et al., 1998). When a program such as Carnegie Learning® allows for invention and discovery, students are more likely to move from a factual level of understanding to a conceptual level of understanding and will readily be able to apply the skills learned as they progress through complex problems in mathematics.

In order for teachers to give detail to all of the aforementioned building blocks of mathematics, they must be well prepared and equipped to teach mathematics to all learners. Effective teaching is depicted by knowing and comprehending mathematics, acknowledging students as learners, and having a solid foundation of pedagogical strategies and practices. What is even more essential for effective teachers is to be cognizant of the need to continually seek improvement as a teacher to best meet the needs of students. Both preservice and professional development contribute equally to the effectiveness of teachers as they continue to grow within their profession. In continuing to grow and determining needed areas of improvement, it is relatively important to reflect on practices that were employed to determine their successfulness and whether the direction of instructional practices should be changed (Cebulla & Grouws, 2000).

The math curriculum within itself is representative of the gathering of activities that illustrate cohesiveness and focus on essential details of mathematics. This, in turn, allows the curriculum to be articulated throughout the development of math in all grades. The effectiveness of the math curriculum can be adhered to by focusing on focal points that serve as instructional targets to convey to students the purpose of their learning. In doing so, we allow students to ascertain deeper levels of comprehension (NCTM, 2014b).

Despite effective teaching and preparation, best practices reflect a curriculum that seeks to allow students to explore and invent. This is an intervention that supports the needs of students who have yet to master certain skills; we must readily acknowledge that there are still large deficits as evidenced by the gap in achievement in relation to African-American students (Nation's Report Card, 2015). Socioeconomic status and social conditions are major contributors to the widening of the gap in academics (Hedges & Nowell, 1998). As educators, one must be willing to recognize diversity within the classroom and focus on providing a balance for students who are school dependent.

Despite all things considered, equity in education is needed to level the playing field for African-American students and other minorities in mathematics. Because students who are racial minorities have a higher likelihood of growing up in impoverished families, we should provide higher levels of instructional support to ensure that these students are academically successful and are reaching appropriate levels of proficiency. There is a great need to recognize the differences between equity and equality and what that means for education (Secada, 1989). Chapter 3 provides an in-depth view and analysis of the research. Moreover, it illustrates the type of design implementation and collection of data as well as measures teacher fidelity as it relates to the fidelity of implementation.

Chapter 3: Methodology

Introduction

Math instruction is intended to provide students with concepts and skills that allow them to use math in everyday living and upcoming careers (Belton, 2016). This chapter describes the methodology used in this mixed-methods study.

Additionally, the methodology outlines the research design, participants, instruments, procedures, and data analysis. Included within the outline was the data collection and analysis using a teacher survey called Math Instruction Survey (developed for this study). The purpose of this study was to determine if teachers in the school district are using Carnegie Learning®, and if so, how is the use of this curriculum impacting student achievement. The research questions for this study were

1. To what extent are teachers using Carnegie Learning® for instructional planning?
2. To what extent are teachers using Carnegie Learning® for direct instruction in the classroom?
3. To what extent are teachers using Carnegie Learning® for assessment of students?
4. What are teacher perceptions regarding the use of Carnegie Learning® for instructional planning, direct instruction, and assessment of students?
5. To what extent is there a statistically significant difference in spring 2016 to spring 2017 MAP scores of students with teachers indicating they frequently use Carnegie Learning® for instructional planning?
6. To what extent is there a statistically significant difference in spring 2016 to spring 2017 MAP scores of students with teachers indicating they frequently

use Carnegie Learning® for direct instruction?

7. To what extent is there a statistically significant difference in spring 2016 to spring 2017 MAP scores of students with teachers indicating they frequently use Carnegie Learning® for assessment of students?

Research Design

This research is a mixed-methods study that uses descriptive survey statistics and quantitative analysis of student achievement data. A mixed-methods study is a way that incorporates quantitative and qualitative data analysis with feedback that are closed and open ended (Creswell, 2014). The mixed-methods study was completed in two phases as shown in Figure 3.

Figure 3. Diagram Developed for this Study, 2017.

In Phase 1, a survey was used that includes six questions. Three survey questions asked teachers to report the extent to which they use Carnegie Learning® curriculum for instructional planning, direct instruction, and assessment of students. Additional open-ended questions were asked to determine why teachers have chosen to use or not use Carnegie Learning® curriculum for instructional planning, direct instruction, and assessment of students.

In Phase 2, the researcher used the results of the survey to compare the mean difference between student spring 2016 MAP scores (pretest) and student spring 2017

MAP scores (posttest) of teachers who indicated they *frequently* and *always* use Carnegie Learning® for instructional planning, direct instruction in the classroom, and assessment of students. Student scores in mathematics on the normative MAP assessment quantifies how well the students do in three areas, one of which is algebraic thinking (NWEA, 2016). A one-group pretest and posttest design was implemented. As shown in Figure 4, Creswell (2014) illustrated that the design group receives a pretest measure followed by the treatment and posttest. A one-group pretest-posttest allows for more structure but provides minimal control. Student data from sixth, seventh, and eighth grade mathematics teachers using Carnegie Learning® curriculum were analyzed to determine its impact on student achievement.

Pro-Experimental Design

One-Group Pretest-Posttest Design

This design includes a pretest measure followed by a treatment and a posttest for a single group.

Group A*0*1------------------X--------------02

Figure 4. Pro-Experimental Design (Creswell, 2014, pp. 171-172).

Participants

The proposed study consisted of sixth, seventh, and eighth grade math teachers and their respective classes from five middle schools within the school district. Convenience sampling was utilized to allow the opportunity to work with the current population within the five middle schools as well as the teachers currently in the PLC within the school. All five middle schools are currently within the fourth year of implementation of Carnegie Learning®. The population of math teachers in each middle

school in each grade level is as follows.

Table 2

Population of Middle School Teachers in School District by School and Grade

School	Sixth Grade	Seventh Grade	Eighth Grade
A	3	3	3
B	3	3	3
C	3	3	2
D	3	3	3
E	3	3	3

Each of the five middle schools house populations varying per school. Each middle school has Grades 6, 7, and 8 with a total population of 3,543 students across the school district. The demographics reflect male and female students of varied races including American Indian, Asian, Black or African-American, Hispanic or Latino, White, Hawaiian or other Pacific Islander, and Two or More Races. Eighth-grade students who took Algebra I have been excluded. The Algebra I students are not using the Carnegie Learning® curriculum. The Algebra 1 students are taking a high school credit course. They are using a different math adopted curriculum, which is the same as the high school adopted curriculum. The population for each middle school is as follows: School A has 740 students, School B has 840 students, School C has 552 students, School D has 742 students, and School E has 669 students. Tables 3 and 4 show 2016-2017 demographics of students included within this study for each of the five middle schools within the school district.

Table 3

Middle School Grades 6, 7, and 8 2016-2017 Demographic Data
Gender and Lunch Status by Grade Level

School	Grade level	Female	Male	Free or Reduced	Full Pay
A	Sixth	138 (54%)	117 (46%)	153 (60%)	102 (40%)
	Seventh	134 (49%)	139 (51%)	164 (60%)	109 (40%)
	Eighth	101 (48%)	111 (52%)	136 (64%)	76 (36%)
B	Sixth	132 (41%)	191 (59%)	166 (51%)	157 (49%)
	Seventh	164 (51%)	159 (49%)	152 (47%)	171 (53%)
	Eighth	90 (46%)	104 (54%)	111 (57%)	83 (43%)
C	Sixth	108 (52%)	99 (48%)	123 (59%)	84 (41%)
	Seventh	103 (50%)	103 (50%)	124 (60%)	83 (40%)
	Eighth	68 (49%)	70 (51%)	95 (69%)	43 (31%)
D	Sixth	134 (47%)	152 (53%)	199 (70%)	87 (30%)
	Seventh	144 (52%)	131 (48%)	155 (56%)	120 (44%)
	Eighth	94 (49%)	99 (51%)	138 (71.5%)	55 (28.5%)
E	Sixth	108 (50%)	107 (50%)	147 (68%)	68 (32%)
	Seventh	124 (46%)	147 (54%)	170 (63%)	101 (37%)
	Eighth	79 (43%)	104 (57%)	137 (75%)	46 (25%)

Table 4

Middle School Grades 6, 7, and 8 2016-2017 Demographic Data
Race/Ethnicity by Grade Level

School	Grade level	American Indian	Asian	Black or African-American	Hawaiian or other Pacific Islander	Hispanic or Latino	Two or More Races	White
A	Sixth	18 (7%)	4 (2%)	71 (28%)	-	17 (7%)	10 (4%)	135 (53%)
	Seventh	14 (5%)	4 (1%)	73 (27%)	-	17 (6%)	13 (6%)	152 (57%)
	Eighth	9 (4%)	1 (0.5%)	83 (39%)	-	13 (6%)	11 (5%)	95 (45%)
B	Sixth	1 (0.3%)	6 (2%)	109 (34%)	2 (0.6%)	32 (10%)	10 (3%)	163 (51%)
	Seventh	4 (1%)	10 (3%)	99 (31%)	-	26 (8%)	6 (2%)	178 (55%)
	Eighth	-	2 (1%)	81 (42%)	-	14 (7%)	6 (3%)	91 (47%)
C	Sixth	1 (0.5%)	2 (1%)	102 (49%)	-	8 (4%)	6 (3%)	88 (43%)
	Seventh	2 (1%)	2 (1%)	94 (45%)	-	12 (6%)	5 (2%)	92 (44%)
	Eighth	1 (1%)	1 (1%)	80 (58%)	-	8 (6%)	5 (4%)	43 (31%)
D	Sixth	2 (1%)	4 (1%)	163 (57%)	-	12 (4%)	5 (2%)	100 (35%)
	Seventh	2 (1%)	1 (0.4%)	136 (49%)	-	15 (5%)	12 (4%)	109 (40%)
	Eighth	2 (1%)	-	65 (61%)	-	5 (3%)	4 (2%)	65 (34%)
E	Sixth	-	9 (4%)	73 (34%)	-	52 (24%)	8 (4%)	73 (34%)
	Seventh	-	2 (1%)	85 (31%)	-	60 (22%)	9 (3%)	115 (42%)
	Eighth	2 (1%)	2 (1%)	72 (39%)	-	34 (19%)	10 (5%)	63 (34%)

Tables 3 and 4 are further broken down to illustrate percentages of female and male students, including free or reduced lunch, full pay lunch, and race/ethnicity by grade level. Table 3 reflects high percentages throughout all five middle schools of free and reduced lunch and reflects Title I status.

Instruments

Students are required to take the MAP test at least twice during the school year, fall and spring. The scores are used to show student progress or growth. The minimum cut score in math for sixth grade is 213, seventh grade is 219, and eighth grade is 227.

The measure of achievement for this study will be the spring 2016 to spring 2017 MAP scores. The SCCCR strands for each grade level band is reflected in Table 1

The survey instrument called Math Instruction Survey is a mixed-method survey

used with the research to determine the level of implementation of Carnegie Learning® curriculum (Appendix A). The survey was validated because of sending it to 16 educators within the school district. Eleven educators responded. The information was given to ensure that the format, questions, and delivery were clear, allowing responses to be used. The survey was sent to approximately 44 math teachers across the five middle schools in the school district in Grades 6, 7, and 8, using items answered with a Likert scale. The survey item responses for Questions 1-3 include a Likert scale: *never, sometimes, frequently, always*. The survey was delivered electronically and allowed for the email of the respondent to be attached to spring 2016 MAP data and spring 2017 MAP data. The Math Instruction Survey utilized for the research was validated to ensure that the questions measured what the survey was designed to measure. A teacher consent form was given to the teachers surveyed prior to volunteering to taking the survey (Appendix B).

Validity and Reliability

The NWEA MAP reports were used to measure student progress and growth individually. NWEA reports marginal reliability as a measure of internal consistency. NWEA claims that its test-retest reliability can also be considered a form of parallel forms reliability. A summary of reliability scores is provided in Figure 5 (NWEA, 2004).

Reliability Type	Data Set	Term	Reading	Math	Language Use
Marginal	1999 NWEA Norms Study	Fall	.94 - .95	.92 - .96	.93 - .94
		Spring	.93 - .95	.93 - .96	.92 - .94
Test-Retest	2002 NWEA Norms study	Fall to Spring	.80 - .92	.77 - .94	.88 - .92
		Spring to Spr.	.84 - .91	.79 - .93	.88 - .92

Adapted from "Reliability and validity estimates: NWEA achievement level tests and measures of academic progress," by NWEA (2004).

Figure 5. MAP Marginal and Test-Retest Reliability Estimate Ranges from Grades 2-10.

The Math Instruction Survey instrument was designed and validated to disclose the frequency in use of Carnegie Learning® curriculum for teachers to plan instruction, allow for direct instruction, and assess students. The survey was reviewed by educators who included a principal, math teachers (not participating in research), English teachers, and an instructional coach. The survey was also viewed and tested by the school district research specialist. This was to ensure the survey was not comprised of common errors, such as being leading or confusing. Since the survey is validated, the validity and reliability will indicate that the researcher can have confidence in the data collected by this instrument. "Establishing the validity of a survey instrument strengthens the data yielded from the data collection process, which allows for greater confidence in the interpretation of the results from the survey" (Burton & Mazerolle, 2011, p. 9).

Data Collection

In Phase 1, data were collected using the Math Instruction Survey. The Math Instruction Survey was used for data collection for Research Questions 1-6. The survey was provided to sixth, seventh, and eighth grade math teachers across all five middle schools within the school district. The survey was provided via a link through school district email. The survey is the best method to use because many variables can be measured without significantly increasing the time or cost. Survey data can be collected electronically from many people at relatively low cost and quickly. Furthermore, "when cross-population generalizability is a key concern, it allows a range of educational contexts and subgroups to be sampled. The consistency of relationships can then be examined across the various subgroups" (Check & Schutt, 2012, p. 160).

The survey composed of both Likert scale questions and open-ended questions to

determine the frequency of use and reasons for using Carnegie Learning® curriculum. Questions focused on three areas: instructional planning, direct instruction in the classroom, and assessment of student learning. The survey was created using Survey Monkey and was emailed to all middle school math teachers who consented to participate via the school district email.

Data Analysis

For Phase 1 of the study, survey Likert scale question responses and open-ended questions were analyzed descriptively. Likert scale questions, which is quantitative data collection, were analyzed using participant responses who *frequently* and *always* use Carnegie Learning® for instructional planning, direct instruction in the classroom, and assessment of students. Open-ended questions, which is qualitative data collection, were analyzed by assessing patterns and trends in the survey responses to reach conclusions that the teachers choose to use or not to use Carnegie Learning® for instructional planning, direct instruction, and assessment of students. The open-ended question collection type is a qualitative document that allows the researcher to "obtain the language and words of participants" (Creswell, 2014, p. 191).

Once response data from the electronic survey were analyzed, the researcher used these data to align *frequently* and *always* survey responses to specific teachers with assistance from the district accountability department. A department analyst matched teacher responses through email addresses to student data. The data were given to the researcher for Phase 2 analysis. Teacher names remained anonymous.

In Phase 2, a paired *t* test was implemented by the researcher using SPSS software. The paired *t* test was used to compare the mean difference between student spring 2016 MAP scores (pretest) and student spring 2017 MAP scores (posttest) of

teachers who answered *frequently* and *always* to using Carnegie Learning® for instructional planning, direct instruction in the classroom, and assessment of students.

The paired *t* test determined if using Carnegie Learning® *frequently* and *always* leads to improvements in student knowledge and skills. To test the null hypothesis that the true mean is zero, the researcher calculated the difference ($d_i = y_i - x_i$) between the pretest scores (*x*) and posttest scores (*y*), making sure there is a distinguishment between positive and negative differences; calculated the mean difference, $\bar{d}$; calculated the standard deviation of the differences, s_d, and used this to calculate the standard error of the mean difference, $SE(\bar{d}) = \frac{s_d}{\sqrt{n}}$; calculated the *t* statistic, which is given by $T = \frac{\bar{d}}{SE(\bar{d})}$. Under the null hypothesis, this statistic follows a *t* distribution with $n - 1$ degrees of freedom. Then, the researcher used tables of *t* distribution to compare the value for *t* to the t_{n-1} distribution. This gave the *p* value for the paired *t* test (Shier, 2004).

The significance level was set at $p < .05$. If $p < .05$, the results in the data collected will reject the null hypothesis and will have a statistically significant difference. If $p > .05$, the results in the data collected will fail to reject the null hypothesis and will have no statistically significant difference.

Matching Procedure

Regarding matching procedure and participants, one must consider the importance of selecting features that will allow for additional control of variables that have the potential to influence the outcome of said experiment (Milner & Howard, 2015). Hence, match participants can be defined as, “in terms of a certain trait or characteristic and then assign one individual from each matched set to each group” (Milner & Howard, 2015, p. 168). In doing so, the probability of implementing Carnegie Learning® math curriculum,

whether profound or limited in its impact, can be determined more readily.

Ethical Protections

Considering the ethical protection of the study, which seeks to determine the impact of Carnegie Learning® curriculum on student achievement, the researcher ensured to maintain a level of quality research, obtained consent to use data and information from the survey, and considered consequences of work as well as opportunities for research.

To protect and maintain the confidentially of data provided to the researcher by the school district, the researcher removed personal and school identification from all published work (Appendix C). The researcher also protected and maintained the confidentially of information provided by the teachers through the survey and student scores provided by the school district by not attaching any personal identification of the participants. A consent form was provided for teachers to volunteer to take the survey (Appendix B).

Maintain quality of research. To make sure the research was of quality, the researcher relied on utilization of peer-reviewed articles and proven existing research regarding Carnegie Learning® curriculum and its impact on student achievement. The researcher conferred with district analysts to guide research and its validity by acquiring needed data for the analysis. The researcher ensured a full understanding of the data sources that confirmed validity of the research. Participation of all participants, specifically students, teachers, middle schools, and the school district, was kept confidential. Data were analyzed objectively to ensure that the impact of Carnegie Learning® curriculum is illustrated with clarity and specific to the actual results.

Obtaining Consent to Use Data

As it relates to the use of student, teacher, school, and school district data, the researcher obtained a consent from the school district as well as the building level principal regarding implementation of the research, in addition to using data for the sole purpose of determining the impact of Carnegie Learning® curriculum on student achievement (Appendix C). The Math Instruction Survey was given to middle school math teachers, Grades 6, 7, and 8, throughout the school district being advised that the information from the data would be used to determine to what extent teachers were using the Carnegie Learning® mathematics curriculum for the 2016-2017 school year. The middle school math teachers in the school district received a consent form prior to volunteering to take the survey (Appendix B).

Consequences of the Work

Research on the impact of Carnegie Learning® curriculum on student achievement in mathematics was used to determine the effectiveness of the program. The information from the research provided an additional means for the district when making informed curriculum decisions about programs and resources to benefit students in mathematics. The research allowed for further studies to be conducted, if a new curriculum program is adopted, to make a comparison of impact regarding student achievement in math. Further, as students matriculate through middle school, the district can continue to monitor the effective of the program as demographics and student needs potentially change.

Summary

This chapter describes the methodology of the study. The purpose of this study was to determine how effective the use of Carnegie Learning® curriculum is for Grades

6, 7, and 8 and whether Carnegie Learning® has an impact on improving student achievement.

Data collection methods include information from the mixed-method survey, Math Instruction Survey, from spring 2016 to spring 2017 student MAP scores. To collect the MAP data, a quantitative design with descriptive statistics from Creswell (2014) was used to collect quantitative data.

The study took place in a single school district with five middle schools with sixth-, seventh-, and eighth-grade students as the sample population. The study attempted to measure the effects of Carnegie Learning® curriculum on student achievement.

Chapter 4 details the results of the study as carried out according to this methodology. Chapter 5 includes a discussion of the findings, implications for practice, and recommendations for further research.

Chapter 4: Results

Introduction

The purpose of this mixed-method study was to determine to what extent (a) teachers are using Carnegie Learning® for instructional planning; (b) teachers are using Carnegie Learning® for direct instruction in the classroom; (c) teachers are using Carnegie Learning® for assessment of students; and (d) there is a statistically significant difference in the spring 2016 MAP scores to spring 2017 MAP scores of students with teachers indicating they frequently use Carnegie Learning® in each of the three areas: instructional planning, direct instruction in the classroom, and assessment of students. The study also determined teacher perceptions regarding the use of Carnegie Learning® in each of the three areas.

The theoretical framework guiding this research study was Cognitive Learning Theory, founded by Gagne (1985). Gagne's theory conveys the variations in internal and external conditions. Relative to Gagne's theory, acquisition of cognitive strategies requires opportunities to practice creating solutions to various problems as well as exposure to credible models and arguments (Gagne, 1985). For example, for cognitive strategies to be learned, there must be a chance to practice developing innovative solutions to problems.

Research Questions

The research questions for this study were as follows.

Phase 1

1. To what extent are teachers using Carnegie Learning® for instructional planning?
2. To what extent are teachers using Carnegie Learning® for direct instruction in

the classroom?

3. To what extent are teachers using Carnegie Learning® for assessment of students?
4. What are teacher perceptions regarding the use of Carnegie Learning® for instructional planning, direct instruction, and assessment of students?

Phase 2

5. To what extent is there a statistically significant difference in spring 2016 to spring 2017 MAP scores of students with teachers indicating they frequently use Carnegie Learning® for instructional planning?
6. To what extent is there a statistically significant difference in spring 2016 to spring 2017 MAP scores of students with teachers indicating they frequently use Carnegie Learning® for direct instruction?
7. To what extent is there a statistically significant difference in spring 2016 to spring 2017 MAP scores of students with teachers indicating they frequently use Carnegie Learning® for assessment of students?

Description of Participation Data

This mixed-methods research study was completed in two phases. The first phase used descriptive survey statistics. The second phase of the survey included a quantitative analysis of student achievement data based on the teacher survey responses. The study consisted of sixth, seventh, and eighth grade math teachers and their respective classes from five middle schools within the school district. Thirty-six teachers participated in the Math Instruction Survey (Appendix B). From the Math Instruction Survey, only 30 teachers taught in the school district during the 2016-2017 school year. To complete Phase 1, teacher survey responses determined to what extent teachers are using Carnegie

Learning® for instructional planning, direct instruction in the classroom, and assessment of students. Phase 1 also included teacher perceptions regarding the use of Carnegie Learning® for instructional planning, direct instruction, and assessment of students. To complete Phase 2, spring 2016 to spring 2017 math MAP scores of 2,113 students were used. These data were analyzed to determine if the teachers frequently used Carnegie Learning® for instructional planning, direct instruction, and assessment of students.

Findings for Research Questions

For Phase 1 of the study, the researcher used qualitative data that were analyzed descriptively. A total of 30 teachers, Grades 6, 7, and 8, participated in the Math Instruction Survey (Appendix B) portion of the research study. The findings are organized by research questions. Research Questions 1-3 had a breakdown of the usage for using the Carnegie Learning® curriculum *always, frequently, sometimes, or never*. *Always* meant the teacher using Carnegie Learning® at least 80% of the time; *frequently* between 50%-80%; *sometimes* 50% of the time or less; and *never* meant the teacher does not use Carnegie Learning® for instructional learning, direct instruction in the classroom, or assessment of students.

Phase 1.

Research Question 1: To what extent are teachers using Carnegie Learning® for instructional planning? Table 5 displays survey research findings for teacher responses using Carnegie Learning® for instructional planning: *always*, *frequently*, *sometimes*, or *never*. Data showed teachers are mostly using Carnegie Learning® *sometimes* (67%) for instructional planning. One teacher *always* (3%), three teachers *frequently* (10%), and six teachers *never* (20%) used Carnegie Learning® for instructional planning.

Table 5

Survey Research Findings

Answer Choices	Responses	Percent
Always	1	3.33%
Frequently	3	10.00%
Sometimes	20	66.67%
Never	6	20.00%
Total	30	

Research Question 2: To what extent are teachers using Carnegie Learning® for direct instruction in the classroom? Table 6 displays survey research findings for teacher responses using Carnegie Learning® for direct instruction: *always, frequently, sometimes,* or *never.* Teachers are mostly using Carnegie Learning® *sometimes* (53%) for direct instruction in the classroom. Four teachers *frequently* (13%) and 10 teachers *never* (33%) used Carnegie Learning® for direct instruction. There were no teachers who *always* used Carnegie Learning® for direct instruction.

Table 6

Survey Research Findings

Answer Choices	Responses	Percent
Always	0	0.00%
Frequently	4	13.33%
Sometimes	16	53.33%
Never	10	33.33%
Total	30	

Research Question 3: To what extent are teachers using Carnegie Learning® for assessment of students? Table 7 displays the survey research findings of teacher responses for using Carnegie Learning® for assessment: *always, frequently, sometimes,* or *never*. Teachers were mostly using Carnegie Learning® *sometimes* (47%) and *never* (47%) for assessment of students. Two teachers *frequently* (7%) used Carnegie

Learning® assessment of students. There are no teachers who *always* used Carnegie Learning® for assessment of students.

Table 7

Survey Research Findings

Answer Choices	Responses	Percent
Always	0	0.00%
Frequently	2	6.67%
Sometimes	14	46.67%
Never	14	46.67%
Total	30	

Research Question 4: What are teacher perceptions regarding the use of Carnegie Learning® for instructional planning, direct instruction in the classroom, and assessment of students? Table 8 highlights the results derived from the open-coding analysis of teacher perceptions regarding the use of Carnegie Learning® for instructional planning, direct instruction in the classroom, and assessment of students. The findings indicated that teachers chose to use Carnegie Learning® to cover the standards for practice and to challenge students. Teachers chose not to use Carnegie Learning® mostly because the content level was too rigorous for the students, especially for students who struggled with reading.

Table 8

Qualitative Survey Research Findings

Instructional Planning	
Choose to Use	Choose Not to Use
Standards Covered	Level too difficult for students to understand
Provide rich problems that apply rich problems	Too wordy
Practice for students and concepts	Not aligned best with Standards
Direct Instruction	
Choose to Use	Choose Not to Use
Concepts to challenge students	Materials not student friendly
Conceptualize math through various text	Did not flow with Standards
Some Standards aligned	Lessons too long
Skill builder for students	Level too difficult for struggling readers
Assessment of Students	
Choose to Use	Choose Not to Use
Test generator	Very high level (difficult)
Rich application	Did not match teaching style
Skill practice	Complexity of problems
Challenge students	Teacher made assessments

The 30 teachers who participated in the Math Instruction Survey gave their personal opinion of the Carnegie Learning® curriculum. Most of the teachers said the curriculum was confusing and complicated, especially for lower level students and students who struggled with reading. Some teachers felt that the textbook was not engaging, visually appealing, and not aligned with the standards. Some teachers felt the textbook and assessment problems were a great resource that provided rich application for skills practice and to challenge students who were on grade level or higher.

Phase 2. For Phase 2 of the study, the researcher used quantitative data. A paired sample *t* test was used to determine to what extent there is a statistically significant difference in spring 2016 to spring 2017 MAP scores of students with teachers indicating they frequently use Carnegie Learning® for instructional planning, direct instruction, and

assessment of students. A total of four teachers *always* or *frequently* use Carnegie Learning® for instructional planning, direct instruction, and assessment of students. The findings are organized after the research questions by including a table for each teacher: A, B, C, and D.

Teacher A

Teacher A *frequently* uses Carnegie Learning® for instructional planning and direct instruction in the classroom. The assessment of students were used *sometimes.* A paired sample *t* test was used to determine whether student performances differed from 2016 spring math MAP pretest to 2017 spring math MAP posttest as illustrated in Table 9 for Teacher A. The results indicated that the calculated *p* value (0.0000003) did not exceed the *p* value of 0.05; therefore, one can reject the null hypothesis of having no statistically significant difference. Therefore, there is strong evidence that the use of Carnegie Learning® resources does lead to improvements.

Table 9

Teacher A: Result of Paired Sample t Test, Spring 2016 to Spring 2017 Pretest and Posttest Math MAP Scores (N = 59)

	Pretest	Posttest
Mean	219.20	223.58
Paired Differences		
Std. deviation	5.83	
t Stat	-5.76	
p value	3.37×10^{-7}	

Note. *$p < 0.05$.

When analyzing Teacher A test data, student 2016 spring math MAP scores (M=219.20) compared to student 2017 spring math MAP scores (M=223.58) showed the average growth of pretest to posttest made by the students. The mean difference was

4.37. These results indicated that students were able to make statistically significant growth in their math ability. These results show that there is a significant difference in spring 2016 to spring 2017 scores of teachers indicating they frequently use Carnegie Learning® for instructional planning, direct instruction, and assessment of students.

Teacher B

Teacher B *frequently* used Carnegie Learning® for instructional planning and direct instruction in the classroom. The assessment of students was only used *sometimes*. A paired sample *t* test was used to determine whether student performances differed from 2016 spring math MAP pretest to 2017 spring math MAP posttest as illustrated in Table 10 for Teacher B. The results indicated that *p* value 0.0000001 did not exceed the *p* value of 0.05. Therefore, one can reject the null hypothesis of having no statistically significant difference. Therefore, there is strong evidence that the use of Carnegie Learning® resources does lead to improvements.

Table 10

Teacher B: Result of Paired Sample t Test, Spring 2016 to Spring 2017 Pretest and Posttest Math MAP Scores (N = 69)

	Pretest	Posttest
Mean	217.57	222.25
Paired Differences		
Std. deviation	6.61	
t Stat	-5.89	
p value	1.34×10^{-7}	

Note. $^{*}p < 0.05$.

When analyzing Teacher B test data, student 2016 spring math MAP scores (M=217.57) compared to student 2017 spring math MAP scores (M=222.25) showed the average growth of pretest to posttest made by the students. The mean difference was

4.68. These results indicated that students were able to make statistically significant growth in their math ability. These results show that there is a significant difference in spring 2016 to spring 2017 scores of teachers indicating they frequently used Carnegie Learning® for instructional planning, direct instruction, and assessment of students.

Teacher C

Teacher C *frequently* used Carnegie Learning® for instructional planning and direct instruction in the classroom. The assessment of students were only used *sometimes*. A paired sample *t* test was used to determine whether student performances differed from 2016 spring math MAP pretest to 2017 spring math MAP posttest as illustrated in Table 11 for Teacher C. The results indicated that *p* value 0.0000000000009 did not exceed the *p* value of 0.05; therefore, one can reject the null hypothesis of having no statistically significant difference. Therefore, there is strong evidence that the use of Carnegie Learning® resources does lead to improvements.

Table 11

Teacher C: Result of Paired Sample t Test, Spring 2016 to Spring 2017 Pretest and Posttest Math MAP Scores (N = 63)

	Pretest	Posttest
Mean	220.46	227.40
Paired Differences		
Std. deviation	6.14574	
t Stat	-8.959	
p value	8.75×10^{-13}	

Note. *$p < 0.05$.

When analyzing Teacher C test data, student 2016 spring math MAP scores (M=220.46) compared to student 2017 spring math MAP scores (M=227.40) showed average growth of pretest to posttest made by the students. The mean difference was

6.94. These results indicated that students were able to make statistically significant growth in their math ability. These results show that there is a significant difference in spring 2016 to spring 2017 scores of teachers, indicating they frequently used Carnegie Learning® for instructional planning, direct instruction, and assessment of students.

Teacher D

Teacher D *always* used Carnegie Learning® for instructional planning and *sometimes* for direct instruction in the classroom and assessment of students. A paired sample *t* test was used to determine whether student performances differed from 2016 spring math MAP pretest to 2017 spring math MAP posttest as illustrated in Table 12 for Teacher D. The results indicated that *p* value 0.0009 did not exceed the *p* value of 0.05; therefore, one can reject the null hypothesis of having no statistically significant difference. Therefore, there is strong evidence that the use of Carnegie Learning® does lead to improvements.

Table 12

Teacher D: Result of Paired Sample t Test, Spring 2016 to Spring 2017 Pretest and Posttest Math MAP Scores (N = 51)

	Pretest	Posttest
Mean	223.14	225.82
Paired Differences		
Std. deviation	7.01	
t Stat	-2.737	
p value	8.57×10^{-4}	

Note. $^{*}p < 0.05$.

When analyzing Teacher D test data, student 2016 spring math MAP scores (M=223.14) compared to student 2017 spring math MAP scores (M=225.82) showed the average growth of pretest to posttest made by the students. These results indicated that

students were able to make statistically significant growth in their math ability. The mean difference was 2.69. These results show that there is a significant difference in spring 2016 to spring 2017 scores of teachers indicating they frequently use Carnegie Learning® for instructional planning, direct instruction, and assessment of students.

Further Findings

The researcher decided to also analyze the MAP scores of teachers who indicated that they *sometimes* and *never* used Carnegie Learning®. A paired sample *t* test was used to determine to what extent there is a statistically significant difference in spring 2016 to spring 2017 MAP scores of students with teachers indicating they *sometimes* or *never* use Carnegie Learning® for instructional planning, direct instruction in the classroom, and assessment of students. The findings are organized in two tables, identifying each teacher as Teachers 1-20 for using Carnegie *sometimes* and Teachers 21-26 for using Carnegie *never.*

Table 13 shows 20 teachers who *sometimes* used Carnegie Learning® for instructional planning, direct instruction in the classroom, and/or assessment of students. A paired sample *t* test was used to determine whether student performances differed from 2016 spring math MAP pretest to 2017 spring math MAP posttest.

Teachers 1-9 used Carnegie Learning® *sometimes* for instructional planning, direct instruction in the classroom, and assessment of students. The results indicated that the *p* value for Teachers 1-3 and 7-9 did not exceed the *p* value of 0.05; therefore, one can reject the null hypothesis of not having a statistically significant difference. Therefore, there is strong evidence that the use of Carnegie Learning® does lead to improvements. The results indicated that Teachers 4-6 exceeded the *p* value of 0.05; therefore, one cannot reject the null hypothesis of not having a statistically significant

difference. There was not a statistically significant difference.

Teachers 10-15 used Carnegie Learning® *sometimes* for instructional planning and direct instruction in the classroom. The teachers *never* used Carnegie Learning® for assessment of students. The results indicated that the p value did not exceed the p value of 0.05; therefore, one can reject the null hypothesis of not having a statistically significant difference. Therefore, there is strong evidence that these data do lead to improvements.

Teachers 16-20 used Carnegie Learning® *sometimes* for instructional planning. The teachers *never* used Carnegie Learning® for direct instruction in the classroom and assessment of students. The results indicated that the p value for Teachers 18-19 did not exceed the p value of 0.05; therefore, one can reject the null hypothesis of not having a statistically significant difference. Therefore, there is strong evidence that the use of Carnegie Learning® resources does lead to improvements.

Teachers 16, 17, and 20 exceeded the p value of 0.05; therefore, one cannot reject the null hypothesis of not having a statistically significant difference. There was not a statistically significant difference.

Table 13

Result of Paired Sample t Test, Spring 2016 to Spring 2017 Pretest and Posttest Math MAP Scores of Teachers who Sometimes Use Carnegie Learning® Curriculum

	N	Pretest(*M*)	Posttest(*M*)	SD	*t* Stat	*p* value
Use Carnegie Learning® for Instructional Planning, Direct Instruction, & Assessment						
Teacher 1	78	220.69	223.60	6.66	-3.86	2.33×10^{-4}
Teacher 2	61	218.49	221.16	6.79	-3.07	3×10^{-3}
Teacher 3	61	222.69	227.25	5.34	-6.67	9.00×10^{-9}
Teacher 4	46	223.20	225.33	7.60	-1.90	0.06
Teacher 5	71	222.14	221.76	7.11	0.451	0.65
Teacher 6	52	223.06	223.44	7.91	-0.350	0.73
Teacher 7	70	224.74	231.40	6.37	-8.74	9.00×10^{-13}
Teacher 8	46	226.22	233.09	6.52	-7.06	9.00×10^{-9}
Teacher 9	92	224.71	230.35	6.92	-7.81	9.00×10^{-12}
Use Carnegie Learning® for Instructional Planning & Direct Instruction						
Teacher 10	81	219.38	224.17	5.28	-8.17	4×10^{-12}
Teacher 11	84	221.98	229.00	8.29	-7.77	2×10^{-11}
Teacher 12	102	223.98	225.73	6.81	-2.59	0.01
Teacher 13	69	221.14	224.19	6.73	-3.76	3.61×10^{-4}
Teacher 14	85	217.88	224.24	6.96	-8.41	9.00×10^{-13}
Teacher 15	66	215.48	218.44	6.71	-3.58	$1 \times 10^{-}$
Use Carnegie Learning® for Instructional Planning						
Teacher 16	99	219.36	220.41	6.45	-1.62	0.11
Teacher 17	18	216.56	218.00	5.97	-1.02	0.32
Teacher 18	58	224.16	230.83	6.90	-7.36	8×10^{-10}
Teacher 19	77	223.10	224.97	6.63	-2.48	0.02
Teacher 20	42	226.81	226.98	6.49	-0.17	0.87

Note. *$p < 0.05$.

Table 14 shows six teachers who *never* use Carnegie Learning® for instructional planning, direct instruction in the classroom, and assessment of students. The results indicated that the *p* value for Teachers 21-24 and 26 did not exceed the *p* value of 0.05; therefore, one can reject the null hypothesis of not having a statistically significant difference. Therefore, there is strong evidence that these data do lead to improvements.

Teacher 25 exceeded the *p* value of 0.05; therefore, one cannot reject the null hypothesis of not having a statistically significant difference. There was not a statistically significant difference.

Table 14

Result of Paired Sample t Test, Spring 2016 to Spring 2017 Pretest and Posttest Math MAP Scores of Teachers who Never Use Carnegie Learning® Curriculum

	N	Pretest(*M*)	Posttest(*M*)	SD	*t* Stat	*p* value
Teacher 21	97	224.78	229.14	6.00	-7.15	0.0000000002
Teacher 22	89	220.06	221.69	7.53	-2.04	0.044
Teacher 23	89	221.87	228.30	7.61	-7.98	0.000000000005
Teacher 24	64	221.00	231.05	6.79	-8.35	1.18×10^{-17}
Teacher 25	49	212.92	213.65	7.00	-0.74	0.466
Teacher 26	99	226.06	232.94	5.90	-11.61	4.07×10^{-20}

Note. *$p < 0.05$.

Summary

This chapter included a mixed-method approach of analysis based on the data collection involving a math instruction survey and student pretest and posttest MAP data. The final results verified positive correlations and the increased academic achievement of students measured by spring 2016 to spring 2017 MAP scores with teachers indicating they frequently use Carnegie Learning® for instructional planning, direct instruction in the classroom, and assessment of students.

The researcher concluded that there was a statistically significant difference in experienced learning gains of students and increased student achievement. The most conclusive evidence showed that students demonstrated academic growth with teachers using the Carnegie Learning® curriculum *always, frequently, sometimes,* and/or *never*.

Chapter 5 provides an analysis of the findings in the research study. The chapter is organized into seven sections: (a) introduction, (b) discussion of results, (c) implication for practice, (d) limitations, (e) recommendations for further study, (f) reflection, and (g)

conclusion.

Chapter 5: Discussion

Introduction

This chapter consists of an overview and summary of the study, questions, further potential research, and the conclusion of the study. In an effort to ensure that mathematics instruction remains at the forefront of education to better prepare students for career fields and higher education that require strong foundational skills in mathematics, it is important to review instructional planning, use of instructional materials, and student growth from year to year.

"Young learners' future understanding of mathematics requires an early foundation based on a high-quality, challenging, and accessible mathematic education" (NCTM, 2013, p. 1). Students need proficient reading and mathematics skills and knowledge to compete for jobs in the global economy (Achieve, 2016).

In order to present educators with the importance of assessing an instructional program such as Carnegie Learning® and its use, this study introduced the concepts of ESSA, understanding the mathematics classroom, the importance of student collaboration, algebra readiness, SCCCR standards in mathematics as well as the mathematics curriculum, instructional process and planning, and assessment within the classroom.

These key concepts provide a visual as to the importance of understanding the necessity of helping each child to succeed: (a) what the mathematics classroom should look like in order to allow for an environment that caters to direct instruction, practice, and application of math skills; and (b) the standards each child must be held to, in addition to the rigor that must be present, while allowing for a means of both formative and summative assessment to determine what students across grade levels do and do not

know.

The ultimate aim of implementing a program like Carnegie Learning® across schools within the district is to blend inquiry learning with technology to provide students with opportunities for investigative learning and individualized practice. Further, the program allows for the direct use of materials for instruction, intervention, and enrichment (Carnegie Learning®, Inc., 2014-15).

In selecting the Carnegie Learning® curriculum, the district sought to accommodate for the lack of proficiency in mathematics and to help students become more equipped with the foundational math skills for eligible entry into the work force or continued schooling. In order to guide the program, the district used SCCCR standards to provide a clear focus on set math skills and concepts. In reviewing previous adoptions, previous curriculum did not provide sufficient support to help prepare students to solve real-world problems at the depth and complexity needed to be proficient.

The concerns presented regarding the lack of student proficiency and the potential for Carnegie Learning® to support student growth and aid in student proficiency are what ultimately led to the focus of the study in order to examine the extent to which teachers use Carnegie Learning® for instructional planning and direct instruction as well as the assessment of students.

Student MAP data are used to monitor the growth of each student. The teachers are able to compare data from previous years and twice during the school year to see the academic growth of each student. The school district is able to use the data to compare school performance or academic growth.

The purpose of this study was to determine (a) to what extent teachers are using Carnegie Learning® for instructional planning, direct instruction in the classroom, and

assessment of students; (b) to what extent there is a statistically significant difference in the spring MAP scores of students from spring 2016 to spring 2017 with teachers indicating they frequently use Carnegie Learning®; and (c) the impact of the Carnegie Learning® student achievement in Grades 6, 7, and 8. Most important, the study determined that students had the necessary foundational skills in algebra to be successful in secondary education, specifically high school and beyond.

Carnegie Learning® is a program that provides continuing opportunities for students to engage as active contributors in the learning process by articulating their knowledge and ideas to the teacher, their peers, and themselves by creating opportunities for students to succeed and build on their respective strengths. Strategies used by the program include collaboration, extension, and reflection, while basing the success of the program on how students think, learn, and apply new knowledge in mathematics.

As it relates to the program and its use, the study reviewed data from 36 teachers, with 30 having taught during the 2016-2017 school year in Grades 6, 7, and 8 across the school district to determine their use of Carnegie Learning® curriculum. The remaining six teachers were able to provide their thoughts and perceptions regarding the program and its benefit, or lack thereof, to students. Teachers varied in their implementation of the program from *always*, *frequently*, s*ometimes*, and/or *never* in instructional planning, direct instruction, and assessment of students. The implementation of Carnegie Learning® varied based on teacher preference, collaboration within PLCs, and student needs.

Of the 36 teachers, consumable textbooks were available to all students across the district; however, three teachers used the consumable textbook provided by Carnegie Learning® *frequently* to provide instruction, practice, and application, while one of the

four teachers, Teacher D, *sometimes* chose to use the text within the classroom.

This chapter seeks to interpret the results and illustrate what teachers convey for instruction of mathematics within the district.

Discussion of Results

Phase 1.

Research Questions 1-3: To what extent are teachers using Carnegie Learning® for (1) instructional planning, (2) direct instruction in the classroom, and (3) assessment of students? Thirty teachers participated in the survey that taught math in the district during the 2016-2017 school year. The researcher was able to determine the use of the Carnegie Learning® curriculum. The results of the findings for instructional planning indicated that 80% (n=24) of teachers used instructional planning *always*, *frequently*, or *sometimes*; and 20% (n=6) *never* used the curriculum for instructional planning. "Evidence suggests that effective teachers follow the instructional or lesson plan while continuously adjusting it to fit the needs of different students" (Jackson & Davis, 2000, p. 61).

The results for direct instruction revealed that 66.7% (n=20) of teachers used Carnegie Learning® for direct instruction in the classroom *frequently* or *sometimes*; and 33.3% (n=10) of the teachers *never* used the curriculum for direct instruction. Topics should be presented in a sequence and manner appropriate for the developmental level of the students (Reys et al., 1999).

The results for assessment of students revealed that 53.5% (n=16) of the teachers used Carnegie Learning® assessment *frequently* or *sometimes*; and 46.7% (n=14) of the teachers *never* used the curriculum for assessment. Assessment is an important part of mathematics instruction that supplements teaching and learning. An important

characteristic of instructional decision-making is the alignment of standards, curriculum, instruction, and assessment (NCTM, 2015).

The majority of teachers, 80%, used Carnegie Learning® for instructional planning. Instructional planning is very important. It helps teachers organize and select materials and activities for students needed to demonstrate mastery of standards. Based on research, planning is a process that causes teachers to be well prepared before entering the classroom each day (Pressley et al., 1998). Organizing time and preparing materials for instruction are key features of effective teaching.

The results show that the teachers used other resources to supplement instructional planning, direct instruction, and assessment. A majority of the teachers chose not to use the Carnegie Learning® assessment component as compared to using the instructional planning and direct instruction resources. The results of the qualitative data revealed that teachers chose not to use the assessment because of very high leveled questions and complexity of assessment problems. Because South Carolina has navigated from South Carolina Common Core to SCCCR standards, the criteria have changed slightly but still allow for a degree of rigor and complexity, such that students can compete with students globally. According to Graham and Fennell (2001), teachers should have or continue to develop an appropriate skill set that allows them to create meaningful, rigorous, and engaging tasks.

Research Question 4: What are teacher perceptions regarding the use of Carnegie Learning® for instructional planning, direct instruction, and assessment of students? In the qualitative portion of the study, the findings indicated that teachers chose to use Carnegie Learning® to cover the standards, for skill practice for students, and to use the content to challenge the students. Teachers chose not to use Carnegie

Learning® because the content level was too rigorous for students, too wordy, not aligned with the standards, and the content level was too difficult for struggling readers. Some teachers felt the textbook lessons and assessment problems were a great resource that provided rich application for skills practice that challenged students who were on grade level or higher. Based on the literature review, the most important challenge middle school teachers must conquer is how to provide appropriate foundation for students so they are ready for algebra. Providing this basis has been proven true through extensive research as the needed foundation for success (Horn & Nunez, 2000).

Phase 2.

Research Questions 5-7: To what extent is there a statistically significant difference in spring 2016 to spring 2017 MAP scores of students with teachers indicating they frequently use Carnegie Learning® for** (5) **instructional planning,** (6) **direct instruction in the classroom, and** (7) **assessment of students? The quantitative portion of the study examined the mean spring 2016 (pretest) and mean spring 2017 (posttest) MAP scores of students with teachers indicating they frequently used Carnegie Learning® for instructional planning, direct instruction in the classroom, and assessment of students. Based on the data analysis of the paired sample *t* test, there were four of 30 teachers who *always* and/or *frequently* used the Carnegie Learning® curriculum. For each teacher, the results revealed that there was a significant difference in student pretest and posttest scores resulting in academic growth. A review of the literature indicated that research highly suggests that regardless of the math program implemented, students not only have the opportunity for additional practice but invention as well. When students are allowed the opportunity to invent and discover, they tend to move from factual to conceptual understanding, which increases the depth of complexity for students (Cebulla

& Grouws, 2000). Carnegie Learning® math program allows for multiple ways to solve a problem as well as to develop a solution based in part or whole from the knowledge that has been ascertained through various skills practice. According to Carnegie Learning®, one of the key areas of their math curriculum is the Cognitive Theory. This theory is how students learn, retain, and apply new mathematical knowledge (Carnegie Learning, Inc.®, 2015-16).

The researcher decided to further analyze the teachers who indicated they *sometimes* or *never* used the curriculum. There were 15 teachers who *sometimes* used Carnegie Learning® curriculum. Based on the data analysis of the paired sample *t* test, nine teachers used the curriculum for instructional planning, direct instruction, and assessment and showed a significant difference in student pretest and posttest scores resulting in academic growth. The results revealed that for two teachers (Teachers 5 and 6) who used the curriculum *sometimes*, a significant difference in student pretest to posttest scores was not evident and therefore did not show significant academic growth.

There were six teachers who *sometimes* used Carnegie Learning® for instructional planning and direct instruction. The results revealed that for each teacher, there was a significant difference in student pretest to posttest scores showing academic growth.

There were five teachers who *sometimes* used Carnegie Learning® for only instructional planning. The results revealed that each teacher, except one (Teacher 20), had a significant difference in student pretest to posttest scores showing academic growth.

There were six teachers who *never* used Carnegie Learning® for instructional planning, direct instruction, and assessment. The results revealed that for each teacher,

there was a significant difference in student pretest to posttest scores showing academic growth. Eighty percent of the surveyed teachers used the curriculum for instructional planning; 30% used the curriculum for direct instruction in the classroom; and 30% used the curriculum for assessment.

The results showed that 87% (n=26) of the teachers demonstrated academic growth, whereas 13% (n=4) did not show a significant difference in academic growth. The importance of teacher preparation has been well documented and continues to be a recurring topic of discussion in education across the districts. Based on the literature review, research results from numerous studies along with research methodologies (Cebulla & Grouws, 2000) illustrate the complexity of both teaching and learning math for teachers and students. If we are to provide a well-founded possibility for which student learning can truly grow, schools and teachers must be willing to implement instructional changes and practices that will evoke success and positively impact the instructional needs and learning for students.

Implication for Practice

The findings and results from Research Questions 1-7 assisted in achieving the program goals of Carnegie Learning® curriculum and suggest that instruction needs to be aligned with SCCCR state standards and state testing and policies. It is important that students have the necessary foundational skills in sixth, seventh, and eighth grade math courses in addition to algebra in order to be successful in secondary education, specifically high school and beyond. The findings within the study have several significant implications for assessing the Carnegie Learning® curriculum and illustrate that the program showed a statistically significant difference in student growth. As they relate to the theoretical framework presented, the findings support the three ideas of

Carnegie Learning® curriculum in which one must engage and motivate students to reflect, promote deep conceptual understanding, and provide powerful ongoing assessment. Teachers who used Carnegie Learning® successfully promoted these three powerful ideas, consequently promoting growth in student achievement (Carnegie Learning, Inc.®, 2015-16).

Further, in considering Gagne's (1985) theory in relation to the findings, the evidence supports the idea that using a curriculum-based program such as Carnegie Learning® curriculum allows one to make the necessary changes according to student need and access the nine steps out of order to maximize student achievement. The flexibility of Carnegie Learning® curriculum allows such by allowing teachers to identify objectives, provide practice opportunities where students can recall prior learning, walk students through "guided learning, elicit and assess performance, provide feedback, and enhance retention/transfer" (p. 243).

Based on the literature review, it is important to provide a solid foundation for each middle school student in math (NCTM, 2014b). The results showed that teachers who *always, frequently, sometimes,* or *never* use Carnegie Learning® still had an impact on student achievement. The teachers successfully adhere to and teach the standards for mathematics, when using or not using Carnegie Learning® curriculum. Because Carnegie Learning® was not fully aligned with the state's math standards, teachers were still able to provide students the appropriate foundation so they are ready for algebra.

According to Carnegie Learning® (2014-15), understanding student thinking is the key to effective education. Carnegie Learning® curriculum is based on scientific research as to how students think, learn, and apply new knowledge in mathematics. Based on Gagne (1985) and Cognitive Learning Theory, there is a framework needed to

prepare and deliver content for instruction (Figure 2). The results of the study in Chapter 4 revealed that there was a significant difference impacting student achievement choosing to use or not use the Carnegie Learning® curriculum.

Based on the overall results, the teachers used the state's standards to guide their instruction for planning, direct instruction, and assessment of students. With using Carnegie Learning® curriculum, all teachers who participated in the study used other resources to supplement their instruction for instructional planning, direct instruction, and assessment of students.

Limitations

After reflecting on the research, the researcher acknowledges the presence of limitations within the study. One limitation was the pace of instruction, referring to the time frame a teacher spends on math concepts and skills, relating to mathematics instruction. This limitation varied based on the teacher's pace as well as the needs and academic levels of students across sixth, seventh, and eighth grades. The quality of the teacher influences the academic gains of the students. The study is contingent upon one academic school year 2016-2017. The spring 2016 to spring 2017 MAP data represent a brief time frame but provide a concrete basis for schools and ultimately the district to determine whether additional research is needed for continuing with textbook adoption and resources.

Recommendation for Further Study

Mertler's (2014) nine-step process for action research includes sharing and communicating results as well as the importance of reflecting on the process of the research. This component of research is essential in both written and verbal forms; as a result, the following questions evolved. The researcher wondered if a study that lasted

longer than 1 full academic school year would have produced comparable results and data. The researcher wondered if more teachers and their respective students had participated within the study, would the results show more or less student growth as a whole across the school district or provide a consistent average with presented data from research, further validating the existing research. Across the school district, there were 44 teachers in sixth, seventh, and eighth grades within the five middle schools. There were 14 of 44 teachers who did not participate in this study. The researcher wondered had the student perception of Carnegie Learning® been included, how that would provide another means to compare teacher results with student results.

The researcher suggests providing a study that analyzes data for more than 1 school year if possible in order to establish trends for teacher and student data as a result of implementation across multiple school years. Providing a multi-year study will provide schools and school districts with more consistent data needed in order to make key decisions regarding the successful implementation of Carnegie Learning® curriculum.

The researcher suggests identifying additional supplemental resources teachers may use to support Carnegie Learning® in order to determine if the use of the resources were integral in the yearly gain of students. Identifying additional resources will determine how instrumental Carnegie Learning® curriculum is in promoting student proficiency in mathematics. Additionally, the researcher suggests researching what strategies the teachers used to teach math.

Recommendations for the District

The researcher chose to study the impact of Carnegie Learning® curriculum on student achievement as a result of its importance on developing foundational

mathematics skills for students to matriculate to higher level math in postsecondary education and career fields that involve mathematics. As the school district seeks to create 21st century global learners, an emphasis has been placed on students meeting proficiency in the areas of reading and math. Because of these observations and the research conducted, the researcher recommends that teachers use Carnegie Learning® as a resource because of the academic growth teachers observed using the curriculum *always*, *frequently*, or *sometimes*. Additionally, the researcher recommends that the district determine what additional resources teachers use that coincide with Carnegie Learning® or in lieu of, in cases where academic growth was minimal or not observed for teachers *never* using Carnegie Learning®, in order to continue to meet the needs of students and maximize student achievement. The researcher also recommends that the district explore why teachers indicated they are not using the assessment component and why teachers felt that Carnegie Learning® did not meet the needs of struggling learners.

Reflection

The purpose of this study was to determine the impact of Carnegie Learning® middle school math curriculum on student achievement in Grades 6, 7, and 8. The results of the study revealed that students showed academic growth with teachers using Carnegie Learning® *always, frequently, sometimes,* and *never*. It was evident that teachers provided the instructional framework needed to impact student academic growth choosing to use or not use Carnegie Learning® curriculum. The instructional framework was (a) planning instruction, (b) delivering the planned instruction, and (c) assessing how well students learn or achieve the expectations or outcomes. Based on the results, the null hypothesis was rejected of not having a statistically significant difference. There was strong evidence that using or not using Carnegie Learning® curriculum did lead to

student academic improvement and growth.

The results of the study showed a significant difference in the pretest to posttest MAP scores of students with teachers using Carnegie Learning® program *always*, *frequently*, or *sometimes* for instructional planning, direct instruction, and assessment of students.

Carnegie Learning® is based on cognitive science research. It is scientific research as to how students think, learn, and apply new knowledge in mathematics (Carnegie Learning, Inc.®, 2015-16). One of the key areas of Carnegie Learning® math is the Cognitive Learning Theory, which was founded by Gagne (1985). This is how students learn, retain, and apply new mathematic knowledge.

Additionally, the results of the study showed a significant difference in the pretest to posttest MAP scores of students with teachers using Carnegie Learning® program *never* for instructional planning, direct instruction, and assessment of students. Even though the teachers *never* used the Carnegie Learning® program, it is evident that teachers successfully adhere to and teach the standards for mathematics when not using Carnegie Learning® curriculum.

Conclusion

In conclusion, a mathematics educator's overall goal should be to produce students who have strong foundational skills in mathematics, allowing for proficiency of math for all students, in addition to continued success in higher mathematics courses and career fields that require use of mathematics skills. The seven research questions provided a mixed-method overview that measured the effects of Carnegie Learning® curriculum on student achievement. The school district, having chosen to adopt the Carnegie Learning® curriculum, sought to implement a program that allows for students

to engage as active contributors in the learning process by articulating their knowledge and ideas, creating opportunities for students to succeed and build upon their strengths and collaborate with their peers.

In moving forward, Carnegie Learning® should be considered as resource for teachers to continue to use. The results of the study provide the school leaders valuable information on the extent to which Carnegie Learning® is used across the school district and the impact it had on student math achievement.

References

Achieve. (2016). *2016 Achieve annual report.* Washington, DC: Achieve Inc. Retrieved from https://www.achieve.org/files/2016AchieveAnnualReport.pdf

Ainsworth, L. (2010). *Rigorous curriculum design.* Englewood: Lead + Learn Press.

American Educational Research Association. (2014). *Standards for educational and psychological testing.* Washington, DC: American Educational Research Association.

Balfanz, R., McPartland, J., & Shaw, A. (2002, April). Re-conceptualizing extra help for high school students in a high standards era. *The Journal for Vocational Special Needs Education, 25*(1). Retrieved from http://files.eric.ed.gov/fulltext/EJ903936.pdf

Ball, D. L., & Forzani, F. M. (2011). Building a common core for learning to teach and connecting professional learning practice. *American Educator, 35*(2), 17-21.

Belton, T. (2016). *Math curriculum resources*. Retrieved from http://www.rock-hill.k12.sc.us/Page/2445

Bransford, J. D., Brown, A. L., & Cocking, R. R. (2000). *How people learn: Brain, mind, experience, and school.* Washington, DC: National Academy Press.

Brewter, C., & Fager, J. (2000, October). *Increasing student engagement and motivation: From time-on-task to homework.* Portland, OR: Northwest Regional Educational Laboratory.

Bruner, J. (. (1985). Vygotsky: An historical and conceptual perspective. In J. V. Wertsch, *Culture, communication, and cognition: Vygotskian perspectives* (pp. 21-34). New York, NY: Cambridge University Press.

Burton, L. J., & Mazerolle, S. M. (2011, Jan-Mar). Survey instrument validity part I: Principles of survey instrument development and validation in athletic training education research. *Athletic Training Education Journal, 6*(1), 9.

Carnegie Learning, Inc.®. (2014-15). *Middle school curricula*. Retrieved from http://www.carnegielearning.com/learning-solutions/curricula/middle-school/

Carnegie Learning Inc. ®. (2015-16). *Middle school math solution*. Retrieved from http://resources.carnegielearning.com/textbooks/COURSE3/

Carroll, C. (2007, November). A conceptual framework for implementation fidelity. *Implementation Science*, 1-9. Retrieved from https://implementationscience.biomedcentral.com/track/pdf/10.1186/1748-5908-2-40

Cebulla, K. J., & Grouws, D. A. (2000, December). Improving student achievement in mathematics, part. 1 research findings. *Eric Digest*, 1-4.

Check, J., & Schutt, R. (2012). *Research methods in education.* Thousands Oaks, CA: SAGE Publications, Inc.

Common Core State Standards Initiative. (2016). Retrieved from http://www.corestandards.org/Math/

Cooper, C. E., Crosnoe, R., Suizzo, M. A., & Pituich, K. (2009). Poverty race, and parental involvement during the transition to elementary school. *Journal of Family Issues, 31*(7), 859-883.

Cooperative Learning. (2016, June 24). *Center for teaching*. Retrieved from https://cft.vanderbilt.edu/guides-sub-pages/cooperative-learning/

Creswell, J. W. (2014). *Research design: Qualitative, quanitative, and mixed methods approaches* (4th ed.). Thousand Oaks, CA: SAGE Publication, Inc.

Critical Social Educator. (2016, September). Instructional planning and assessment. Retrieved from https://criticalsocialeducator.files.wordpress.com/2016/09/instructional-planning.pdf

District School Board of Madison County. (n.d.). *What is a "rigorous" curriculum?* Retrieved from http://www.madison.k12.fl.us/?L=1&LMID=817696&PN=Blog&DivisionID=18164&DepartmentID=&SubDepartmentID=&Blog=Permalink&id=8317

Donovan, M. S., & Bransford, J. D. (2005). *How students learn: History, mathematics, and science in the classroom.* Washingtion, DC: National Academics Press.

Eisner, E. W. (2002). *The educational imagination: On the design and evaluation of school programs.* Upper Saddle River, NJ: Prentice Hall.

Explorable. (2016). *Cognitive learning theory*. Retrieved from https://explorable.com/cognitive-learning-theory

Fairfield-Suisun Unified School District. (2016). *Learning targets*. Retrieved from http://www.fsusd.org/Page/8774

Fennell, F. (2006, October). Curriculum focal points for pre-k grade 8 mathematics: A quest for coherence. *Mathematics Teaching in Middle School, 12*(3), 150.

Finkelstein, N., Fong, A., Tiffany-Morales, J., Shields, P., & Huang, M. (2012). College bound in middle school & high school? How math course sequence matter. Retrieved from https://files.eric.ed.gov/fulltext/ED538053.pdf

Foorman, B. R., & Moats, L. C. (2004). Conditions for Sustaining research-based practices in early reading instruction. *Remedial and Special Education, 25*(1), 51-60.

Foorman, B. R., & Schatschneider, C. (2003). Measuring teaching practices in reading/language arts instruction and their relation to student achievement. In S. Vaughn, & K. Briggs, *Reading in the classroom: Systems for oberving teaching and learning.* Baltimore, MD: Brookes Publishing Co.

Gagne, R. (1985). *The conditions of learning and theory of instruction.* New York: Holt, Rinehart & Winston.

Gagne, R. M., Briggs, L. J., & Wager, W. W. (1992). *Principles of instructional design* (4th ed.). Fort Worth, TX: Harcourt Brace Jovanovich College Publishers.

Good, T., & Brophy, J. (1977). *Educational psychology: A realistic approach.* New York: Holt, Rinehart and Winston.

Graham, K. J., & Fennel, F. (2001, October). Principles and standards for school mathematics and teacher education: Preparing and empowering teachers. *School of Science and Mathematics, 101*(6), 319-327.

Great Schools Partnership. (2014). *Assessment*. Retrieved from http://edglossary.org/assessment/

Gresham, F. M., MacMillan, D. L., Beebe-Franken-Berger, M. E., & Bocian, K. M. (2000). Treatment integrity in learning disabilities intervention research: Do we really know how treatments are implemented? *Learning Disabilities Research & Practice, 15*(4), 198-205.

Hedges, L. V., & Nowell, A. (1998). Black-White test score convergence since 1965. In C. Jencks, & M. Phllips, *The Black-White test score gap* (pp. 149-181). Washington, DC: Brookings Institution Press.

Hoover, J. J., & Patton, J. R. (2005). *Curriculum adaptions for students with learning and behavior problems: Differentiating instruction to meet divers needs* (3rd ed.). Austin, TX: Pro-Ed.

Horn, L., & Nunez, A. M. (2000). *Mapping the road to college: First-generation students' math track, planning strategies, and context of support.* U.S. Department of Education. Washington, DC: National Center for Education Statistics.

Hosp, M. K., Hosp, J. L., & Howell, K. W. (2007). *The ABC's of CBM: A practical guide to curriculum-based measurement.* New York: Guilford.

Isman, A. (2011, January). Instructional design in education: New model. *The Turkish Online Journal of Educational Technology, 10*(1). Retrieved from http://files.eric.ed.gov/fulltext/EJ926562.pdf

Jackson, A. W., & Davis, G. A. (2000). *Turning points 2000: Educating adolescents in the 21st century.* New York: Teachers College Press.

Johnson, R. T., & Johnson, D. W. (1986, October). Action research: Cooperative learning in the science classroom. *Science and Children, 24*, 31-32. Retrieved from https://www.researchgate.net/publication/234773546_Action_Research_Cooperative_Learning_in_the_Science_Classroom

Ketterlin-Geller, L. R., & Chard, D. J. (2011). Algebra readiness for students with learning difficulties in grades 4-8: Support through the study of number. *Australian Journal of Learning Disabilities, 16*, 65-78.

Kovaleski, J. F., Gickling, E. E., & Marrow, H. (1999). High versus low implementation of instructional support teams: A case for maintaining program fidelity. *Remedial and Special Education, 20*, 170-183.

Lester, F. K. (2007). *Second handbook of research on mathematics teaching and learnning.* Reston, VA: National Council of Teachers of Mathematics.

Lumsden, L. (1996). Motivating today's students: The same old stuff just doesn't work. *Portaits of Success, 1*(2), 9.

Marzano, R. J., & Simms, J. A. (2014). *Questioning sequences in the classroom.* Bloomington, IN: Marzano Research. Retrieved from http://wres.pasco.k12.fl.us/wp-content/uploads/wres/2016/02/Marzano-Taxonomy_Questions-Stems-Phrases-Products1.pdf

Mayer, R. E. (2002). Rote versus meaningful learning. *Theory into Practice, 41*(4), 226-232.

Mertler, C. A. (2014). *Action research: Improving schools and empowering educators.* Thousands Oaks, CA: SAGE.

Milner, R. H., & Howard, T. C. (2015). *Rac(e)ing to class: Confronting poverty and race in schools and classrooms.* Cambridge: Harvard Education Press.

National Center for Education Statistics. (2016, March 30). *National Assessment of Educational Progress (NAEP)*. Retrieved from http://nces.ed.gov/nationsreportcard/about/

National Center for Learning Disabilities. (2016). *What is RTI?* Retrieved from http://www.rtinetwork.org/learn/what/whatisrti

National Council of Supervisors of Mathematics. (2008). *The PRIME leadership framework: Principles and indicators of mathematics education leaders.* Bloomington, IN: Solution Tree.

National Council of Teachers of Mathematics. (2000). *Principals and standards for school mathematics.* Reston, VA: National Council of Teachers of Mathematics, Inc.

National Council of Teachers of Mathematics. (2009). *Focus in high school mathematics: Reasoning and sense making.* Reston, VA: NCTM.

National Council of Teachers of Mathematics. (2013, October). *Mathematics in early childhood: A position of the national council of teachers of mathematics.* Retrieved from https://www.nctm.org/uploadedFiles/Standards_and_Positions/Position_Statements/Early%20Childhood%20Mathematics%20(2013).pdf

National Council of Teachers of Mathematics. (2014a, December 2014/January 2015). Call for manuscripts: Technology in the math classroom. (M. T. School, Ed.) *National Coucil of Teachers of Mathematics, 20*(5), 319. Retrieved June 15, 2016, from http://www.jstor.org/stable/10.5951/mathteacmiddscho.20.5.0319

National Council of Teachers of Mathematics. (2014b). Effective teaching and learning. In NCTM, *Principles to actions: Ensuring mathematical success for all* (p. 7). Reston, VA: The National Council of Teachers of Mathematics, Inc.

National Council of Teachers of Mathematics. (2015). *Principles to actions: Ensuring mathematical success for all.* Reston, VA: The National Council of Teachers of Mathematics, Inc.

National Governors Association Center for Best Practices and Council of Chief State School Officers. (2010). Common core state standards for mathematics. Common core state standards (college- and career-readiness standards and k-12 standards in english language arts and math). Washington, DC: NGA Center and CCSSO. Retrieved from http://www.corestandards.org

National Mathematics Advisory Panel. (2008). *Foundations for success: The final report of the National Mathematics Advisory Panel.* Washington, DC: U.S. Department of Education. Retrieved from https://www2.ed.gov/about/bdscomm/list/mathpanel/report/final-report.pdf

Nation's Report Card. (2015). *2015 mathematics & reading assessment*. Retrieved from http://www.nationsreportcard.gov/reading_math_2015/#mathematics?grade=4

Nation's Report Card. (2016). *Nine subjects, Three grades, One report card*. Retrieved from http://www.nationsreportcard.gov/

National Research Council. (2012). *Education for Life and Work: Developing transferable knowledge and skills in the 21st century.* Washington: National Academics Press. Retrieved from https://hewlett.org/wp-content/uploads/2016/08/Education_for_Life_and_Work.pdf

Northwest Evaluation Association. (2004, March). Reliability and validity estimates: NWEA achievement level tests and measures of academic progress. Lake Oswego, OR. Retrieved from http://images.pcmac.org/Uploads/Jacksonville117/Jacksonville117/Sites/DocumentsCategories/Documents/Reliability_and_Validity_Estimates.pdf

Northwest Evaluation Association. (2016). *MAP assessments: Our scale and norms*. Retrieved from https://www.nwea.org/assessments/map/scale-and-norms/

Ormrod, J. E. (2008). *Human learning* (5th ed.). Saddle River, NJ: Pearson/Merrill Prentice Hall, Inc.

Pajares, F., & Schunk, D. (2002). Self and self-belief in psychology and education: An historical perspective. In J. Aronson, *Improving academic achievement: Impact of psychological factors on education (Educational Psychology Series).* New York, NY: Academic Press.

Piccolo, D. L., Harbaugh, A. P., Carter, T. A., Capraro, M. M., & Capraro, R. M. (2008). Quality of instruction: Examining discourse in middle school mathematics instruction. *Journal of Advanced Academics, 19*(3), 376-410.

Pressley, M., Wharton-McDonald, R., Allington, R., Block, C. C., & Morrow, L. (1998). *The nature of effective first-grade literacy instruction.* Albany: The National Research on English & Achievement.

Protheroe, N. (2007). What does good math instruction look like. *Principal, 87*(1), 51-54. Retrieved from https://www.andrews.edu/sed/leadership_dept/webinars/presentationdocuments/what_does_good_math_instruction_look_like.pdf

Reys, R., Suydam, M., Lindquist, M., & Smith, N. (1999). *Helping children learn mathematics* (5th ed.). New York: John Wiley and Sons.

SCCCR Standards for Mathematics. (2015). *South Carolina college- and career-ready standards for mathematics, grade 6-8.* Columbia, SC: SC Department of Education.

Secada, W. G. (1989). Agenda setting, enlightened self-interest and equity in mathematics education. *Peabody Journal of Education, 66*(2), 23.

Shellard, E., & Moyer-Packenham, P. (2002). *What principals need to know about teaching math.* Alexandria, VA: National Association of Elementary School Principals/Educational Research Services.

Shier, R. (2004). *Mathematics learning support centre.* Retrieved from http://www.statstutor.ac.uk/resources/uploaded/paired-t-test.pdf

South Carolina Department of Education. (2016). *Standards*. Retrieved from http://ed.sc.gov/instruction/standards-learning/mathematics/standards/

Study.com. (2017). *Direct instruction teaching method: Definition, examples & strategies*. Retrieved from http://study.com/academy/lesson/direct-instruction-teaching-method-definition-examples-strategies.html

Telzrow, C. F., McNamara, K., & Hollinger, C. L. (2000). Fidelity of problem-solving implementation and relationship to student performance. *School Psychology Review, 29*, 443-461.

Totten, S. (1991). *Cooperative learning: A guide to research.* (T. Sills, & A. Digby, Eds.) New York: Garland Science.

U.S. Department of Education. (2010, March). *A blueprint for reform: The reauthorization of the Elementary and Secondary Education Act.* United States Department of Education. Retrieved from https://www2.ed.gov/policy/elsec/leg/blueprint/blueprint.pdf

U.S. Department of Education. (2016a, June 23). *College- and career-ready standards and assessments.* Retrieved from http://www2.ed.gov/policy/elsec/leg/blueprint/faq/college-career.pdf

U.S. Department of Education. (2016b, February 14). *Every student succeeds act (ESSA)*. Retrieved from http://www.ed.gov/essa

Vaughn, S., Hughes, M. T., Schumm, J. S., & Klingner, J. (1998). A collaborative effort to enhance reading and writing instruction in inclusion classrooms. *Learning Disability Quarterly, 21*(1), 57-74.

Vygotsky, L. S. (1978). *Mind in society: Development of higher psychological processes.* Cambridge: Harvard University Press.

What Works Clearinghouse. (2013). *Carnegie learning curricula and cognitive tutor[r]. What works clearinghouse intervention report.* Princeton: Reports-Evaluative. Retrieved from http://www.eric.ed.gov/contentdelivery/servlet/ERICServlet?accno=ED539061

Wiles, J., & Bondi, J. (2007). *Curriculum development: A guide to practice* (7th ed.). Upper Saddle River, NJ: Pearson Education, Inc.

Appendix A

Math Instruction Survey

Math Instruction Survey

Dissertation: A Study of the Implementation of a Middle School Math Program and Student Achievement

This is a mixed method Teacher Survey being conducted to determine to what extent are teachers using the Carnegie Learning math curriculum for school year 2016-17. (*This is last school year.*) Individual responses are kept strictly confidential. Thank you for taking the time to fill out this survey. Your feedback is very important for this research.

The results of this survey will be collected and analyzed in a doctoral study being conducted by Carla White. If you have any questions, please feel free to correspond with the researcher prior to completing the survey. Your participation in this study is completely voluntary.Please complete the survey and submit electronically by Friday, March 30, 2018.

Directions: *For Questions 1-4*, please click on the response that matches your personal experience of the Carnegie Learning curriculum. *For Questions 5-8*, type in your answer and be as detailed as you can. If you answer "Yes" to question 1, you will be prompted to answer the remaining seven questions, which is a total of 8 questions.

If you answer "No" to question 1, you will be prompted to answer only 1 more question, which is a total of two questions. Type in your answer and be as detailed as you can.

<u>For questions 2-4, below is a breakdown of the usage for using the Carnegie Learning Curriculum</u>:
Never **means the teacher does not use Carnegie Learning at all for instructional planning, direct instruction in the classroom, and for assessment of students.**

Sometimes **means the teacher uses Carnegie Learning 50% of the time or less for instructional planning, direct instruction in the classroom, and for assessment of students.**

Frequently **means the teacher uses Carnegie Learning between 50% - 80% of the time for instructional planning, direct instruction in the classroom, and for assessment of students.**

Always **means the teacher uses Carnegie Learning at least 80% of the time for instructional planning, direct instruction in the classroom, and for assessment of students.**

* 1. Did you teach middle school math in School District during the 2016-17 school year?

- ◯ Yes
- ◯ No

* 2. During the 2016-17 school year, how often did you use the Carnegie learning Teacher Edition for instructional planning?

- Never
- Sometimes
- Frequently
- Always

* 3. During the 2016-17 school year, how often did you use the Carnegie instructional materials for direct instruction in your classroom?

- Never
- Sometimes
- Frequently
- Always

* 4. During the 2016-17 school year, how often did you use Carnegie Learning for assessment of your students?

- Never
- Sometimes
- Frequently
- Always

* 5. During the 2016-17 school year, why did choose***to use*** or ***not to use*** the Carnegie Learning Teacher Edition for instructional planning?

* 6. During the 2016-17 school year, why did you choose***to use*** or ***not to use*** the Carnegie Learning instructional materials for direct instruction in your classroom?

* 7. During the 2016-17 school year, why did you choose ***to use*** or ***not to use*** Carnegie Learning for assessment of your students?

* 8. What is your personal opinion of the Carnegie Learning curriculum?

Appendix B

Teacher Online Survey Consent Form

Gardner-Webb University IRB
Informed Consent Form

Title of Study
A Study of the implementation of a Middle School Math Program and Student Achievement

Researcher
Carla White
Doctorial Student at Gardner-Webb University

Purpose
The purpose of the study is to determine the extent (1) teachers are using Carnegie Learning ® for instructional planning; (2) teachers are using Carnegie Learning ® for direct instruction in the classroom; (3) teachers are using Carnegie Learning ® for assessment of students; and (4) to what extent is there a statistically significant difference in the spring 2016 MAP scores to spring 2017 MAP scores of students with teachers indicating that they frequently use Carnegie Learning ® in grades 6^{th}, 7^{th}, and 8^{th}.

Procedure
What you will do in the study:
The participate will receive an online survey called, "Math Instruction Survey" from a Survey Monkey link. There are six questions. Three questions are open-ended answers. The survey should take approximately 5-10 minutes to complete. The survey requires the participant to answer all six questions. The participant can stop the survey at any time if the questions causes discomfort by not submitting the survey. The purpose to the research is to determine to what extent are teachers using the Carnegie Learning ® Math Curriculum for 2016-17 school year.

Time Required
It is anticipated that the study will require about 5-10 *minutes* of your time.

Voluntary Participation
Participation in this study is voluntary. You have the right to withdraw from the research study at any time without penalty. You also have the right to refuse to answer any question(s) for any reason without penalty. If you choose to withdraw, you may request that any of your data which has been collected be destroyed unless it is in a de-identified state.

Confidentiality
The survey will be sent to you from SurveyMonkey.com called, "Math Instruction Survey"; and your survey answers will be sent to a link at SurveyMonkey.com where data will be stored in a password protected electronic format. Survey Monkey does not collect identifying information such as your name, email address, or IP address. Once the study is completed, all data stored in Survey Monkey will be deleted.

Data Linked with Identifying Information
The information that you give in the study will be handled confidentially. Your information will be identified by your school district email address that the researcher uses to assign the survey. The list connecting your name to the school district email address will be kept in a *locked file*. When the study is completed and the data have been analyzed, this list will be destroyed. Your name will not be used in any report.

Anonymous Data
The information that you give in the study will be handled confidentially. Your data will be reported in a way that will not identify you.

Risks
There are no anticipated risks in this study.

Benefits
There are no direct benefits associated with participation in this study. The study may help us to understand the effects of Carnegie Learning ® on student achievement. The Institutional Review Board at Gardner-Webb University has determined that participation in this study poses minimal risk to participants.

Payment
You will receive no payment for participating in the study.

Right to Withdraw From the Study
You have the right to withdraw from the study at any time without penalty. If you choose to withdraw from the study, your data will be destroyed.

How to Withdraw From the Study

- If you want to withdraw from the study after starting the survey, do not click submit and leave the survey. There is no penalty for withdrawing.
- If you would like to withdraw after your materials have been submitted, please contact the researcher, Carla White via email at [redacted].

<u>If you have questions about the study, contact the following individuals.</u>

Carla White
Doctoral Student
Gardner-Webb University
Boiling Springs, NC 28017
[redacted]

Dr. Mary Roth
Doctorial Advisor
Gardner-Webb University
Boiling Springs, NC 28017
[redacted]

If the research design of the study necessitates that its full scope is not explained prior to participation, it will be explained to you after completion of the study. If you have concerns about your rights or how you are being treated, or if you have questions, want more information, or have suggestions, please contact the IRB Institutional Administrator listed below.

Dr. Jeffrey S. Rogers
IRB Institutional Administrator
Gardner-Webb University
Boiling Springs, NC 28017
[redacted]

<u>Voluntary Consent by Participant</u>

I have read the information in this consent form and fully understand the contents of this document. I have had a chance to ask any questions concerning this study and they have been answered for me.

<u>Voluntary Consent by Participant</u>

I have read the information in this consent form and fully understand the contents of this document. I have had a chance to ask any questions concerning this study and they have been answered for me.

_____ I agree to participate in the confidential survey.
_____ I do not agree to participate in the confidential survey.

______________________________________ Date: ________________

Participant Printed Name

______________________________________ Date: ________________

Participant Signature

You will receive a copy of this form for your records.

Appendix C

Request for District Collaboration for Doctoral Candidates

Request for District Collaboration for Doctoral Candidates

The [redacted] School District has set up a means of support for individuals who are seeking doctorate degrees and who agree to develop a dissertation on a topic that is mutually agreeable and beneficial to the individual and District.

To be eligible, a person must:

- have been an employee of the [redacted] School District for at least six months;
- select a topic approved by the District;
- orally present topic to district committee; and
- commit to completion of the data collection and analysis submitted to the District within an allotted time.

Employees who are interested in being considered for this opportunity may complete the form below and submit it and related documents to the Associate Superintendent for Instruction, Dr. Harriet Jaworowski.

Name	White Last	Carla First	Yvette Middle
Address	[redacted] Street	[redacted] City	[redacted] State/Zip
School/Location	[redacted] Middle School		
Current Position	8th Grade Math Teacher		
College/University	Gardner-Webb University		
Doctoral Program of Study/Expected Date of Completion	May 2018		
Suggested Dissertation Topic (Attach the research proposal)	A Study of the Implementation of a Middle School Math Program and Student Achievement		
Expected Completion Date of Data Analysis	April 2018		

By my signature below, I agree to complete the data collection and analysis for my dissertation within 6 months and submit it to the District by May 2018. I also agree to maintain the confidentiality of the data provided to me by the district and will remove personal and school identification from all published work.

Carla Y. White 11/14/17

Signature Date

- -

District Response: Approved ✓ Denied ______

Comments:

Signature Signature Signature 11/14/17

Date

Form created September 2006