Effects of the enVisionMATH Common Core Mathematical Diagnostic Intervention System on Student Achievement in Kindergarten through Fifth Grade

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Abstract

The purpose of this study was to determine to what extent there was a difference in the change of mathematics achievement for students in Kindergarten through fifth grade, as measured by the Measures of Academic Progress (MAP), between students who participated in a mathematics intervention program and those who did not. The study was conducted in a Midwest suburban school district. During the 2013-2014 school year, District XYZ implemented the enVisionMATH Common Core Mathematical Diagnostic Intervention System (MDIS) program.

Mathematic scores from the fall 2013-2014 Mathematics MAP assessment and the spring 2013-2014 Mathematics MAP assessment were used to analyze the growth of at-risk learners participating in the MDIS program as well as the growth of students not participating in the program. Variables such as grade level, gender, and intervention status were investigated. A factorial analysis of variance (ANOVA) was conducted to address the research questions.

Results from the study indicated the MDIS intervention program had a positive effect on student achievement. Specifically, students who participated in the MDIS intervention program had a higher mean growth score than students who did not participate in the intervention.

This study may be utilized by District XYZ to identify any changes that might be necessary in their district's current mathematics intervention program. School districts other than District XYZ may choose to utilize the results from this study as they consider implementing effective intervention programs. Recommendations for future studies include duplicating the study in District XYZ during the second year of the MDIS

intervention program, utilizing the MDIS intervention program as an in-class intervention, and determining which of elementary schools in District XYZ demonstrated the greatest amount of academic growth.

Dedication

The work is dedicated to my incredible wife, Leah. You sacrificed so much for our family as I pursued my goal. Your continual encouragement and support motivated me to keep going, and for that, I am forever thankful. You always assured me it was okay to be away from home during class sessions or to stay up late to work on this study. You did this all while welcoming two beautiful twin boys into this world and keeping our other children safe and in a love-filled home. For those things and many more, I am grateful.

To my wonderful children, Adria, Isaac, Eli, and Owen, I am so excited to be able to spend even more time with you. Completing this study while you were young so that I would not have to miss activities when you are older was a priority of mine. As you become even more involved in evening activities, I am thankful to know my schedule will be less busy now that this study is complete. You all are the reason I strive to be the best I can be in life and at work.

To my parents, thank you for your continued support. During my time between class sessions and working on this study, you consistently provided me with encouragement and support. You also raised me and my siblings in a home that valued education, and for that, I am thankful.

Lastly, this study is dedicated to my former, current, and the future students with whom I will work. I am simply blessed to work in a field with people who want to make positive differences in the lives of children. May the time spent in class sessions and the learnings discovered through this study enhance my leadership for your benefit.

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Chapter One

Introduction

School districts are committed to ensuring that all students learn. Whether students excel academically or demonstrate learning difficulties, educators are given the task of meeting the learning needs of individual learners. A crucial aspect of Kindergarten through twelfth grade (K-12) education is the development of mathematical understanding (Ketterlin-Geller, Chard, & Fien, 2008). Although school districts strive for all students to have a firm understanding of mathematical concepts, many students require mathematical intervention (National Council of Teachers of Mathematics, n.d.).

According to Garnett (1998), "mathematical learning difficulties are common, significant, and worthy of serious instructional attention in both regular and special education classes" (p. 6). Research indicates that approximately 5% to 10% of children in grades K-12 have some difficulty learning mathematics due to a specific learning disability directly related to mathematical abilities (Steedly, Dragoo, Arafeh, & Luke, 2008). Difficulties with mathematics can "affect a student's ability to formulate, represent, and solve math problems" (Steedly, Dragoo, Arafeh, & Luke, 2008, p. 2). Despite the number of students who have been identified with mathematical learning disabilities, K-12 students across the United States continue to struggle in the area of mathematics. Results from the 2013 National Assessment of Educational Progress (NAEP) in mathematics indicated that 58% of students in fourth grade scored below a proficient level. According to the National Center for Education Statistics (NCES) (2012), students who perform at the proficient level have "demonstrated competency" in the assessed subject (NCES, 2012, p. 1).

Background

In accordance with provisions outlined in "two of the nation's most important federal laws relating to the education of children" (Cortilla, 2006, p. 5), the No Child Left Behind (NCLB) Act of 2001 and the Individuals with Disabilities Education Act (IDEA) of 2004, school districts are required to provide interventions for students as early as determined necessary (Berkas & Pattison, 2007). Hanover Research (2014) found that "interventions at the elementary school level are essential to avoiding later difficulties" (p. 11). Bryant (2014) emphasized the importance of including effective instructional practices for early mathematical interventions.

To ensure students are making adequate progress towards mathematical standards, school districts often implement a response to intervention (RtI) support system in their schools. RtI is an intervention system characterized by three tiers. The three tiers include universal screening for all students, a pre-referral intervention for select students, and more intensive and involved interventions for students typically diagnosed with some sort of learning disability (Berkas & Pattison, 2007).

As an option for school districts to adequately address the needs of students, specifically those students who struggle in mathematics, school districts may choose to implement a mathematics intervention program for struggling learners. Due to the importance of a strong mathematics intervention program, school districts must view the choice of the intervention program as critical. When making the important decision of selecting an intervention program, school districts should consider a program that meets their particular needs (Hanover Research, 2014).

More than six million elementary-aged students nationwide learn mathematics through the enVisionMATH Math program (Pearson, 2013). Published by Pearson Education, Inc., enVisionMATH Common Core is a mathematics curriculum designed for Kindergarten through sixth grade students. enVisionMATH Common Core is noted for providing differentiated learning opportunities for all students and incorporating a variety of instructional strategies that have the potential to impact positively mathematic achievement for students (Pearson, 2013). To provide exceptional learning opportunities, enVisionMath Common Core's daily lessons are divided into a daily review, a problem-solving activity to be completed in small groups, individual practice problems, and a guided lesson component. The mathematics program utilizes a variety of assessments to ensure student learning occurs. Curriculum for each grade level includes 120 to 130 lessons (Pearson Education, 2013).

One component of the enVisionMATH Common Core Program is the MDIS resource. Although designed to be implemented by the classroom teacher, District XYZ utilizes the MDIS intervention program taught outside of regular mathematics classroom instruction. The intervention is provided to students who demonstrate a need for instructional mathematics support based on a mathematical topic pre-assessment. A mathematic interventionist is responsible for implementing, leading, and teaching the intervention program with those students who qualify. Mathematics interventionists in District XYZ collaborate and receive monthly professional development during the school year. These monthly professional development sessions are led by the district mathematics coordinator.

During the 2013-2014 school year, District XYZ implemented the enVisionMATH Common Core curriculum for all students in Kindergarten through fifth grade. During the 2014-2015 school year, District XYZ was in its second year of utilizing the enVisionMATH Common Core curriculum and resources. Additionally, during the 2013-2014 school year, District XYZ also implemented the MDIS program as an out-of-class intervention. Students are referred to the MDIS mathematics intervention program based on results from a unit pre-assessment. The MDIS material is aligned with the mathematics curriculum the student is receiving in class. Students are pre-assessed for each unit and participate in the intervention program only when meeting a pre-determined criteria based on the pre-assessment (Pearson Education, 2011).

District XYZ is located in a large metropolitan area in the Midwest and is one of the area's larger school districts. According to the 2012-2013 State Department of Education Report Card, the district's five high schools, nine middle schools, 20 elementary schools, and one alternative high school hosted 21,967 students (KSDE, 2012-2013).

Table 1 includes a description of the demographics of District XYZ. The information was obtained from the 2012-2013 State Report Card data. At the time of the study, the 2012-2013 demographic data was the most current available. Specific demographics were selected to provide a demographic description of District XYZ.

Table 1

Selected Demographics of District XYZ

Demographic	Percent of Students in District XYZ	Percent of Students in State
ELL Students	1.1	8.3
Non-ELL Students	98.9	91.7
Male Students	51.3	51.5
Female Students	48.7	48.5
Students with Disabilities	9.3	13.7
Students without Disabilities	90.7	86.3

Note. Adapted from KSDE 2012-2013 State Report Card for District XYZ.

Statement of the Problem

District XYZ is dedicated to providing an exceptional learning experience for all students. Additionally, all school districts face the challenge of ensuring all students learn mathematics. At times, school districts may choose to utilize a mathematics intervention with students who are not demonstrating mathematical understanding. During the 2013-2014 school year, the district implemented a new mathematics curriculum and mathematics intervention program. To ensure the school district is making gains towards its commitment of an exceptional learning experience for all students, district leaders need to ascertain whether the implemented intervention program has improved student achievement. Currently, there is no research on the effectiveness of the MDIS program.

Purpose of the Study

The purpose of this study was to identify the extent of impact the MDIS program had on student achievement as measured by the Mathematics MAP assessment. The study was focused on student achievement scores for students in Kindergarten through fifth grade. Assessment data from students who participated in the MDIS program, as well as students who did not participate, were analyzed. The purpose of the study was to gain an understanding of whether District XYZ has implemented an appropriate and positively impactful intervention program.

Significance of the Study

The significance of this study is critical as all school districts face the obstacles of meeting the needs of individual learners. The results and suggestions of this study may be considered by District XYZ, as well as other school districts that implement the MDIS intervention program. Results from the study could be utilized by school district administrators to determine whether the MDIS program has a positive impact on student learning. Results from the study may assist in the establishment of a stronger K-5 mathematics intervention program in District XYZ. District staff from school districts other than District XYZ may benefit from the study as they will be able to determine whether the MDIS program could meet their students' needs. Other school districts may also benefit from the study as they will be able to use the study as a basis for assessing their current intervention program. This study also contributes to the understanding of ways the MDIS intervention program impacts student learning.

Delimitations

Lunenburg and Irby (2008) stated that a study is intentionally delimited by the researcher as deemed necessary in accordance to the purpose of the research. This study is delimited in that it was focused solely on District XYZ. A second delimitation was the restriction of data collection to the elementary school setting. Results from the study may not generalize to levels other than elementary grade levels. A third delimitation is the manner in which District XYZ utilized the MDIS intervention program. A final delimitation was that only MAP assessment results were used to determine the impact of the mathematics intervention program.

Assumptions

According to Lunenburg and Irby (2008), assumptions are “postulates, premises, and propositions that are accepted as operational for purposes of the research” (Lunenburg & Irby, 2008, p. 135). This study included the following assumptions: (a) the mathematics interventionists at each elementary school utilized the mathematics intervention resources as directed by the school district; (b) all elementary schools utilized the same criteria for identifying students to participate in mathematic interventions; (c) the involved schools administered the MAP assessment according to district expectations; and (d) students taking the MAP assessments only were given testing accommodations as per district guidelines.

Research Questions

The following research questions guided the study:

RQ1. To what extent was there a difference in the change in mathematics achievement for students in Kindergarten through fifth grade, as measured by the MAP, between students who participated in the enVisionMATH Common Core MDIS intervention program and those who did not?

RQ2. To what extent is there a difference in the change in Kindergarten through fifth grade students' mathematics achievement, as measured by the MAP, among grade levels for students who participated in the enVisionMATH Common Core MDIS intervention program?

RQ3. To what extent was the change in student mathematics achievement, as measured by the MAP, different for males and females who participated in the enVisionMATH Common Core MDIS intervention program?

Definition of Terms

Definitions for this quantitative study are as follows:

Intervention. The New York State of Education (NYSED, 2008) defines academic interventions as services "intended to assist students who are at risk of not achieving the state learning standards in English language arts, mathematics" (NYSED, 2008, p. 2). Although interventions vary in intensity and the manner in which they occur, the current study refers to mathematics intervention as additional time students receive support in mathematics.

Mathematical Diagnostic Intervention System (MDIS). The MDIS is a mathematics intervention program as part of the enVisionMATH Common Core mathematics curriculum. MDIS was created as a mathematics intervention program to be utilized by the classroom teacher; however, District XYZ utilizes MDIS as a pull-out intervention program (Pearson, 2011).

Overview of the Methodology

This non-experimental quantitative study was based on MAP assessment results from Kindergarten to fifth grade students within District XYZ, a suburban school district in Kansas. Data from the MAP assessment from students involved and not involved in the MDIS intervention program were analyzed. Data from all elementary students in District XYZ were used. Data were requested and obtained from the Director of Assessment and Research in District XYZ. The data collection method was approved by the Baker University Institutional Review Board, as well as District XYZ. A factorial analysis of variance (ANOVA) was conducted to address all research questions.

Organization of the Study

This study is organized in five chapters. Chapter one included the background, statement of problem, purpose of study, significance of study, delimitations, assumptions, research questions, definition of terms, overview of the methods, and the organization of study. Chapter two is a review of the literature. The review of literature includes background information on mathematical interventions, the three tiers of Responsiveness-to-Intervention (RtI), and the enVisionMATH Common Core curriculum resource. Provided in chapter three is information on the methodology used for this non-experimental study. The chapter includes the research design, population and sample, sampling procedures, instrumentation used, including its measurement and reliability, and validity, as well as information on the validity and reliability of the instrumentation, data collection procedures, data analysis and hypothesis testing, and the limitations of the research. Chapter four includes descriptive statistics and results of hypothesis testing. Chapter five is a summary of the quantitative study. Included in chapter five are data interpretations and recommendations, an overview of the problem, the purpose statement and research questions, a review of the study methodology, connections to the literature, and recommendations for future research.

Chapter Two

Review of Literature

Approximately 5% to 10% of school-aged children demonstrate some sort of mathematics disability (Bryant, Bryant, Gersten, Scammacca & Chavez, 2008). These disabilities can negatively affect a student's ability to work through mathematics problems (Steedly et al., 2008). In addition to students who have a diagnosed mathematics disability, many students may achieve lower than typical peers and require a mathematical intervention. In order for school districts to provide an exceptional learning experience for all students, they must address potential math deficits. Bryant et al. (2008) stated that without early identification for the need of an intervention, the intervention itself, and continual progress monitoring "many young students with mathematics difficulties may not develop a level of mathematics automaticity that is necessary for becoming proficient in mathematics" (p. 1). Mathematical automaticity occurs when one can perform a particular skill without much thought of the operation (Axtell, McCallum & Bell, 2009).

The purpose of this literature review is to examine previous studies related to the research topic. The first section provides the reader with a history of mathematical interventions. The second section examines information relative to the three tiers of Responsiveness-to-Intervention (RtI). The third section focuses on the enVisionMATH Common Core curriculum resource.

History of Mathematical Interventions

The first public school in the United States was founded in Boston, Massachusetts, on April 23, 1635 (Boston Latin School, n.d.). During the first 300 years of public education, mathematicians had limited impact on the development of mathematical school curriculum (Hayden, 1981). Although the National Council of Teachers of Mathematics (NCTM) was founded in 1920 (Klein, 2003), it was not until the 1950s that mathematicians and curriculum leaders "felt the impact of centuries of accumulated growth in mathematics" (Hayden, 1981, p. 5). Hayden (1981) wrote that during this time the field of mathematics in public education saw a "sudden acceleration in the rate of change of the school mathematics curriculum" (p. 5). Since the 1950s, the identification and definition of mathematical deficits and mathematical difficulties have evolved.

In the 1950s and 1960s, the field of mathematics experienced a variety of federally-funded research and training initiatives. Specifically in 1950, the United States Congress formed the National Science Foundation (NSF). The NSF's role was to create policies in mathematics education (Thaler, 2013).

Several events during the 1950s, including the creation of atomic weapons as well as the launching of a Soviet satellite, drove the U.S.'s increased interest in mathematics. Although there was a strong presence of research in public education during that time, the study of learning disabilities, specifically in mathematics, was not yet considered. In the 1960s, definitions of learning disabilities began to recognize and accept arithmetic disorders as part of a defined disability. Although research in the 1960s was limited, it was concluded that slow learners require specific instructional goals due to the fact that the amount of mastered information over a period of time would be less for the slow learner than for a typical student (Woodward, 2004).

The 1950s through the 1970s are commonly referred to as “modern mathematics or new math” (Thaler, 2013, p. 15). “New math” focused on “language and properties, proof, and abstraction” (Burris, 2014, p.1). The “new math” period is credited as the first time that mathematicians provided significant input to mathematics curriculum in public schools (Klein, 2003). One of the first major projects of the “new math” era was led by Max Beberman. Klein (2003) reported that in 1951, Beberman was the leader of The University of Illinois Committee on School Mathematics. His committee was funded by the Carnegie Corporation and the U.S. Office of Education whose purpose was to publish mathematical textbooks. Later, in 1955, the College Entrance Examination Board created a Commission on Mathematics. According to Klein (2003) the purpose of this Commission was to look at the “mathematics needs of today’s American youth” (Klein, 2003, para. 19). High school teachers, mathematicians, and mathematics teachers worked collectively in preparing a document that recommended a mathematics curriculum designed to prepare high school students for college (Klein, 2003).

As Klein (2003) described, the curriculum recommendation movement influenced by Beberman prompted other organizations with an emphasis in mathematics to set up their own committees. In 1958 the American Mathematical Society created the School Mathematics Study Group to design new high school mathematics curriculum. Later, in 1959, NCTM formed the Secondary School Curriculum Committee, which, similar to other organizations, set forth to provide recommendations for math curriculum (Klein, 2003). The “new math” movement resulted in an unprecedented curriculum change in the history of the United States (Hayden, 1981). During this time, there were academic advocates who urged educational leaders to focus on a more traditional curriculum, while others advocated moving forward with the reform (Hayden, 1981).

Interventions for students who had difficulty learning mathematical concepts and for students who had learning disabilities were just coming into existence during the "new math" movement. During the "new math" period, schools used intervention strategies that included "visual-motor perceptual training" and "task analysis" (Woodward, 2004, p. 18). According to Woodward (2004) interventions during the "new math" movement also included the use of "manipulatives, pictorial representations, and conceivably, the student's cultural or ethnic background" (p. 18). Targeted instruction, such as focusing on one particular mathematical concept, also was practiced during the "new math" period. At the time, school leaders deemed it more beneficial for slow learners to focus on fewer skills than typical learners as it would take more time for those students to learn the targeted skills (Woodward, 2004).

Although the "new math" movement gained tremendous momentum in the 1950s and 1960s, by the 1970s, it was no longer funded by NSF and eventually faltered (Klein, 2003). The 1970s were met with uncertainty and a desire to move back to the basics of mathematics education (Klein, 2003). According to Klein (2003), in the 1970s, many states "created minimum competency tests in basic skills" and "standardized test scores steadily decreased and bottomed out in the early 1980s" (Klein, 2003, para 37).

The early 1980s began with recognition that the quality of mathematics and science education in the country had diminished (Klein, 2003). A call for going back to the basics arose in the late 1970s and early 1980s. The Back to the Basics movement focused on "arithmetic computation and rote memorization of algorithms and basic arithmetic facts" (Burris, 2014, p. 1). As reported by Klein (2003), *An Agenda for Action* and *A Nation at Risk* were two key educational reports that were part of the 1980s movement to revise mathematics curriculum. In its publication Agenda for Action, which was released in 1980, the National Council of Teachers of Mathematics (NCTM) called for the implementation of more mathematical skills (Thaler, 2013). The recommendations set forth in the *Agenda for Action* (NCTM, 1980) publication included the following:

- A focus on problem solving
- Broader focus on basic mathematic skills
- Greater utilization of calculators and computers
- More rigorous standards on the teaching of mathematics
- More comprehensive evaluation of mathematics programs
- Greater requirement for students to study mathematics
- Higher level of professionalism for mathematic teachers
- Greater amount of public support for mathematics

The second report detailing the state of mathematics education was Terrell Bell's 1983 report *A Nation At Risk*. At the time the report was released, Bell served as the U.S. Secretary of Education (Klein, 2003). Bell's to-the-point document garnered the attention of readers. As reported by Klein (2003), in his report, Bell emphasized these points:

- The U.S. educational system had deteriorated.
- Public colleges saw a 72 percent increase in corrective mathematics courses between 1975 and 1980.

- Leaders in the business and military fields were spending millions of dollars on corrective education in reading, computation, writing, and spelling.
- In 1981, 43 out of 45 surveyed states indicated a shortage in mathematical teachers.
- In 1981, 33 out of 45 surveyed states indicated a critical shortage in earth science teachers.
- Textbooks were not rigorous enough. (para 41)

Bell's report prompted numerous newspaper articles throughout the United States. More importantly, many states created committees and commissions to address the recommendations as outlined in *A Nation at Risk* (Klein, 2003).

In 1989, NCTM released recommendations for new mathematical teaching standards. The NCTM Standards focused on "problem solving, communication, connections, and reasonings" (Burris, 2014, p. 1). In spite of the 1989 NCTM Standards and the universal encouragement for stronger, more rigorous mathematics gaining momentum, the Standards neglected to put much emphasis on ways the new curricular changes would impact students with disabilities (Woodward, 2004).

While there were changes and advancements in mathematical education during the 1970s and 1980s, such as the NCTM standards, considerations for students with mathematical learning difficulties continued to lag behind. In light of the new changes, special education teachers in the 1980s were now called upon to focus on systematic skills instruction and to align those skills with the new curricular demands. During this time of uncertainty, special education teachers focused on concerns with mathematics facts and mental addition (Woodward, 2004). According to Woodward (2004), educational researchers were "more interested in the application of strategy instruction, direct instruction, or curriculum-based measurement as a generalized intervention framework for students with LD than in a detailed analysis of mathematical topics" (p. 20). During this time period, instructional strategies, including those within interventions, also focused on teaching students direct instruction, identifying ways to look for key words or numbers in word problems, and attaining mathematics fact fluency (Woodward, 2004).

During the 1990s, there was a significant increase in mathematics research (Woodward, 2004). Woodward (2004) writes, "Mathematics research conducted within the United States moved from a cognitive and information processing framework to a constructivist orientation" (p. 22). During this time researchers were attempting to determine how learning occurs. Because of this, the major reform focus was now the impact of teaching pedagogy (Burris, 2014).

During the 1990s, states were also encouraged, through grants, to align their state-specific mathematical standards to those outlined in the NCTM standards (Klein, 2003). Klein (2003) writes, "The blueprint for change in mathematics would be the NCTM Standards" (Klein, 2003, para 58). Although the NCTM standards set forth a more aligned national mathematics program, special education teachers and those entrusted with providing interventions for students not making gains in the classroom were concerned with the challenge of more demanding standards for students with mathematical learning difficulties. There was little mention of how the NCTM standards would impact students in need of interventions. With the outcome of the NCTM standards, special education teachers and interventionists focused on systematic skills (Woodward, 2004).

Continuing with their leadership in establishing mathematical curriculum standards, in 2000 NCTM published *Principles and Standards for School Mathematics* (Comparing the Common Core State Standards, 2010). According to NCTM (n.d.), *Principles and Standards for School Mathematics* "outlines the essential components of a high-quality school mathematics program. NCTM's document called for and presented a common foundation of mathematics to be learned by all students" (NCTM, n.d., p. 1). *Principles and Standards for School Mathematics* was designed to provide mathematical learning goals for students from pre-Kindergarten through twelfth grade, give educational leaders and policymakers a framework as they considered improving mathematical programs, assist with the establishment of curriculum and assessments, and prompt conversations amongst a variety of educational and non-educational groups about ways to best help students understand mathematical concepts (NCTM, n.d.).

By the start of the 21st century all states had developed their own educational standards identifying concepts students in third through eighth grade and high school should know (Development Process, n.d.). One of the concerns for each state having its own mathematical learning standards was that each state also had its own definition of proficiency. Proficiency was defined as "the level at which a student is determined to be sufficiently educated at each grade level and upon graduation" (Development Process, n.d., para. 2). The lack of consistency across state standards was one factor that led many states to develop and adopt the Common Core State Standards (Development Process, n.d.).

The Common Core State Standards were developed in 2010 by chief academic officers and governors from 48 states. Similar to the development of previous standards, NCTM played a significant role in the development of the Common Core State Standards (Making it Happen, 2010). The Common Core standards are a "set of clear college and career-ready standards for Kindergarten through 12th grade in English language arts/literacy and mathematics" (Common Core State Standards Initiative, n.d., p. 1). J. Michael Shaughnessy (2010), president, NCTM, states the standards were developed to:

> Provide more clarity on what students are expected to learn, in an effort to make education more consistent across states in our nation and to guide teachers and parents in preparing students for the challenges of the workplace or postsecondary study. (Making it Happen, 2010, p. vii)

How Elementary Students Learn Mathematics

Since the early 1900s researchers have been investigating how children learn mathematics (Geary, 2006). The same topics which were studied in the 1900s are the same topics being investigated today. Topics such as speed and accuracy, the use of strategies to solve mathematical problems, and how students learn algebra and geometry are some of the mathematical concepts that have been studied throughout the years (Geary, 2006). Referencing two significantly relevant mathematical based reports, Math Solutions, which was founded by mathematical expert Marilyn Burns, identified key principles educators should include as they teach students how to learn mathematics (Math Solutions, n.d.). Math Solutions is an organization that is "dedicated to improving children's learning of mathematics by providing the highest quality professional development services, products and resources to educators" (Math Solutions, n.d., p. 2).

The first report Math Solutions referenced for their findings on how students learn mathematics was National Research Council's (NRC) 2005 report, "How Students Learn Mathematics in the Classroom." The NRC is part of a group of "private nonprofit institutions that provide expert advice on some of the most pressing challenges facing the nation and the world" (The National Academies, p. 1, n.d.). The purpose of NRC's 2005 report was to use "research on cognition, teaching, and learning to provide answers to the questions that are confronted in classrooms in ways that be used immediately by teachers and teacher leaders" (NRC, 2012, p. 1). In referencing NRC's report, Math Solutions determined students learn mathematics best when educators engage students with prior learnings and misunderstandings, focus on strong foundational fact based learnings and conceptual frameworks, and helping students understand and self-monitor the thinking behind solving mathematical problems (Math Solutions, n.d.). Math Solutions confirmed the principles as summarized in "How Students Learn Mathematics in the Classroom" in a reference to NCTMs 2000 report titled *Principles and Standards Report for School Mathematics.* The *Principles and Standards for School Mathematics* report is a "comprehensive and coherent set of mathematics standards for all students from pre-Kindergarten through grade 12" (NCTM, n.d., p. 1). As referenced by Math Solutions (n.d.), in its report, and similar to those ideas later outlined in "How Students Learn Mathematics in the Classroom," NCTM reported students learn math best when they are able to use experience and prior knowledge to build new learnings, have a strong sense of conceptual understanding, and when they are able to reflect on their understandings and learn from the misunderstandings (Math Solutions, n.d.).

Gender Differences in Mathematics Performance

The study of gender differences in abilities has been investigated since the 1880s (Hyde & Mertz, 2009). Early research on mathematical differences sometimes revealed a stronger performance by male students, while other studies revealed a stronger performance by female students. However, some researchers began to find the differences to be minimal or statistically irrelevant. Levi (2000) wrote that research centered on gender differences in mathematics performance reveal Kindergarten through twelfth grade male and female students score similar results on standardized texts. Lindberg, Hyde, Petersen, and Linn (2010) wrote, “research showed that gender differences in mathematics performance were very small and, depending on the sample and outcome measure, sometimes favored boys and sometimes favored girls” (p. 1). Since then researchers have published a variety of findings which subsequently have provided others with the ability to conduct meta-analysis studies. A consistent finding from the meta-analysis studies is that there is little to no gender differences for elementary students. During the NCLB era, all states were required to administer annual assessments. A meta-analysis of over 7 million students indicated no gender differences in mathematical assessment scores between male and female students in second through eleventh grade (Hyde, Lindberg, Linn, Ellis, & Williams, 2008).

A meta-analysis study conducted by Lindberg, Hyde, Petersen, and Linn (2010) confirmed the lack of differences between male and female performance in mathematics. Seeking to understand whether or not gender difference existed in mathematics performance, Lindberg et al. performed two meta-analysis studies. The first meta-analysis reviewed research that was published between 1990 and 2007. The 242 studies included statistical information from 1,286,350 people (Lindberg et al., 2010). The meta-analysis from these studies reviewed there was no gender differences in mathematics performance.

Response to Intervention

While writing for NCTM, Berkas and Pattison (2007) describe intervention as "teaching and learning and the opportunity to learn" (p. 1). While school systems employ a variety of methods for providing interventions for students with significant mathematical deficits, NCTM has given guidance on critical components to consider when creating or selecting mathematical intervention programs. NCTM (n.d.) defines an intervention program as a "structured plan for providing instructional materials and activities to support students' learning during class time, in programs before or after school, and for use by providers of supplemental services" (p. 1). NCTM (n.d.) views intervention programs as a three-phase cycle: diagnostic assessment, instructional actions, and follow-up assessment. Within the diagnostic assessment phase, the student takes a brief and specific assessment aligned with a precise component of mathematics. The instructional actions phase identifies the manner in which the school system chooses to provide instructional opportunities for the student based on the diagnostic system. This can take place in a one-on-one setting, as a whole class, during the school day, or in whatever method deemed appropriate by the school. During the follow-up assessment phase, the student takes another targeted assessment that provides feedback on the extent to which the instructional actions enhanced the student's learning (NCTM, n.d.).

As some students may have difficulty learning the curriculum from only the classroom teacher, interventions must be put in place to ensure those students learn the curriculum. Berkas and Pattison (2009) credit the No Child Left Behind Act of 2001 and the Individuals with Disabilities Education Act (IDEA) of 2004 with ensuring that school districts provide adequate support for students who demonstrate difficulties in learning. Following IDEA, states and school districts began to further utilize an intervention system known as Responsiveness-to-Intervention (RtI) (Berkas & Pattison, 2007, Institute of Education Science (IES), 2009). A panel working with the IES defined RtI as "an early detection, prevention, and support system that identifies struggling students and assists them before they fall behind" (IES, 2009, p. 4). VanDerHeyden (n.d.) writes that RtI "has become a vehicle for system reform" (p. 1). VanDerHeyden (n.d.) credits the positive impact of RtI due to the data framework that is utilized for making instructional decisions and the distribution of resources to reach as many students as possible.

Hughes and Dexter (2011) confirmed the impact RtI programs have on student achievement with a meta-analysis. As part of their research Hughes and Dexter reviewed 13 previously published studies. The studies were based on intervention programs that utilized RtI. Hughes and Dexter determined all 13 studies reported the RtI program had some level of positive impact on student learning (Hughes & Dexter, 2011).

The core of an effective RtI program is through key components such as the screening of all students to identify those students in need of an intervention, interventions that are utilized with fidelity, and ongoing student progress monitoring (Bryant, 2014). The National Association of Elementary School Principals (NAESP) proposed that effective RtI programs include: a system for screening and monitoring student achievement, an intervention system that focuses on core mathematical concepts, and a system the merges exceptional instruction with effective and meaningful data collection for all students (NAESP, 2011). The assessments and universal screening allows schools more readily to identify potential learning difficulties, so staff members can respond accordingly. Students who demonstrate a potential learning difficulty are provided with targeted interventions. According to the IES, students respond to these targeted interventions in three different ways: (1) no longer needing the intervention, (2) demonstrating a need to remain in the intervention, or (3) needing a more intensive intervention (IES, 2009). The three distinct levels of intervention are commonly referred to as “tiers” (IES, 2009).

Fuchs and Fuchs (2001) describe Tier 1 as “instruction for all students is formulated to incorporate principles that address the needs of specialized populations while benefiting (or at least not harming) others” (p. 85). Tier 1 provides classroom teachers with the opportunity to assess students, so struggling learners can receive timely intervention (IES, 2009). Bryant et al. (2008) states that “Tier 1 consists of evidence-based core instruction for all students” (p. 1).

Tier 2 interventions are designed for students who, based on the initial screening or pre-assessment, demonstrate difficulties or potential for learning difficulties. Students involved in Tier 2 also may attend the interventions when they perform below their classmates (VanDerHeyden, n.d.). The Tier 2 intervention generally takes place in a small group setting outside the classroom and targets specific skills. Rather than a completely new curriculum resource, Tier 2 interventions usually employ a modified version of the general education curriculum (Fuchs & Fuchs, 2001). Tier 2 intervention materials typically are designed to meet the needs of a particular group of learners (VanDerHeyden, n.d.). Tier 2 interventions traditionally occur for 20 to 40 minutes for 4 to 5 days each week (IES, 2009). The National Center on Response to Intervention (NCRTI) identified three characteristics of Tier 2 interventions. Members of NCRTI propose that Tier 2 interventions should be: (1) based on evidence, (2) involve small-group instruction, and (3) implemented as intended (Johnson, n.d.). Additionally, Fuchs (n.d.) proposes that mathematical interventions at Tier 2 must contain the following six instructional principles:

1. Explicit instruction: Interventionists share information with the student;
2. Design of the instruction that simplifies learning: Interventionists anticipate student difficulties and provide strategically sequential instruction;
3. Development of a strong understanding of mathematical procedures: Emphasis is on students learning mathematical procedure;
4. Drill and practice: Students engage in a daily review of learned materials;
5. All-encompassing review aligned with drill and practice: Interventionists continually revisiting the foundational skills being taught;
6. Motivational tools to keep students aware of their attention and work ethic: Lower-achieving students are provided an opportunity to monitor their work through motivators. (p. 1)

Tier 3 intervention refers to an intervention that typically is reserved for specific learning disabilities. This tier provides students with "intensive, individualized instruction using specialized resources to alleviate very specific learning difficulties" (Berkas & Pattison, 2007, p. 1). Students are involved in Tier 3 interventions when their "performances were below that of their classmates and in the risk range at screening, and for whom subsequent assessment shows extensive skill gaps" (VanDerHeyden, n.d., p.

4). Due to the specificity of the intervention, Tier 3 interventions may require highly intensive intervention with additional pull-out time, curriculum adaption, and materials different from the core curriculum resources (Bryant, et al. 2008). Typically, Tier 3 interventions are interventions to support students who show little to no benefit from Tier 1 and Tier 2 interventions. Due to the specialization of Tier 3 interventions, generally special education teachers and school psychologists are involved in the process and, in some cases, provide the services (IES, 2009).

NAESP (2011) writes, "The first step in RtI is universal student screening, so schools systematically can identify those at risk for math difficulties" (p. 3). In addition to the assessments that take place in the classroom, NAESP recommends twice-a-year screening. To identify and provide intervention services in an optimal timeframe, NAESP recommends students receive assessment screening at the beginning and middle of the school year (NAESP, 2011). Although twice-a-year universal screening provides valuable data, the leaders at NAESP also recommend monitoring individual progress on a regular basis. NAESP (2011) suggests using "grade-appropriate general outcome measures to monitor the progress of students receiving Tier 2 and Tier 3 interventions" (p. 3).

enVisionMATH Common Core Curriculum

Published by Pearson Education, the enVisionMATH Common Core is a core curriculum mathematics program and is Pearson's most recent resource within their enVisionMATH Common Core curriculum series. The enVisionMATH Common Core resources have been well received by school districts wanting to become more aligned with the Common Core (enVisionMATH Common Core, 2013). Nationwide, the enVisionMATH Common Core is utilized by more than six million students (Department of Education What Works Clearinghouse, 2013). The enVisionMATH Common Core program is noted for its “problem-based instruction, small-group interaction, and visual learning with a focus on reasoning and modeling” (enVisionMATH Common Core, 2013, p. 1). The program design provides differentiated learning opportunities and utilizes a variety of assessments to support student learning (enVisionMATH Common Core Math, 2013).

Teachers are also provided with the enVisionMATH Common Core Mathematical Diagnosis and Intervention System (MDIS) resource. Pearson Education created the MDIS resource for use by classroom teachers. This system employs three levels of intervention: Ongoing Intervention throughout the lesson; Strategic Intervention that occurs at the end of each lesson; and Intensive Intervention that occurs at the end of each topic (Pearson Education, 2011). Although Pearson Education created the intervention program to be utilized by the classroom teacher, District XYZ has chosen to utilize the MDIS lesson plans during pull-out interventions. The MDIS program contains several intervention program traits as recommended by NAESP. NAESP (n.d.) writes, “Intervention instruction should be explicit and systematic, incorporating models of proficient problem solving, verbalization of thought processes, guided practice, corrective feedback, and frequent cumulative review” (NAESP, n.d., p. 6).

Multiple studies have demonstrated the impact the enVisionMATH Common Core curriculum resource may have on student achievement. As the MDIS intervention program is part of a resource from within the enVisionMATH Common Core program, the findings are relevant for the study. One study that investigated the impact the enVisionMath curriculum, and its resources, have on student learning was conducted by IES. The IES (2013) study sought to gain an understanding of the extent of impact curriculums have on student learning as measured by the mathematics assessment from the Childhood Longitudinal Study-Kindergarten (ECLS-K) Class of 1998-1999 study. The report was published in September 2013 after two years of research. The four curriculum materials involved in the study are Investigations in Number, Data, and Space (Investigations); Math Expressions; Saxon Math; and Scott Foresman-Addison Wesley Mathematics (SFAW), which was renamed enVision Math (enVisionMATH) during the study (IES, 2013).

During the study's first year, 111 schools from 12 school districts participated in the study. Of the 111 schools that participated in the first year, 58 agreed to continue the study for a second year. While the schools were spread out across the United States and represented a variety of urban settings, the schools that participated did have a higher percentage of students who were eligible for free or reduced-price meals than the national average. The IES study utilized students in 1st and 2nd grade (IES, 2013).

The ECLS-K assessment is an "individually administered, adaptive, and nationally normed test that measures student achievement both within and across grades and meets accepted standards of validity and reliability" (IES, 2013, p. 6). Participants in the ECLS-K assessment answer open-ended questions, as well as multiple choice questions (IES, 2013). According to IES (2013), the assessment looks at five areas of mathematical understanding: "(1) number sense, properties, and operations; (2) measurement; (3) geometry and spatial sense; (4) data analysis, statistics, and probability; and (5) patterns, algebra, and functions" (p. 6).

Table 2 provides a summary of the ECLS-K Math Scores for the four different mathematics programs after two years of use. The results of the study indicate that students utilizing Math Expressions, Saxon Math, and enVisionMath demonstrated stronger mathematics achievement gains than students who utilized the Investigations curriculum resource. Table 2 shows the ECLS-K Math Scores for the first year of the curriculum program (1^{st} grade) and then the scores for the second year of the curriculum program (2^{nd} grade).

Table 2

ECLS-K Math Scores of Different Mathematical Curriculum Programs

Program	1^{st} Grade	2^{nd} Grade
Math Expressions	56.6	69.8
Investigations	53.5	65.5
Saxon Math	56.0	69.2
enVisionMath	54.4	69.2

Note. Adapted from "After Two Years, Three Elementary Math Curricula Outperform A Fourth," by IES, 2013. Copyright 2013 by the Institute of Education Sciences.

Researchers concluded that, based on the above results, "a student at the 50^{th} percentile in math would score 9 percentile points higher as a result of being taught in first and second grade with Math Expressions, Saxon, or SFAW/enVision instead of Investigations" (IES, 2013, p. 7).

Additionally, a study conducted by the What Works Clearinghouse (WWC) found the enVisionMATH Common Core has "potentially positive effects on mathematics achievement for elementary school students" (What Works Clearinghouse, 2013, p. 1).

The WWC was commissioned in 2002 by IES under the direction of the U.S. Department of Education. The WWC's main purpose is to help educational leaders, policy makers, and others make informed decisions through a reliable and non-biased scientific driven source (IES, n.d.).

As part of its inquiry, the WWC reviewed a study conducted by Resendez, Azin, and Strobel (2009). The study, prepared by Planning, Research, and Evaluation Services (PRES), was designed as a two-year study aimed at obtaining an understanding of the effect the enVisionMATH program had on elementary students. The study, which focused on the enVisionMATH program and included the MDIS intervention system, began in 2007 and concluded in 2009. During the 2007-2008 school year, researchers for PRES followed second and fourth grade students from eight elementary schools. Researchers sought to follow the students for two school years. The study's first year included a sampling of 1,197 students from 8 elementary schools and 56 teachers. The second year, due to reasons such as adopting a different mathematics program, the total number of participants dropped to 708 students and 44 teachers (Resendez, Azin, & Strobel, 2009).

Results from the PRES study showed "significant growth over the two-year period in math knowledge and skills among enVisionMATH students across all grade levels and assessments" (Resendez et al., 2009, p. 2). Resendez et al. (2009) specifically noted that students involved in the enVisionMATH program showed "significant improvement in math concepts, and problem-solving, math computation, and math vocabulary" (p. 2). The study also presented evidence that the second year of using the enVisionMATH program resulted in rapid rates of mathematical growth. Resendez et al.

(2009) concluded the positive effects of utilizing the enVisionMATH program increased over subsequent years. The increased growth over the two-year study was identified in both the Metropolitan Achievement Test (MAT8) and the Group Mathematics and Diagnostic Evaluation (GMADE) Assessment. The MAT8 is a multiple choice, norm-referenced standardized assessment and provides users data centered on “(1) Math Concepts and Problem Solving and (2) Math Computation” (Resendez, et al., 2009, p. 13). The GMADE “is a norm-referenced, standards-based assessment of mathematical skills” (Resendez, et al., 2009, p. 14).

Table 3 provides the results of the MAT8 Problem Solving Subtest, the MAT8 Computation Subtest, and the GMADE Math Vocabulary assessment after utilizing the enVisionMATH curriculum program for two years. As indicated on Table 3, better results occurred during the 2nd year of implanting the enVisionMATH program.

Table 3

Assessment Results After Utilizing enVisionMATH

Assessment	MAT8 Problem Solving Subtest	MAT8 Computation Subtest	GMADE Math Vocabulary Assessment
Year 1	67th percentile	60th percentile	37th percentile
Year 2	74th percentile	67th percentile	73rd percentile

Note. Adapted from “A Study on the Effects of Pearson’s 2009 enVisionMATH Program”, by M. Resendez, M. Azin, and A. Strobel, 2009. Copyright 2009 by Planning, Research & Evaluation Services.

Resendez, et al. (2009) noted a positive increase of mathematical understanding and concepts in all subgroups that participated in the study. Specifically, Resendez, et al. (2009) noted stronger gains for the subgroups of students receiving special education, students receiving free and reduced meals, students performing lower than their peers, and students performing higher than their peers.

The PRES research also investigated the extent of mathematical gains experienced by students who used the enVisionMATH program compared to students who used alternative curriculum resources. Results indicated that students who used the enVisionMATH program showed "significantly greater improvement in math computation, math problem-solving, and math communication as compared to students using other math programs" (Resendez, et al., 2009, p. 3). During this portion of the study, researchers once again noticed that the positive effects of the enVisionMATH program increased during the second year of utilization.

Table 4 describes the effect sizes of the enVisionMATH curriculum program compared to students who did not use the enVisionMATH program. Data from a variety assessments, including the MAT8 and the Balanced Assessment of Mathematics, as well as open-ended performance-based assessment, were utilized. Table 4 describes the effect sizes of the curriculum programs for two years of implementation.

Table 4

Effect Sizes of enVisionMATH Compared with Non-enVisionMATH

Program	2007-2008 Year	2008-2009 Year
enVisionMATH	.20	.46
Non enVisionMATH	.24	.25

Note. Adapted from "A Study on the Effects of Pearson's 2009 enVisionMATH Program," by M. Resendez, M. Azin, and A. Strobel, 2009. Copyright 2009 by Planning, Research & Evaluation Services.

In addition to noting the positive effects enVisionMATH had on student achievement and mathematical understanding, Resendez et. al (2009) also set out to identify the opinions of enVisionMATH program users. Of teachers using the enVisionMATH program, 95% were satisfied with the extent to which their students were learning mathematics. This 95% satisfaction rate was higher than the 74% satisfactory rating that occurred after the first year of utilization (Resendez et al., 2009). Pearson and other organizations use the study by Resendez et. al to claim the academic benefits of the enVisionMATH program.

Hanover Research (2014) also investigated a variety of effective mathematical intervention programs. The study analyzed seven intervention programs including the enVisionMATH Common Core 2013 intervention. The purpose of the study was to provide insight on the seven different mathematical instruction and intervention programs which had been determined effective by a variety of publications, organizations, and educational leaders. Hanover Research acknowledged the variety of academic intervention decisions school districts must face and sought to provide additional information to the field. Hanover Research (2014) described enVisionMATH as a "classroom-and computer-based, Common Core Standards-aligned program for students in grades K-6" (p. 25). Hanover Research noted the designers of enVisionMATH recognized many mathematics programs have concerns that technology may be a distraction to learning; therefore they avoid using technology altogether. On the other hand, enVisionMATH recognizes the needs of the 21st century learner and utilizes technology to enhance student learning. Hanover Research noted the daily videos, digital resources, technology-based activities, and the ability to access student assignments from home as ways in which enVisionMATH utilized technology for student learning.

Summary

This review of literature provided an overview of the history of mathematical interventions in the United States from the 1950s to present. The literature review continued with a description of the Response to Intervention approach of academic interventions. Chapter two concluded with a review of the enVisionMATH Common Core Curriculum. Chapter three details the research methodology for the study and describes the research design, population and sample, sampling procedures, instrumentation used, data collection methods, data analysis and hypothesis testing, and limitations of the study.

Chapter Three

Methods

The study was designed to analyze the effects of the enVisionMATH Common Core's MDIS program as determined by the results from the Mathematics MAP assessment for Kindergarten through fifth grade students in District XYZ. In 2014-2015, District XYZ was in its second year of implementing the enVisionMATH Common Core curriculum resource, as well as the MDIS intervention program. In order to ensure the mathematical intervention system was providing positive results, the Mathematics MAP assessment data was compared between students who participated in the enVisionMATH intervention program with students who did not participate in the intervention program. Chapter three is a description of the research methodology for the study and details the research design, population and sample, sampling procedures, instrumentation used, data collection methods, data analysis and hypothesis testing, and limitations of the study.

Research Design

A non-experimental quantitative research design was used in this study. This study was designed to research the extent of impact the MDIS intervention program had on student learning as indicated on the Mathematics MAP assessment for all Kindergarten through fifth grade students in District XYZ. A comparison of academic growth as determined by a fall Mathematics Map score and a spring Mathematics Map scores was made between the students who participated in the MDIS intervention program and students who did not participate. The data needed for this study was obtained from the Director of Assessment and Research from District XYZ.

The independent variable used in this study was whether or not students were involved in the MDIS intervention program. The students' grade level and gender were also independent variables. The dependent variable for this study was the results from the Mathematics MAP assessment.

Population and Sample

The study site was in the fourth largest school district in the state. During the 2012-2013 school year, District XYZ had approximately 21,967 students. Of these 21,967 students, 91.9% were considered non-economically disadvantaged, and 8.1% were considered economically disadvantaged. The student population was classified as: 78.4% White, 4.7% Hispanic, 3.1% African American, and 13.8% Other. District XYZ had 20 elementary schools with approximately 9,300 students attending these schools. Data from all elementary schools in District XYZ were included in the study. At the time of the study, 8,990 K-5 students in District XYZ took the fall Mathematics MAP assessment and the spring Mathematics MAP assessment. Of the 8,990 K-5 students who took both Mathematics MAP assessments, 1,803 students were involved in the MDIS intervention program and 7,187 had no involvement in the MDIS intervention program.

Sampling Procedures

Purposive sampling was utilized for the study. Lunenburg and Irby (2008) define purposive sampling as sampling that "involves selecting a sample based on the researcher's experience or knowledge of the group to be sampled" (Lunenburg & Irby, p. 175). Data were collected by identifying the students in Kindergarten through fifth grade (K-5) who had participated in the MDIS program for at least one class session during the 2013-2014 school year.

Instrumentation

The enVisionMATH Common Core Program contains a variety of resources for classroom teachers. Although the program is designed for use by students in Kindergarten through sixth grade, District XYZ only uses enVisionMATH Common Core for students in Kindergarten through fifth grade. Teachers using the enVisionMATH Common Core program receive a resource package containing each topic's teacher manual (Pearson Education, 2011). The Topic Teacher's Edition includes all instructional materials necessary to teach each lesson. The Topic Teacher's Edition incorporates additional resources that can be used for re-teaching, intervention, and assessment purposes (Pearson Education, 2011). The Teacher's Edition and Resource Package includes master copies for each lesson, the Daily Common Core Review, and homework pages. A CD-ROM is provided as a resource (Pearson Education, 2011).

Within each daily lesson plan for students in Kindergarten through sixth grade are comprised of four-part lessons: Daily Common Core Review; Developing the Concept: Interactive; Developing the Concept: Visual; and Close/Assess and Differentiate (Department of Education What Works Clearinghouse, 2013). During the Daily Common Core Review lesson, students complete a short pre-assessment of their knowledge of the day's lesson. The next lesson component, Developing the Concept: Interactive, provides students with an opportunity to participate in teacher-led interactive learning activities (Department of Education What Works Clearinghouse, 2013). For example, a fourth-grade student learning about arrays may use blocks or other mathematical tools to show the array. During the third lesson component, Develop the Concept: Visual, visual strategies enhance student understanding. For example, the student workbook may include pictures of the materials to be learned. The final lesson component, Close/Assess and Differentiate provides students with the opportunity to demonstrate their learning (Department of Education What Works Clearinghouse, 2013). This can be done through a variety of methods, including a Quick Check post-assessment. Based on the Quick Check results, teachers may choose to provide leveled homework for their students. The enVisionMATH Common Core provides teachers with re-teaching, practice (on level), and enrichment homework worksheets (Department of Education What Works Clearinghouse, 2013).

Numerous studies indicate a strong correlation between utilizing the enVisionMATH curriculum and mathematical achievement. Although enVisionMATH Common Core 2013 has undergone a variety of updates, Pearson Education utilizes research to ensure the most current version of enVisionMATH meets the mathematical needs of its users. In a research overview report, Pearson (n.d.) writes, "Pearson Education is committed to using scientific, evidence-based methods in the development of its educational curricula" (p. 2). Pearson (n.d.) relies on its own research team and collaborative efforts with research companies, universities, and educational laboratories to ensure the latest version of enVisionMATH is created through scientific and research-based measures.

While writing new mathematics curriculum resources, Pearson utilized four phases of research (Pearson, n.d.). The first phase involves evaluating previous editions of the curriculum resource to identify the instruction and practices supported by scientific evidence. During the second phase of curricula research, the enVisionMATH authors and researchers "conduct extensive literature reviews on content, instructional practices, and education standards" (Pearson, n.d., p. 2). The findings during the second phase are incorporated into the new curricula. The third phase involves field tests of the new curriculum resource. Feedback from teachers, students, administrators, and other mathematical educational specialists are considered when evaluating the program being developed (Pearson, n.d.). The final phase of the curricula research is an examination of the effectiveness of the mathematics curriculum. Pearson (n.d.) uses "independent randomized control trial students" to "provide scientific evidence of student achievement on standardized assessments" (p. 2).

This study included data from the MAP assessment. The MAP assessment was created by the Northwest Evaluation Association (NWEA), a non-for-profit organization founded in 1974 by a group of educators and researchers. In 2013, it was estimated that NWEA provided a variety of assessment tools, including the MAP assessment, to more than 5,200 school districts (NWEA, 2013). District XYZ utilizes the MAP assessment to collect English language arts and mathematics data for students in Kindergarten through eighth grade. Specifically, students in grades Kindergarten through second take the MAP: Math Primary Grades KS 2010 Common Core State Standards. Students in grades third through fifth take the MAP: Math 2-5 KS 2010 Common Core State Standards. Students are required to take the MAP assessment in the fall and in the spring. For the purposes of this study the Mathematics MAP data was used to measure a student's ability in mathematics.

The MAP assessment is a "computer-based adaptive assessment that provides precise and immediate feedback" (NWEA, 2013, p. 1). The difficulty of each question is dependent on how successful a student has answered the previous questions. As the student answers questions correctly, the subsequent questions become more difficult. If the student answers a question incorrectly, the ensuing questions become less difficult (Parent Toolkit, 2011). Teachers can analyze the results from the MAP assessment to determine specific skills individual students need to improve upon in order to be a successful student (NWEA, 2013). Because the MAP assessment is typically administered at least two times throughout the school year, it also provides critical information about a student's academic growth (NWEA, 2013).

A typical MAP assessment is comprised of 42 to 50 questions, which are aligned with each state's content standards. Because the MAP assessment is an adaptive assessment, with a pool of approximately 3,000 questions aligned to state standards, the questions differ among MAP assessments (NWEA, 2013).

Measurement. Results from the MAP assessment are defined with a Rasch UnIT (RIT) score, named after George Rasch who significantly contributed to the Item Response Theory (IRT) of measurement (NWEA, 2013). The IRT idea of measurement concludes that one's achievement level and the degree of difficulty of test items can be measured using the same scale. A RIT score is a scale of measurement that assists with the analysis of scores. A RIT score is given to a student and indicates the most challenging question the student would be able to answer correctly approximately 50% of the time (NWEA, 2013). RIT scores range from 100 to 300 and are on an equal-interval scale. Assigning a RIT score to the results from the MAP assessment provides an opportunity to follow a student's academic growth over the span of several years (Parent Toolkit, 2011). There is no research on the MDIS intervention program to date.

Validity and reliability. In March 2004 NWEA conducted its own research on validity and reliability. To determine the MAP assessment's validity, NWEA tested for concurrent validity. According to NWEA (2004) concurrent validity is "expressed in the form of a Pearson correlation coefficient" (p. 3). Concurrent validity addresses how well the scores referenced in a RIT scale correlate to scores obtained from an alternate assessment with a different scale, in the same subject area. During its study, NWEA analyzed how well scores from the MAP assessment corresponded to scores from another normed assessment in the same subject area. NWEA (2004) determined a strong concurrent validity when the correlations between both assessments were in the mid-.80s. Tests were conducted to determine the validity with multiple data sets including the 2001 spring Mathematics Stanford Achievement Test 9th Edition (SAT9) assessment.

Table 5 provides a summary of the correlation between the Mathematics MAP assessment and the 2001 SAT9. The correlations for 2nd, 3rd, 4th, and 5th grade students are shown. Table 5 also provides the number of student data used in the study.

Table 5

Correlation Between MAP Assessment and SAT9

Grade	*r*	*n*
2	.80	5,633
3	.85	7,806
4	.85	7,929
5	.87	7,794

Note. Adapted from "Reliability and Validity Estimates: NWEA Achievement Level Tests and Measures of Academic Progress," by NWEA, 2004, p. 8. Copyright 2004 by Northwest Evaluation Association.

NWEA also determined the validity of the MAP assessment using the 2003 Illinois Standards Achievement Tests (ISAT).

Table 6 provides a summary of the correlation between the Mathematics MAP assessment and the 2003 ISAT. The correlations for 3rd, 5th, and 8th grade students are shown. Table 6 also provides the number of student data used in the study.

Table 6

Correlation Between MAP Assessment and ISAT

Grade	*r*	*n*
3	.80	1,759
5	.80	2,514
8	.79	962

Note. Adapted from "Reliability and Validity Estimates: NWEA Achievement Level Tests and Measures of Academic Progress," by NWEA, 2004, p. 6. Copyright 2004 by Northwest Evaluation Association, 2004.

Also included in the study was validity tested with the 2003 Nevada Criterion Referenced Assessment.

Table 7 provides a summary of the correlation between the Mathematics MAP assessment and the 2003 Nevada Criterion Referenced Assessment. The correlations for 2nd and 5th grade students are shown. Table 7 also provides the number of student data used in the study.

Table 7

Correlation Between Mathematics MAP assessment and 2003 Nevada Criterion Referenced Assessment

Grade	*r*	*n*
2	.82	1,084
5	.83	1,184

Note. Adapted from "Reliability and Validity Estimates: NWEA Achievement Level Tests and Measures of Academic Progress," by NWEA, 2004, p. 7. Copyright 2004 by Northwest Evaluation Association, 2004.

Lunenburg and Irby (2008) describe reliability as the "degree to which an instrument consistently measures whatever it is measuring" (Lunenburg & Irby, 2008, p. 182). To provide evidence of the reliability for the MAP assessment, NWEA (2004) chose a "mix between test-retest reliability and a type of parallel forms reliability" (p. 1) that spanned 7 to 12 months. NWEA (2004) considered its approach to testing reliability as "rigorous," as the second test is not the same test. The second test is similar in content and structure of questions, yet differs in degree of difficulty.

Table 8 provides a summary of the reliability of mathematics measures between NWEA Achievement Level Tests and the MAP Assessment. Table 8 includes data for assessment scores for students in 2^{nd}, 3^{rd}, 4^{th}, and 5^{th} grade. Table 8 also provides the number of student scores used in each grade level as well as the correlations of reliability between the assessments.

Table 8

Reliability of Mathematics Measures

Grade	Term	*r*	*n*
2	Fall to Spring	.83	5,963
3	Fall to Spring	.87	49,806
4	Fall to Spring	.90	54,971
5	Fall to Spring	.91	56,500

Note. Adapted from "Reliability and Validity Estimates: NWEA Achievement Level Tests and Measures of Academic Progress," by NWEA, 2004, p. 5. Copyright 2004 by Northwest Evaluation Association.

The Mathematics MAP assessment is a valid and reliable measure. The MDIS intervention program is part of the enVisionMath Common Core mathematics curriculum which is designed for Kindergarten through sixth grade students (Pearson, 2013).

Data Collection Procedures

Prior to collecting data for the study, the Baker University Institutional Review Board (IRB) and District XYZ approved the research. Documentation regarding District XYZ's approval for the research is included in Appendix A. District XYZ's student information system, Synergy, was utilized to obtain student information. Created by Edupoint, Synergy is an all-encompassing student information system providing users with access to student contact information, attendance records, standardized test scores, grades, and other pertinent information. Synergy was used to gather data from fall 2013 and spring 2014 Mathematics MAP assessments. To protect the identity of students, District XYZ's Director of Assessment and Research removed the student identifications of all students in Kindergarten through fifth grade and coded them as either having participated in the MDIS intervention program or not. In addition, data included grade level, gender, fall RIT score, and spring RIT score. The information was stored on a Microsoft Excel spreadsheet.

Data Analysis and Hypothesis Testing

A quantitative method of data analysis was used in the study. Three questions were addressed within the study. Each research question is detailed along with the hypothesis and the hypothesis testing method.

RQ1. To what extent was there a difference in the change in mathematics achievement for students in Kindergarten through fifth grade, as measured by the MAP, between students who participated in the enVisionMATH Common Core MDIS intervention program and those who did not?

H1. There was a difference in the change in mathematics achievement for students in Kindergarten through fifth grade, as measured by the MAP, between students who participated in the enVisionMATH Common Core MDIS intervention program and those who did not.

RQ2. To what extent is there a difference in the change in Kindergarten through fifth grade students' mathematics achievement, as measured by the MAP, among grade levels for students who participated in the enVisionMATH Common Core MDIS intervention program?

H2. There is a difference in the change in mathematics achievement for students in Kindergarten through fifth grade students, as measured by the MAP, among grade levels for students who participated in the enVisionMATH Common Core MDIS intervention program.

RQ3. To what extent was the change in student mathematics achievement, as measured by the MAP, different for males and females who participated in the enVisionMATH Common Core MDIS intervention program?

H3. There was a difference in mathematics achievement, as measured by the MAP, between males who participated in the enVisionMATH Common Core MDIS intervention program and females who participated in the enVisionMATH Common Core MDIS intervention program.

A factorial ANOVA was conducted to address RQ1-RQ3. The categorical variables used to group the dependent variable (change in mathematics achievement) were intervention status (participated or did not participate), grade level (K-5), and gender (male and female). The factorial ANOVA was used to test a main effect for intervention status (*H1*), an interaction effect between intervention status and grade level (*H2*), and an interaction effect between intervention status and gender (*H3*). The level of significance was set at .05.

Limitations

Lunenburg and Irby (2008) posit that limitations are "factors that may have an effect on the interpretations of the findings or on the generalizability of the results" (Lunenburg & Irby, 2008, p. 133). This study was limited as it was unknown to what extent the mathematics interventionist used the MDIS intervention in accordance with the teacher's manual. A second limitation is that teachers may not have followed the district's protocol for recommending students to participate in the MDIS intervention. A third limitation to the study is the quality of instruction students received in their individual classrooms.

Summary

The purpose of this study was to determine the extent of impact the enVisionMATH Common Core MDIS intervention program has on student achievement as determined by Mathematics MAP assessment results. The study took place during the 2014-2015 school year. During this time, District XYZ was in its second year of implementing the enVisionMATH Common Core curriculum resource as well as the intervention program. Data from all Kindergarten through fifth grade students in District XYZ were utilized in the study. The RIT growth of students involved in the mathematical intervention program was compared with the RIT growth of students not involved in the mathematical intervention program. Chapter four includes a description of the results of the study.

Chapter Four

Results

The purpose of this study was to identify the extent of impact the MDIS program had on student achievement as measured by the Mathematics MAP assessment. Specifically, the study was focused on student achievement scores for students in Kindergarten through fifth grade. Growth from the fall Mathematics MAP scores and spring Mathematics MAP scores were compared between students who had participated in the MDIS program and students who did not participate in the intervention program. Descriptive statistics are described in chapter four. Additionally, a description of the hypothesis testing results for each research question within this study is included.

Descriptive Statistics

Descriptive statistics are defined as "mathematical procedures for organizing and summarizing numerical data" (Lunenburg & Irby, 2008, p. 63). Fall and spring Mathematics MAP data for students in Kindergarten through fifth grade were used in this study. A total of 8,990 student scores were utilized for the study. Of the 8,990 students included in the study, 7,187 did not participate in the MDIS intervention program and 1,803 participated in the MDIS intervention program. Additionally, the data included results from 4,604 male students and 4,386 female students. 869 male students and 934 female students participated in the MDIS intervention program.

Table 9 includes data for the number of students who took the fall and spring Mathematics MAP assessments in Kindergarten through fifth grade. Table 9 also includes the percentage of students in each grade level as it relates to all students assessed.

Table 9

Valid Number of Mathematics MAP Scores by Grade Level

Grade	*n*	Percent
K	1,285	14.3
1	1,430	15.9
2	1,483	16.5
3	1,505	16.7
4	1,643	18.3
5	1,644	18.3
Total	8,990	100.0

Hypothesis Testing

Three research questions were investigated during this study. An overview of the hypothesis testing results for the research questions is presented.

RQ1. To what extent was there a difference in the change in mathematics achievement for students in Kindergarten through fifth grade, as measured by the MAP, between students who participated in the enVisionMATH Common Core MDIS intervention program and those who did not?

H1. There was a difference in the change in mathematics achievement for students in Kindergarten through fifth grade, as measured by the MAP, between students who participated in the enVisionMATH Common Core MDIS intervention program and those who did not.

The results of the analysis indicated a statistically significant difference between students who participated in the intervention program and those who did not, $F = 8.609$, $df = 1, 8966$, $p < .05$. Those students in the intervention program had a greater mean growth change in mathematics achievement ($M = 15.142$) than those students who were not in the intervention program ($M = 14.558$).

The difference between the mean growth scores for students who participated in the intervention program compared to those students not involved in the intervention program provided evidence that the MDIS intervention program is having a positive impact on student learning. The results indicate that mathematical academic achievement increases more for those who participate in the intervention program. This supports H1.

RQ2. To what extent is there a difference in the change in Kindergarten through fifth grade students' mathematics achievement, as measured by the MAP, among grade levels for students who participated in the enVisionMATH Common Core MDIS intervention program?

H2. There is a difference in the change in mathematics achievement for students in Kindergarten through fifth grade students, as measured by the MAP, among grade levels for students who participated in the enVisionMATH Common Core MDIS intervention program.

The results of the analysis indicated a statistically significant interaction effect between intervention status and grade level, $F = 90.095$, $df = 5, 1{,}791$, $p < .001$. A follow-up post hoc was conducted to determine which pairs of growth means were different using Tukey's Honestly Significant Difference (HSD). Table 10 includes data on the follow-up post hoc test.

Table 10

Post Hoc Results of the Test for H2

Grade Levels	Mean Difference	*p*
Kindergarten – 1st	2.68	.05
Kindergarten – 2nd	5.92	< .001
Kindergarten – 3rd	8.17	< .001
Kindergarten – 4th	11.29	< .001
Kindergarten – 5th	10.85	< .001
1st – 2nd	3.24	< .001
1st – 3rd	5.49	< .001
1st – 4th	8.61	< .001
1st – 5th	8.17	< .001
2nd – 3rd	2.25	.05
2nd – 4th	5.37	< .001
2nd – 5th	4.93	< .001
3rd – 4th	3.12	< .001
3rd – 5th	2.68	.05
4th – 5th	-.44	.986

The difference in the pairs of growth means indicated larger growth mean differences between primary grade levels (Kindergarten, 1st, and 2nd) than intermediate (3rd, 4th, and 5th) grade levels. For example, the growth mean difference between Kindergarten and 4th grade was 11.29 and the growth mean difference between Kindergarten and 5th grade was 10.85. The difference between growth mean scores between 1st grade and 4th grade was 8.61 and the difference between 1st grade and 5th grade was 8.17. The growth mean scores for these grade levels were greater than the differences between intermediate grade levels. For example the growth mean difference between 3rd grade and 4th grade was 3.122 and the difference between 3rd grade and 5th grade was 2.68. The growth mean difference between 4th grade and 5th grade was -.44; however, this was not a statistically significant difference. This supports H2.

RQ3. To what extent was the change in student mathematics achievement, as measured by the MAP, different for males and females who participated in the enVisionMATH Common Core MDIS intervention program?

H3. There was a difference in mathematics achievement, as measured by the MAP, between males who participated in the enVisionMATH Common Core MDIS intervention program and females who participated in the enVisionMATH Common Core MDIS intervention program.

The results of the analysis indicated there was a statistically significant interaction effect between intervention status and gender, F = 4.968, df = 1, 1,791, p < .05. The difference between the growth mean scores between male students (M = 15.555) and female students (M = 14.7728) who participated in the intervention program provided evidence that there is a difference of growth mean scores between male students and female students. The results indicate that males had a higher average growth mean scores than females. This supports H3.

Summary

Chapter four began with a summary of the descriptive statistics used to analyze the data. Included was the sample size, percent of scores, and frequencies organized by grade level.

Results related to RQ1 indicated a statistically significant difference between students who participated in the intervention program and those who did not. The data revealed participating in the math intervention program has a positive impact on mathematical academic achievement as demonstrated on the Mathematics MAP assessment.

Results related to RQ2 indicated a statistically significant interaction effect between intervention status and grade level. A follow-up post hoc was utilized to determine which pairs of growth means were different using Tukey's HSD. Results indicated there is a greater growth mean difference from primary to intermediate grade levels, specifically Kindergarten and 1st grade, compared to intermediate grade levels, such as 3rd, 4th, and 5th grade.

Results related to RQ3 indicated a statistically significant interaction effect between intervention status and gender. Results indicated a significant difference in the growth mean scores between male students and female students who participated in the intervention program.

Detailed in chapter five is an interpretation of the results from the study as well as recommendations for future research. A summary of the study, an overview of the problem, the purpose statement, and research questions are also included in chapter five. The chapter also contains a review of the major findings from the study. Recommendations for future research are also included. Chapter five concludes with final remarks.

Chapter Five

Interpretation and Recommendations

Included in chapter five is a summary of the study and an overview of the problem, purpose statement, and research questions. Chapter five continues with a connection of the study to the literature review. A review of the major findings from the study as well as recommendations for future research is also described. Chapter five ends with concluding remarks.

Study Summary

The purpose of this study was to identify the extent of impact the MDIS program had on student achievement as measured by the Mathematics MAP assessment. The study was focused on student achievement scores for students in Kindergarten through fifth grade. The following section describes the purpose for the study and the research questions addressed during the study.

Overview of the problem. School districts are required to meet the needs of all learners (Berkas & Pattison, 2007). As part of their commitment to ensuring all students an appropriate educational experience, school districts should consider carefully selecting instructional materials to assist students with learning the intended curriculum. One of the many curriculum resources several school districts carefully must select is a mathematical intervention program. Mathematical interventions at the elementary level are a critical component of preventing later learning difficulties (Hanover Research, 2014). Mathematical intervention programs are designed to assist students who are not responding positively to the instruction provided in class. Mathematical interventions should be a methodized plan for supporting students with academic materials and activities (NCTM, n.d.). RtI is an intervention model that has a positive impact on student achievement (Hughes & Dexter, 2011). When school districts select a new mathematical intervention program, they should consider evaluating the extent of impact the mathematical intervention program has on student achievement.

Purpose statement and research questions. The purpose of this study was to identify the extent of impact the MDIS program had on student achievement as measured by the Mathematics MAP assessment. The study was focused on student achievement scores for students in Kindergarten through fifth grade. The Director of Assessment and Research for District XYZ provided the data for the study. In addition to basic information about the students, the data identified whether the student participated in the mathematical intervention program. Data were analyzed to determine the extent of impact the mathematical intervention program had on student achievement for mathematics. Mathematical growth for individual grade levels and gender was also investigated.

Review of the methodology. The study included data for students in grades K-5. The students were enrolled in a large suburban school district in the Midwest. The data obtained included the fall and spring Mathematics MAP scores for the 2013-2014 school year. Data on students’ participation status in the MDIS intervention program, grade level, and gender were used in data analysis. A factorial ANOVA was conducted to address the three research questions within the study.

Major findings. Results from this study indicated that for grades K-5 there was a statistically significant difference between students who participated in the intervention program and those who did not. The students in the intervention program had a greater growth mean change in mathematics achievement than those students who were not in the intervention program. The results also indicated a statistically significant interaction effect between intervention status and grade level. With the exception of the mean difference between 4^{th} grade and 5^{th} grade, all other grade levels had statistically significant mean differences between a lower grade level and a higher grade level. The larger mean differences occurred when primary grade levels (Kindergarten, 1^{st}, 2^{nd}) were compared with intermediate grade levels (3^{rd}, 4^{th}, 5^{th}). The largest mean difference occurred between Kindergarten and 4^{th} grade. Results from the study also indicated there was a statistically significant interaction effect between intervention status and gender. The difference between the growth mean scores between male students and females provided evidence that males had higher average scores.

Findings Related to the Literature

This section contains a summary of the results from this study as they relate to current literature included in chapter two. Findings related to literature for the research questions from this study are included. The findings revealed consistencies between the study and relevant literature and previous studies.

RQ1 sought to investigate to what extent was there a difference in the change in mathematics achievement for students in Kindergarten through fifth grade. Results from RQ1 indicated a statistically significant difference between students who participated in the intervention program and those who did not. These findings are consistent with Hughes and Dexter (2011) who determined all 13 RtI programs, which were part of their meta-analysis to determine the effect of RtI interventions, had positive academic impacts on student achievement. As the MDIS intervention program is part of an RtI intervention model, Hughes and Dexter's (2011) study mirrors the findings that intervention programs have a positive impact on student achievement. The results from RQ1 also mirror the study conducted by IES (2013) which investigated the impact four curriculum materials had on student achievement. IES (2013) concluded that students involved in the enVisionMath program had a positive increase with student achievement. Results from RQ1 are also aligned with the study conducted by the WWC (2013) which concluded the enVisionMATH Common Core program has "potentially positive effects on mathematics achievement for elementary school students" (WWC, 2013, p. 1). The results from this study's findings are consistent with those of the WWC as academic achievement increased with participation in the curriculum's intervention program. The results from this study mirror with the findings of Resendez et al. (2009) who concluded students who used the enVisionMATH program demonstrated an increase in mathematical achievement. Lastly, the results from RQ1 support the findings of Hanover Research (2014) which concluded the enVisionMATH Common Core 2013 intervention program is an effective intervention program.

RQ2 was intended to investigate to what extent is there a difference in the change in Kindergarten through fifth grade students' mathematics achievement, as measured by the MAP, among grade levels for students who participated in the enVisionMATH Common Core MDIS intervention program. The results of the analysis indicated a statistically significant interaction effect between intervention status and grade level. Specifically, there was a greater difference in the pairs of means between primary grade levels and intermediate elementary grade levels. The results from RQ2 mirror the findings of Bryant et al. (2008) who concluded that "many young students with mathematics difficulties may not develop a level of mathematics automaticity that is necessary for becoming proficient in mathematics" (p. 1). The results within the current study also support the findings of Resendez et al. (2009) who concluded the enVisionMATH program showed "significantly greater improvement in math computation, math problem-solving, and math communication" (p. 3).

RQ3 was designed to investigate to what extent the change in student mathematics achievement, as measured by the MAP, was different for males and females who participated in the enVisionMATH Common Core MDIS intervention program. Results from RQ3 indicated there was a statistically significant interaction effect between intervention status and gender. Results indicated male students had a mean growth score of 15.555 compared to a mean growth score of 14.728 for female students. The findings from RQ3 are not consistent with the results of several relevant studies including Levi (2000) who concluded that male and female students score similar on standardized tests. The findings from the current study are also inconsistent with the findings of Hyde et al. (2008) whose review of studies that included more than 7 million students indicated there was no difference in mathematical assessment scores between male and female students in second through eleventh grade.

Conclusions

Results from the study indicate the enVisionMATH Common Core MDIS intervention program is having a positive effect on student achievement. As school districts are required to have an intervention system in place for students not making progress towards the general curriculum, the MDIS intervention program appears to be an effective intervention program. Students in the primary elementary levels had a greater growth mean score difference than students in the intermediate elementary levels. These findings provide evidence for the need for students to receive mathematical intervention as early as possible.

Implications for action. The findings from this study have implications for all elementary school districts. The data from the current study indicate the MDIS intervention program has a positive effect on student achievement. In accordance to the No Child Left Behind Act of 2001 and IDEA school districts must provide support for students who demonstrate difficulties in learning (Berkas & Pattison, 2009). As school districts are required to provide support for students not making adequate progress towards learning mathematics, school districts may consider utilizing an intervention program. The results from the students indicate the MDIS intervention program can meet the requirements of providing support for students who qualify for an intervention program. It is suggested that school districts not currently utilizing a math intervention program for students not making progress towards their mathematical achievement consider implementing the MDIS intervention program. Additionally, it is suggested that school districts currently utilizing a mathematical intervention program other than the MDIS intervention program analyze their current intervention program to determine whether or not their intervention program is as effective as the MDIS intervention program.

Recommendations for future research. The purpose of this study was to identify the extent of impact the MDIS program had on student achievement as measured by the Mathematics MAP assessment. While there are a few studies assessing the impact the enVisionMATH Common Core program has on student achievement, there is even more limited information on the effects the enVisionMATH Common Core MDIS intervention program has on student learning. Although this study was helpful for investigating the extent of impact the MDIS intervention program had on student achievement, there are recommendations for future research.

At the time of the study, District XYZ was in its second year of utilizing the MDIS program. This study could be replicated to determine to what extent the intervention program became more or less effective in the second year of implementation. As previously noted, research studies have indicated student achievement increases at a faster pace during the second year of utilizing the enVisionMATH program. Future research could investigate whether or not that is true of the intervention program.

The MDIS intervention program was originally created for use in the classroom. At the time of the study, District XYZ utilized the program as an out-of-classroom intervention. Future research could examine whether the MDIS intervention program is more effective as an in-class intervention or, as in the case of District XYZ, as an out-of-class intervention.

Educational leaders in District XYZ may further the research found in this study to determine to what extent academic achievement differs among elementary schools in the district. A study similar to this would help District XYZ identify the elementary schools with the greatest amount of academic growth. This potentially would allow staff members in District XYZ to better understand the practices of the most effective intervention systems and then replicate them across the district.

Concluding remarks. School districts are charged with the responsibility of meeting the needs of all learners. As students learn differently, there will always be a need for school districts to provide students with mathematical interventions. Not only is providing students with supports to ensure they are learning required by law, it is the right thing to do. It is essential for school districts to ensure the mathematical intervention they are using has a positive effect on student learning. The negative implications of using an ineffective intervention program are many. The current study demonstrates the MDIS intervention program is an effective intervention program for increasing student learning.

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Appendices

Appendix A: Letter to District XYZ Regarding the Study

BAKER UNIVERSITY
SCHOOL OF EDUCATION – GRADUATE DEPARTMENT
8001 COLLEGE BLVD., OVERLAND PARK, KS 66210
913-491-4432

March 30, 2015

[redacted]

To [redacted]

This letter is written verify the status of Steve Heinauer , a candidate for the degree Doctor of Education in Educational Leadership. Steve has completed all course requirements and portfolio development and presentation and is currently completing requirements for the dissertation. His study proposal will be considered as an "Expedited" study by the Baker University Institutional Review Board. The study intends to investigate the relationship between [redacted] uses of envisionMATH as an intervention and student achievement. As an "Expedited" study, he will analyze data provided by [redacted] No aspects of the study will in way identify individuals, schools, or the school district.

As Steve's major advisor, I am thoroughly familiar with the study and its intent. We are anxious to see the results of his research as we know that information helpful to today's schools will become clearer.

If there are questions that would need further follow-up, I would be most pleased to respond.

Sincerely,

Harold B. Frye

Harold B. Frye, Ed.D.
Graduate Education Programs

Appendix B: District XYZ Authorizing Research Study

From: [redacted]
To: Heinauer, Steve
Subject: Research Proposal
Date: Wednesday, April 29, 2015 4:35:28 PM

Steve,
You research proposal in conjunction with Baker University has been approved. Please remember that all data must be free of identifiable information (including name and student id numbers), and you should continue to reference the district in your generic manner.

We would love to have a copy of your results for our files.

Thank you,

[redacted]
Director of Assessment and Research
[redacted]

Appendix C: Proposal for Research to Baker University

BAKER UNIVERSITY

SCHOOL OF EDUCATION
GRADUATE DEPARTMENT

Date: 6/22/15
IRB PROTOCOL NUMBER ______
(IRB USE ONLY)

IRB REQUEST
Proposal for Research
Submitted to the Baker University Institutional Review Board

I. Research Investigator(s) (Students must list faculty sponsor first)

Department(s) **School of Education Graduate Department**

Name	Signature	
1. Dr. Harold Frye	[signature],	Major Advisor
2. Dr. Katie Hole	[signature],	Research Analyst
3. Dr. Verneda Edwards		University Committee Member
4.		External Committee Member

Principal Investigator: Stephen Heinauer [signature]
Phone: 913-940-1501
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Faculty sponsor: Dr. Harold Frye
Phone: 913-344-1220
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Expected Category of Review: _X___Exempt ____Expedited ____Full

II: Protocol Title
Effects of the enVisionMath Common Core Math Diagnostic Intervention System on Student Achievement for Students in Kindergarten Through Fifth Grade

Summary
The following summary must accompany the proposal. Be specific about exactly what participants will experience, and about the protections that have been included to safeguard participants from harm. Careful attention to the following may help facilitate the review process:

In a sentence or two, please describe the background and purpose of the research.

The purpose of this study is to investigate the extent of impact the implemented math intervention program in the [redacted] School District (referred to as District XYZ for purposes of this study) had on student achievement as indicated in the MAP assessment. Data from the 2013-2014 Measures of Academic Progress (MAP) for all students K-5 in District XYZ will be utilized. Data indicating which students participated in the district's math intervention program, and for what length, will also be analyzed.

Briefly describe each condition or manipulation to be included within the study.

No special conditions or manipulations will be made.

What measures or observations will be taken in the study? If any questionnaire or other instruments are used, provide a brief description and attach a copy.

No observations or questionnaires will be used during the study.

Will the subjects encounter the risk of psychological, social, physical, or legal risk? If so, please describe the nature of the risk and any measures designed to mitigate that risk.

No subjects will encounter the risk of psychological, social, physical or legal risk.

Will any stress to subjects be involved? If so, please describe.

No stress to subjects will be involved.

Will the subjects be deceived or misled in any way? If so, include an outline or script of the debriefing.

No subjects will be deceived or misled in any way.

Will there be a request for information that subjects might consider to be personal or sensitive? If so, please include a description.

There will not be a request for information which subjects may consider to be personal or sensitive.

Will the subjects be presented with materials that might be considered to be offensive, threatening, or degrading? If so, please describe.

As the study does not involve any interactions, subjects will not be presented with materials which might be considered to be offensive, threatening, or degrading.

Approximately how much time will be demanded of each subject?

No time will be demanded of any subject.

Who will be the subjects in this study? How will they be solicited or contacted? Provide an outline or script of the information which will be provided to subjects prior to their

volunteering to participate. Include a copy of any written solicitation as well as an outline of any oral solicitation.

As pre-established, archived data will be utilized, subjects will not be required to participate in the study.

What steps will be taken to ensure that each subject's participation is voluntary? What if any inducements will be offered to the subjects for their participation?

Subject participation is not necessary as the study involves pre-established data.

How will you ensure that the subjects give their consent prior to participating? Will a written consent form be used? If so, include the form. If not, explain why not.

As interaction with subjects is not necessary, subject consent will not be necessary.

Will any aspect of the data be made a part of any permanent record that can be identified with the subject? If so, please explain the necessity.

No part of the data will become part of any part of a permanent record in which can be identified with the subject.

Will the fact that a subject did or did not participate in a specific experiment or study be made part of any permanent record available to a supervisor, teacher or employer? If so, explain.

Information regarding a subject participation or non-participation in an experiment or study will not be made part of any permanent record.

What steps will be taken to ensure the confidentiality of the data?

The school district in which the data is taken from will be referred to as District XYZ during the entire study. No student will be individually identified. The researcher will maintain all data without providing access to anyone. Access to the data provided by District XYZ will be maintained and controlled by the researcher at all times.

If there are any risks involved in the study, are there any offsetting benefits that might accrue to either the subjects or society?

There are no risks involved in the study. Furthermore, there are no offsetting benefits that might accrue to the subjects or society.

Will any data from files or archival data be used? If so, please describe.

Data from the 2013-2014 school years will be used. Specifically, results from the MAP Math assessment for all students K-5 in District XYZ will be analyzed. Additionally, archival data regarding the students involved in District XYZ's math intervention program will be used.

Appendix D: IRB Letter of Approval

BAKER UNIVERSITY

Baker University Institutional Review Board

July 1, 2015

Dear Stephen Heinauer and Dr. Frye,

The Baker University IRB has reviewed your research project application and approved this project under Exempt Status Review. As described, the project complies with all the requirements and policies established by the University for protection of human subjects in research. Unless renewed, approval lapses one year after approval date.

Please be aware of the following:

1. Any significant change in the research protocol as described should be reviewed by this Committee prior to altering the project.
2. Notify the IRB about any new investigators not named in original application.
3. When signed consent documents are required, the primary investigator must retain the signed consent documents of the research activity.
4. If this is a funded project, keep a copy of this approval letter with your proposal/grant file.
5. If the results of the research are used to prepare papers for publication or oral presentation at professional conferences, manuscripts or abstracts are requested for IRB as part of the project record.

Please inform this Committee or myself when this project is terminated or completed. As noted above, you must also provide IRB with an annual status report and receive approval for maintaining your status. If you have any questions, please contact me at CTodden@BakerU.edu or 785.594.8440.

Sincerely,

Chris Todden EdD
Chair, Baker University IRB

Baker University IRB Committee
Verneda Edwards EdD
Sara Crump PhD
Erin Morris PhD
Scott Crenshaw