A Comparison of Fifth Grade Mathematics Curriculum Materials

by

Michael E. Starks, Sr.

A Dissertation submitted to the Education Faculty of Lindenwood University

in partial fulfillment of the requirements for the

degree of

Doctor of Education

School of Education

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Declaration of Originality

I do hereby declare and attest to the fact that this is an original study based solely upon my own scholarly work here at Lindenwood University and that I have not submitted it for any other college or university course or degree here or elsewhere.

Full Legal Name: Michael Edward Starks, Sr.

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you for your unconditional love. As I will always uphold, “To one much is given, much is required” Luke 12:48.

Abstract

In the USA, the No Child Left Behind Act of 2001 resulted in requirements placed on school districts to show student achievement in mathematics, based on measured adequate yearly progress. This caused school districts to search for standards-based programs that improve mathematics learning. A quantitative multi-year study was used to compare the state-assessed achievement levels of 1,695 fifth-grade Midwestern children in the state of Missouri, who learned mathematics from two different curriculum-delivery programs, *EveryDay* Mathematics and *EnVision* Mathematics. A 2 by 2 by 8 research design was used through the choice of two elementary schools using *EveryDay* Mathematics and two different elementary schools using *EnVision* Mathematics, across an eight-year timeline. The dependent variable was represented by the students' scores on the mathematics portion of the standardized required state test, the Missouri Assessment Program. Student scores from 2006-2013 were collected for the four public schools in the St. Louis Metropolitan area. The schools chosen were matched to control for socio-economic level, ethnicity mix, departmentalization of content areas, extent of teacher experience, and class sizes. The four schools represented two school districts. Each district uniformly used one of the mathematics programs examined in this study, over the eight years. Results of this study could not show that either mathematics program was significantly better, as measured by student test scores on mathematics topics. Unfortunately, results also showed no overall increase in mathematics learning at these four schools over the eight year period. The study concluded that curriculum materials choice, alone, is not sufficient to insure increased fifth-grade student learning of

mathematics. Variables such as the extent of teacher professional development, teacher specialization, and curriculum launch practices at schools were discussed as possible influences on the results of the study.

Table of Contents

List of Tables

List of Figures

Chapter One: Introduction

The scientific education of children in the United States of America has been a pivotal concern for technological advancements of the future space (DeBoer, 1997; Marsh, 1963). This study focused on mathematics proficiency as an aspect of scientific preparedness. The research question examined whether or not one mathematics curriculum was a better instrument than another for teaching mathematics to children in the fifth grade. To accomplish this examination, the researcher analyzed longitudinal outcomes data for fifth grade students taught with the *EveryDay* Mathematics and *EnVision* Mathematics study materials.

Background of the Study

Legislation regarding education reform in the United States has continued for over 50 years. Americans were surprised in 1957 when they learned that Russia had the successful launch of Sputnik, the first man-made satellite, to outer space (DeBoer, 1997; Marsh, 1963). The U.S. no longer dominated the world technologically.

Some Americans blamed schools for technological inferiority. Many scientists were outspoken when citing American education as mediocre. Researchers examining science education in the U.S. found the subject was not taught conceptually; instead, procedurally through rote memorization. Textbooks were outdated and sometimes erroneous (Dow, 1991). Russia's dominance in technologically was forecast as a definite, if the U.S. did not aggressively reform its educational system. American scientists believed a national policy in education should promote and strengthen mathematics and science knowledge of U.S. students (DeBoer 1997; Marsh 1963). Thus, began the movement to reform mathematics and science education in the U.S.

By 1957, the Physical Sciences Study Committee (PSSC) was established. Funded by the then recently-created National Science Foundation (NSF), the PSSC wanted to emphasize conceptual understanding over memorization and focus on fewer topics, rather than many. The groups' objective was to create new science textbooks, teachers' guides, and laboratory guides, revolutionizing science education (Dow 1991; Marsh, 1963).

Sputnik was the catalyst, in 1957, for education reform within the U.S., with emphasis on mathematics and science (Divine, 1993). Then, in 1958, during President Eisenhower's Administration, Congress passed the National Education Defense Act. The NSF was allotted funds through this Act to support programs, such as the Physical Sciences Study Committee (Marsh, 1963). Thus, U.S. education experts developed an interrelationship between mathematics, science, and technology, moreso because of the PSSC (DeBoer, 1997).

As explained, there have been clear advocates for education reform for more than 50 years. When Russia launched Sputnik, it was evident that Russia was surpassing the United States technologically. Americans began to look at their educational systems for increased competitiveness (Howes, 2005). At that time, scientists considered American education as mediocre. Mathematics was usually taught only as rote memorization, with no conceptual basis, and with outdated textbooks. America's technological position in the world was diminishing. By comparison, education in Russia focused more on mathematics and science (Clark, 1956). While the United States was drafting gifted students into the military, Russia was exempting gifted students from serving in the military. It seemed Russia would dominate scientifically unless America reformed its school system.

Government intervention. After the Sputnik launch, the American general public attributed Russia's feat to their better schools. President Eisenhower and Congress collaborated strategically to address public demands. The federal government, for the first time, became involved with the establishment of national educational priorities (Steeves, 2009). President Eisenhower and Congress passed the National Defense Education Act (NDEA) of 1957. This bill was the first and largest federal expenditure the nation sponsored towards education reform, in the amount of one billion dollars (Dow, 1991).

Michigan Institute of Technology (MIT) professors and American scientists collaborated to form the Physical Science Study Committee (PSSC) to review and evaluate the physical science content courses. This group's goal was student understanding of mathematics and science concepts. The PSSC developed and implemented new mathematics and science curriculums and new textbooks, with funding from the National Science Foundation (NSF). This reform caused textbook publishing companies to include content and concepts. This was the first time in education reform that science, mathematics, and technology were interrelated. Technologically, America was pressing forward again (DeBoer, 1997).

Developing mathematics standards. In 1983, the Education Commission's report, *A Nation at Risk* concluded the quality of education in America was a threat to our national security. Education reform was emphasized. However, for years following the report, there was no national education reform implemented (NCTM, 1989). Finally in

1989, the National Council of Teachers of Mathematics (NCTM), funded by the National Science Foundation (NSF), developed a standards-based curriculum. This was the official beginning of mathematics reform. The NCTM was instrumental in publishing national mathematics standards. In 1989, NCTM published the Curriculum and Evaluation Standards for School Mathematics. The standards were developed to improve mathematics instruction focusing on problem-solving, communication, reasoning, and connections. Less emphasis was placed on memorization of mathematics facts and more on conceptual understanding (NCTM, 1989).

In 1991, NCTM published the Professional Standards for Teaching Mathematics and then, in 1995, the Assessments Standards for School Mathematics. Standards-based mathematic curriculum was developed to be consistent with the recommended standards. The Department of Education lauded NCTM for several of its mathematic standards programs. However, standards-based mathematics was met with some opposition. Some organizations wanted to continue the traditional methods of teaching mathematic facts, instead of promoting students' developing conceptual understanding of mathematics and problem-solving. Although mathematics curriculums may differ because of state autonomy, more than 45 states implemented a standard-based mathematics curriculum using the NCTM standards as a guide (Infozine, 2010). By 2000, publication of Principles and Standards for School Mathematics (PSSM) was met with little controversy. The National Center for Education Statistics released a report in 2009, confirming Missouri's academic performance standards in reading and mathematics were among the most rigorous in the nation. Missouri's standards rated second-highest among all states in three out of four areas (Infozine).

In 2009, the researcher attended a symposium on mathematics education in the U.S. The keynote speaker, Hrabowski, was mathematics professor and President of the University of Maryland-Baltimore. The symposium was held at City Academy, a public-private elementary school located in the city of St. Louis, Missouri. Hrabowski was addressing the importance of developing children's mathematical thinking and proficiency during the early years in preparation for more advanced mathematics courses. The researcher posed a question to Hrabowski, "Should the U.S. develop a set of national mathematics standards?" Hrabowski's response was, "Yes, because mathematics is no different here in Missouri, than Florida" (personal communication, Hrabowski, April 2009). In fact, the National Council for Teachers of Mathematics (NCTM), National Governors Association (NGA), and The Council of Chief State School Officials (CCSSO) were collaborating on drafting the Common Core State Standards.

International ranking in mathematics. The international performance of U.S. students was a major concern since Sputnik. The Trends in International Mathematics & Science Study (TIMSS) 2011 report, showed the performance of U.S. students relative to their peers around the world in fifty-six countries and other education systems. The report showed the average U.S. mathematics score at fourth grade was 541, higher than the international scale score of 500. At fourth grade, U.S. students were ranked among the top 15 education systems in mathematics. However, eight other education systems scored above the U.S. average score. They were Singapore, South Korea, Hong Kong-China, Chinese Taipel-China, Japan, Northern Ireland-Great Britain, North Carolina-USA, and Belgium (NCES, 2013, p. iii).

The U.S. average mathematics score at eighth grade was 509, just nine points above the scale score average of 500. At eighth grade, U.S. students were among the top 24 education systems in mathematics. However, 11 other education systems scored above the U.S. average score. They were South Korea, Singapore, Chinese Taipel-China, Hong Kong-China, Japan, Massachusetts-USA, Minnesota-USA, the Russian Federation, North Carolina-USA, Quebec-Canada, and Indiana-USA (NCES, 2013, p. iv).

Conversely, in a 2009 report on Organization of Economic Cooperation and Development (OECD), countries ranking in mathematics placed the U.S. 25th out of 34 countries. The OECD average scale score was 496. The U.S. scored 487, below the scale score average (Program for International Student Assessment [PISA], 2009, p. 1).

The nation's report card. In the *Nation's Report Card*, published by the National Assessment of Educational Progress (NAEP), fourth and eighth-grade students showed marginal gains in mathematics. Fifth-graders' results are not reported in the *Nation's Report Card*. Mathematics scores were higher in 2013 than all previous years. Although students showed some improvement from 1990-2013, the score changes were not that dramatic. Fourth graders in 1990 scored 213 points; 2011 scored 241 points; and 2013 scored 242 points. Within approximately 20 years, fourth grade students improved only 29 points in mathematics. Eighth-graders in 1990 scored 263 points; 2011 scored 284 points; and two years later 2013 scored 285 points. Overall, within approximately 20 years, eighth-graders improved only 23 points (NCES, 2014, p. 4).

No Child Left Behind

The No Child Left Behind (NCLB) Act mandated that all children would achieve proficiency in mathematics by 2014 (Missouri Department of Elementary and Secondary

Education [MODESE], 2012b). Examining the state standardize test data at the time of the Act's adoption, this projected goal was perceived as unrealistic. By fifth grade, students' mathematics achievement levels were well below the projected timetable established by (NCLB). After being tested eight consecutive years, since third grade, fifth-graders showed incremental and fluctuating gains in mathematic achievement levels (MODESE, 2012b). Based on the evidence, it was predicted that all students would not attain full proficiency in mathematics by the end of the 2013-14 school year as mandated (U.S. Department of Education, 2010b). At the time of this writing, during the year 2014, the proficiency goal was not met.

It takes time to acquire proficiency in mathematics. Each school year, at each grade, students should become increasingly proficient. To become proficient, children need extensive time doing mathematics in the form of solving problems, reasoning, developing conceptual understanding, and practicing skills, while building connections between previous knowledge (National Research Council, 2001).

Characteristics of fifth graders. By fifth grade, children were challenged to think abstractly in their elementary experiences. Each child at this grade level does not develop socially, emotionally, physically, cognitively, or linguistically at the same rate. Fifth-graders, not only show physical changes following fourth grade, but also exhibit socio-emotional, cognitive, and language development. By fifth grade, children have a prominent characteristic to be more talkative, whether in the hallways, cafeteria, riding the school bus, or during school assemblies (Anderson, 2011). Table 1 shows the common characteristics of fifth-graders.

Table 1.

Fifth Graders-Common Characteristics

Social-Emotional
Work well in groups
Sensitive to and able to resolve issues of fairness
Able to enjoy cooperative and competitive games
Generally happy, enjoy family, peers, and teachers
Usually truthful; developing a more mature sense of right and wrong
Physical
Large muscles developing quickly
Drawn to the outdoors and physical challenges
Handwriting may become messier than in fourth grade
Due the growth spurts, frequently hungry and can tire easily
Cognitive
Enjoy rules and logic
Take pride in schoolwork
Good at memorizing facts
Enjoy collecting, classifying, and organizing
Able to concentrate for longer periods of time
Increasing able to think abstractly; good at solving problems
Language
Able to listen well.
Like to explain things.
Expressive and talkative.
Interest in reading independently becomes stronger.

Source: Anderson, 2011.

In any classroom there are students of various ages and developmental levels. Some fifth-grade classroom students may exhibit the characteristics of fourth-graders, and some may display the characteristics of sixth-graders. In some cases, students who are younger chronologically may be stronger academically (Anderson, 2011).

Are you smarter than a 5th grader? In 1993, Studio One debuted a popular television game show, *Are You Smarter Than a 5th Grader*? Content for the show was taken from elementary school textbooks; two questions were selected from each grade level, first through fifth grade. When a contestant answered a question incorrectly or decided to end the game prematurely, the contestant was required to state that he or she, "Is not smarter than a 5th grader" (personal communication, game show participant, July, 2014). Attempts were made to contact the show's producer, Burnett and the host, Foxworthy to ask more about the show's content. Neither of the two could be reached. The researcher was able to contact one of five cast members via Facebook, who appeared on 56 episodes of *Are You Smarter than A 5th Grader*? When asked, "why fifth-graders were specifically chosen for the show", her response was, "My best speculation is, fifth grade is a milestone grade" (personal communication, game show participant, July, 2014).

What nine and ten-year-olds should know. By the age of 10, children have a basic understanding of the number system. They can compute double-digit addition and subtract numbers mentally. They can solve problems consisting of triple-digit numbers. At this age, children have the knowledge to convert minutes to hours and vice-versa. Children also understand different combinations of coins and their monetary dimensions. Ten-year olds can also solve problems using the balance-beam determining the weights needed based on the beam and fulcrum distance from each other (Sousa, 2008).

Traditional versus conceptual understanding. Students can acquire meaning if mathematics is to be stored and retrieved when needed. Perhaps teachers need to focus on teaching lessons with meaning for students to retain the information. Memorizing multiplication tables and facts allows students to compute mathematics facts without any understanding of the principles. Students can skilled at memorization, then arrive at answers they cannot explain nor defend. Proficiency in mathematics required the student to use the appropriate algorithm to solve a particular problem. When students see mathematics as memorization, it has no practical meaning (Sousa, 2008).

Long-term memory can be stored in declarative and non-declarative memory. Declarative memory is when the brain preserves memory of facts and makes connections. Declarative memory is conceptual, while non-declarative memory is procedural (Sousa, 2008). Therefore, to engage long-term memory, mathematics should be taught as conceptual algorithm.

Purpose of the Study

The purpose of this research was to determine if there was a significant difference in the mathematics achievement of fifth grade Midwest Missouri students receiving instruction using the *EveryDay* Mathematics program in comparison to fifth grade students receiving instruction using the *EnVision* Mathematics program.

Student achievement was measured using the 2006-2013 mathematics scale scores on the Missouri Assessment Program (MAP) standardize test (MODESE, 2012b). This quantitative design was used to examine the impact of two different mathematics programs on student achievement.

Research Question

Is there a difference in fifth grade students' mathematics achievement levels on the Missouri Achievement Program (MAP) test when comparing the use of *EveryDay* Mathematics to the *EnVision* Mathematics program?

Hypotheses

Hypothesis A1. Among the study schools and study districts, there will be no difference in year-to-year proportions of students scoring Below Basic, Basic, and Proficient-Advanced on the 2006 – 2013 Missouri Assessment Program (MAP) fifth grade mathematics exams (Null Hypotheses 1 & 3).

Hypothesis A2: Within the study schools and study districts, student achievement measured by the MAP fifth grade mathematics exam, will be dependent on the school building and use of the *EveryDay* and *EnVision* study materials (Null Hypotheses 2 & 11).

Hypothesis A3: Among the study schools and study districts, there will be no difference in year-to-year proportions of students scoring Proficient-Advanced on the 2006 – 2013 Missouri Assessment Program (MAP) fifth grade mathematics exams (Null Hypotheses 4 & 5).

Hypothesis A4: Among the study schools and study districts, there will be no difference in proportion of students scoring Proficient-Advanced on the first year of the study, 2006, when compared to the last year of the study, 2013, measured by the Missouri Assessment Program (MAP) fifth grade mathematics exams (Null Hypotheses 6 & 7).

Hypothesis A5: Student achievement in the Proficient-Advanced category on the Missouri Assessment Program mathematics exam is dependent on the curriculum in use: *EveryDay* Mathematics or *EnVision* Mathematics, when considering the first year of study, 2006 and the last year of study, 2013 (Null Hypothesis 8).

Hypothesis A6: Within the study schools and study districts, student achievement measured by the MAP fifth grade mathematics exam, will be dependent on the phase of implementation of mathematics curriculum. The early phase was 2006-2008; the latter phase was 2009-2013 (Null Hypotheses 9 & 10).

Hypothesis A7: When comparing districts, there is no difference between average proportion in the Below Basic category and in the Proficient-Advanced category, measured by the fifth grade mathematics MAP (Null Hypothesis 12).

Hypothesis A8: There will be no difference in overall district proportion of students scoring Proficient-Advanced on the 2006 – 2013 Missouri Assessment Program (MAP) fifth-grade mathematics exams, when comparing District A, which prepared its students through use of *EveryDay* Mathematics, to District B, which prepared its students through use of *EnVision* Mathematics (Null Hypothesis 13).

Definitions of Terms

Adequate yearly progress (AYP). Under Title I of the No Child Left Behind Act of 2001, schools, districts, and states are held accountable for student performance on standardized tests. AYP is a measure to determine if schools are successfully educating all their students, including individual subgroups (House Research, 2003). Each state must establish a timeline for adequate yearly progress with the goal of all students performing at the proficient level by 2014. Students are tested on the standards yearly in grades three through eight, and at least twice for high school students. Test results are compared to prior years and determined if a school has met adequate yearly progress.

***EnVision* Mathematics.** A kindergarten through sixth grade core curriculum, published by Pearson Education, Inc. (1998) designed to meet the needs of all ability levels and help students improve their understanding of mathematics concepts (Caldwell et al., 2012; U.S. Department of Education, 2013b).

***EveryDay* Mathematics.** A pre-kindergarten through sixth grade core curriculum developed by the University of Chicago School Mathematics Project (UCSMP) (1985), and published by Wright Group/McGraw Hill (1998). The program provides multiple opportunities to learn concepts and practice skills (Bell et al., 2007; U.S. Department of Education, 2010a).

Curriculum. Curriculum refers to the set of standards used to form learning goals in the daily lesson plans formulated by teachers for their students. In this study, the word curriculum is used interchangeably with the term ‘program’ or ‘program of study’, and is represented by the two different sets of content delivery materials, *EnVision* Mathematics and *Everyday* Mathematics.

Missouri Assessment Program (MAP). The MAP is a mandatory standardized test administered annually throughout the state of Missouri during April and May. Students, grades three through eight are tested in reading and mathematics. The MAP measures what students are expected to know to indicate the teacher, school, and district AYP (MODESE, 2009b).

Missouri Department of Elementary and Secondary Education (MODESE). The agency that coordinates and regulates kindergarten-12th grade education in the state of Missouri (MODESE, 2013b).

National Assessment of Educational Progress (NAEP). *The Nation’s Report Card*, as the National Assessment of Educational Progress (NAEP) is often called, is the only nationally representative and continuing assessment of what America’s students know and can do in various academic subjects. Since 1969, NAEP assessments have been conducted periodically in reading, mathematics, science, writing, U.S. history, civics, geography, and other subjects. The NAEP assesses students at grades four, eight, and twelve in reading, writing, mathematics, and science. All states must administer reading and mathematics assessments for grades four and eight. The No Child Left Behind Act 2001, requires participation in NAEP of all schools receiving Title I funding. Reading and mathematics are tested every two years (U.S. Department of Education, 2013a).

National Council of Teachers of Mathematics (NCTM). NCTM is a nonprofit organization established as the public voice of mathematics education. NCTM is the global leader and authority in mathematics education, ensuring that high quality mathematics teaching and learning is provided for all students. In 1989, the NCTM developed the Curriculum and Evaluation Standards for School Mathematics, grades kindergarten through twelve mathematics education in the United States and Canada. The emphasis was on students' conceptual thinking and problem solving. The standards established a goal to promote equity and mathematical power for all students. A series of mathematics standards followed: Professional Standards for Teaching Mathematics (1991), Assessment Standards for School Mathematics (1995), and Principles and Standards for School Mathematics (2000) (NCTM, 1989; 1991; 1995; 2000).

National Governors Association. A collective collaboration of governors from 55 states, commonwealths, and territories. NGA provides governors with services regarding key federal issues. States were represented on federal issues that develop and implement public policy challenges and Best Practices (National Governors Association, 2013).

National Science Foundation (NSF). A government research agency formed by Congress in 1950, to support research and education in the fields of mathematics, science, economics, computer science, and social science. The NSF was the major source of federal support for these fields of study (National Science Foundation, 2013).

No Child Left Behind Act of 2001 (NCLB). Enacted in 2002, NCLB was designed to address the concerns about the quality of education in America with the implementation of standards-based education reform. Emphasis was on improving results of mathematics and reading. Schools, states, and districts are held accountable for student performance on standardized tests and must reach AYP for all student groups (U.S. Department of Education, 2010b).

Organization for Economic Cooperation and Development (OECD). The OECD consist of 30 member countries with relationships of 70 other countries. It is known for its publications and statistics covering such issues as; economics, education, development, and science. The OECD provides international data on participating countries' education systems and how they are performing academically. OECD publishes data on international assessments, such as PISA (Jackson, 2013).

Principles and Standards for School Mathematics (PSSM). Produced by the National Council of Teachers of Mathematics (NCTM), an international professional organization first published in 1989. The current edition was published 2000. Intended to be a resource guide for mathematics education grades prekindergarten through twelve.

Program for International Student Achievement (PISA). Tests administered every three years to fifteen-year-old students globally. The tests are to assess how well students are prepared in order to participate in society. PISA surveys reading, math, and science literacy. Approximately 58 countries participate (NCTM, 2000).

Standards-Based Curriculum. Mathematics learning, teaching, and assessments that shift the focus away from memorization and rote application of procedures toward standards for performance that are based on conceptual understanding and reasoning (Education Development Center, 1998).

Title I. Enacted as part of the Elementary and Secondary act of 1965. Reauthorized as part of the No Child Left Behind Act of 2001. The purpose of Title I is to provide states and school districts additional remedial education resources for children living in poverty. It is the government's commitment to closing the achievement gap between low-income and other students. Funds are used to improve academic achievement, professional development for teachers, parent involvement, extend learning time for students, and provide activities connected to raising student achievement. A Title I school is identified as one with a student enrollment of more than half low-income income (U.S. Department of Education, 2010b).

Trends in International Mathematics & Science Study. An international assessment of the mathematics and science knowledge of fourth and eighth grade students around the world. TIMSS was first administered in 1995, and every four years thereafter. Fifty-nine nations participated in TIMSS 2007. In 2011, TIMSS was administered at grade 4 in 57 countries and other educational systems and, at grade 8, in 56 countries and other educational systems (NCES, 2013).

University of Chicago School Mathematics Project. *EveryDay* Mathematics curriculum was developed by UCSMP in 1989, to enable children grades kindergarten through six to become more knowledgeable of mathematical content and develop their mathematical thinking. *EveryDay* Mathematics began with the focus that students can, and must learn more mathematics than required and expected in the past. Published by Wright Group/McGraw-Hill (Bell et al, 2007; UCSMP, 2013).

Identification of Variables

Mathematics achievement measured by the Missouri Assessment Program was the dependent variable of interest in the study.

The independent variable in the study was the choice of *EveryDay* Mathematics curriculum compared to *EnVision* Mathematics.

The subjects in this study who generated the secondary data used for analysis were fifth-grade students during 2006-2013 in urban Missouri public school districts.

Summary

Following the introduction of Chapter One is the literature review in Chapter Two. Chapter Two focuses on research showing national efforts to improve mathematics in elementary schools, mathematic standards, conceptual instruction, and understanding, global competiveness, teacher quality, the correlation between social economics and student achievement. Chapter Three gives the description of the methods and procedures used to conduct the research study. Chapter Four reports the analyses and results of the statistics applied. Chapter Five summarizes the previous chapters, discusses the findings, and suggests recommendations for future research.

Chapter Two: Literature Review

This chapter provides an overview of research relevant to how fifth-grade children learned mathematics in the United States. Historical catalysts recent at the time of this writing are presented, such as global contrasts, the U.S. education system, student attributes, teacher training (professional development) with regard to specific mathematics curriculum, teacher characteristics, school procedures, departmentalization in teaching assignments, time allotment in teaching mathematics topics, and mathematics curriculum choice.

Global Comparisons

The Trends in International Mathematics and Science Study (TIMSS) compared student achievement internationally for grades four and eight (NCES, 2013). TIMSS was administered every four years with approximately 56 countries participating. At the time of this writing, the next assessment was scheduled for 2015, with results expected by the end of 2016 (NCES).

TIMSS assessed the content domains of number, geometric shapes and measure, and data display for fourth-grade students. For eighth graders, TIMSS assessed the content domains of number, algebra, geometry, data, and chance (NCES, 2013). At both grade levels TIMSS assessed the cognitive domains of students' mathematical thinking for knowing, applying, and reasoning. The TIMSS scale average was set at 500 points (NCES).

Based on the TIMSS 2011 report, the United States scored 541 points for fourth grade (NCES, 2013). Eight other education systems scored higher averages than the United States: Singapore, 606; South Korea, 605; Hong Kong-CHN, 602; Chinese

Taipei-CHN, 591; Japan, 585; Northern Ireland-GBR, 562; North Carolina-USA, 554; and Belgium (Flemish)-BEL, 549 (NCES, 2013, p. 9).

At the eighth grade level, the United States score was 509. Eleven education systems scored higher averages than the United States: South Korea, 613; Singapore, 611; Chinese Taipei-CHN, 609; Hong Kong-CHN, 586; Japan 570; Massachusetts-USA, 561; Minnesota-USA, 545; Russian Federation, 539; North Carolina-USA, 537; Quebec-CAN, 532; Indiana-USA, 522) (NCES, 2013, p. 9).

U.S. Education System

During the 1980s, concern about mathematics achievement of U.S. students continued to grow (Stevenson, 1986). The National Research Council (2001) made recommendations to place emphasis on improving schools in the U.S. and suggested not to focus primarily on high school performance, because the problem with poor performance began much earlier. U.S. children began to fall behind in mathematics as early as kindergarten and continued through the elementary years. For secondary schools to improve in mathematics, remedial efforts were too late (Stevenson).

There seemed to be little argument that the teaching and learning of mathematics needed improvement. The U.S. took into account the dismal past and examined the success factors in other countries. The traditional method for mathematics was to develop new curriculum and articulate standards for what students should learn (Ball, 2003). However, the more important issue at hand for improving mathematics achievement was focus on the practice, context, content, and recipients of teaching. For example, teachers must understand the subject to effectively implement any chosen curriculum and aspire for student results that show improvement achieving new standards (Ball).

In the United States, diversity among students and differences among schools made a daunting task trying to forecast the best path for improving mathematics achievement. Substantial differences in schools, curricula, student preparation, and expectations of students made it difficult to describe a consistent experience in U.S. schools (Ashwill, 1999). The U.S. federal government did not have the authority to determine what students should learn and perform in any subject or grade level. Instead, state and local authorities had autonomy to implement standards for student performance. There were 50 decentralized state departments of education within the U.S. and 16,000 school districts - each managed and financed by local communities (Ashwill).

When the American economy shifted from an industrial workforce to a more technological workforce, there was additional impetus for higher standards in education (Ashwill, 1999). There was a perception that the U.S. was not meeting the needs of a 'high tech' workforce. Severe criticism ensued regarding U.S. public schools and the quality of education - especially when U.S. students ranked near the bottom in mathematics compared to other industrialized countries (Ashwill).

In other countries different approaches were used. For example, Singapore's education system was centralized and controlled by the Ministry of Education (Ministry of Education, 2000; 2003). The system implemented the chosen national curriculum, developed a syllabus to guide instruction for required subjects, and used high-stakes assessments. Prior to fifth grade, 80% of instructional time was devoted to learning English, the student's own cultural language (Chinese, Malay, or Tamil), and mathematics (Ashwill, 1999).

Student Attributes Related to Mathematics Comprehension

Several characteristics of a fifth grade child could influence the ability to learn mathematics. The 2011 TIMSS assessment revealed a correlation between U.S. student ethnicity and average mathematics achievement scores. As shown in Figure 1, when comparing the U.S. national average, Caucasian, Asian, and multiracial fourth graders scored higher than the TIMSS average of 500, while African-American and Hispanic students scored lower (NCES, 2013).

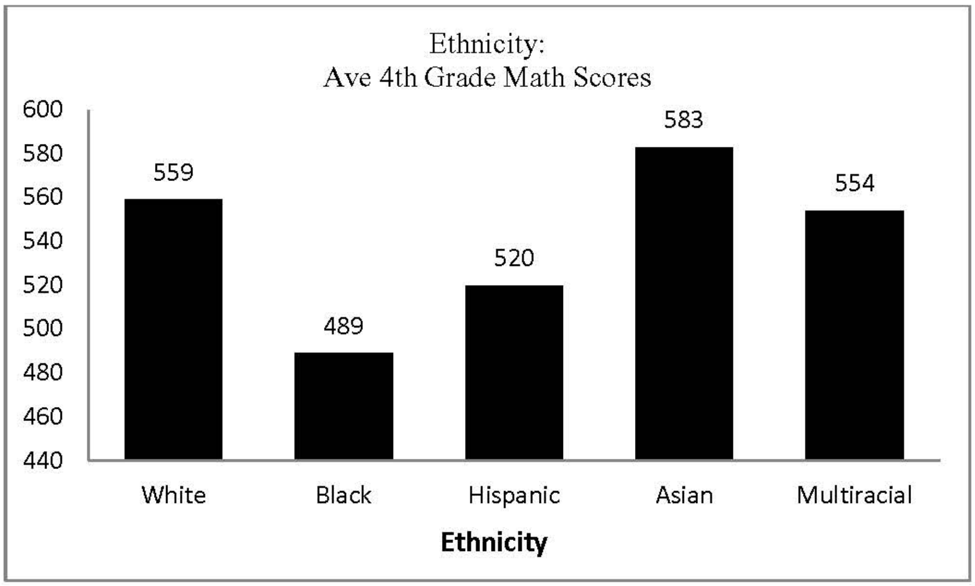

Figure 1. Average mathematics scores of U.S. 4th grade students, by ethnicity. *Source:* Trends in International Mathematics and Science Study, (NCES, 2013).

U.S. Caucasian and Asian eight graders' average mathematics scores were higher than the TIMSS scale average and the national average. However, African-American students scored below the TIMSS scale average, while both African-American and Hispanic students scored below the national average (NCES, 2013). As shown in Figure 2, multiracial eighth graders scored higher than the TIMSS scale average of 500. There was no measurable difference from the national average (NCES, 2013).

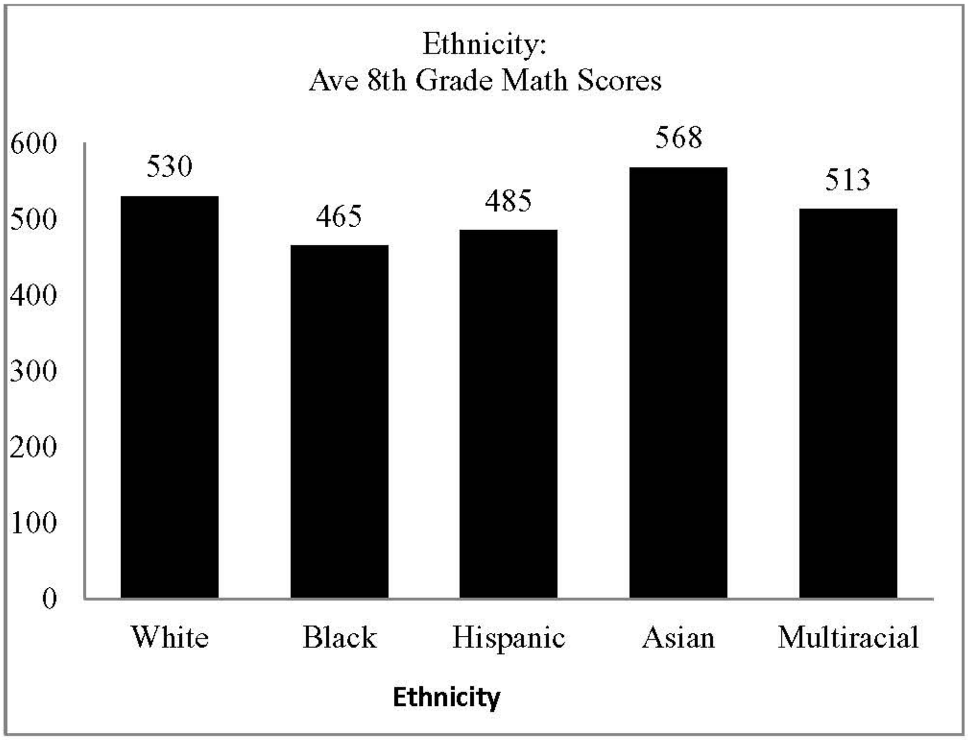

Figure 2. Average mathematics scores of U.S. 8th grade students, by ethnicity. *Source:* Trends in International Mathematics and Science Study, (NCES, 2013).

The TIMSS study also showed a relationship between mathematics scores and income level. Income level was operationally defined as the proportion of students eligible to receive free lunch meals or lunch at a reduced price. Fourth graders in the highest poverty public schools, with 75 %t or more students eligible for free or reduced lunch, were not measurably different from the TIMSS scale average, considering 505 compared to 500; however, fourth graders in the other categories with less than 75% eligible for free or reduced lunch, scored above the TIMSS scale average of 500. . However, as shown in Figure 3, fourth-graders in high poverty public schools and those with 50% eligible for free or reduced lunch, scored below the U.S. national average. Public schools with a smaller proportion of low income students scored above the U.S. national average (NCES, 2013).

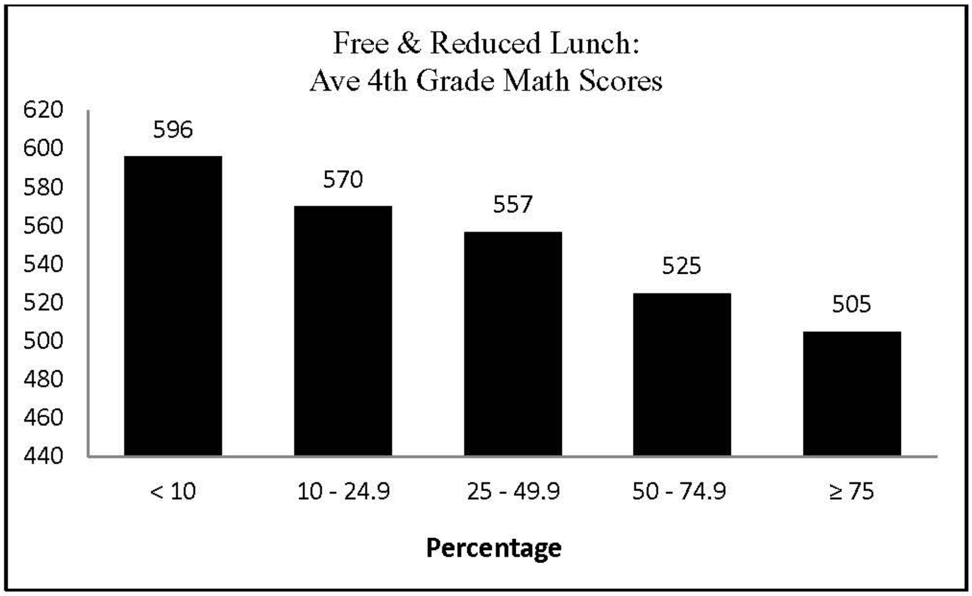

Figure 3. Average mathematics scores of U.S. 4th grade students by percentage of free/ reduced lunch. *Source:* Trends in International Mathematics and Science Study, (NCES, 2013).

Eighth graders in high poverty schools scored 468, which was lower than the TIMSS scale average of 500 (Figure 4). Students in public schools with 50% of eighth graders eligible for free or reduced lunch, but less than 75%, showed no measurable difference from the TIMSS scale average. U.S. eighth graders attending public schools receiving less than 50% free or reduced lunch scored above the TIMSS scale average and the U.S. national average. Students enrolled in schools eligible for more than 50% free or reduced lunch scored below the national average (NCES, 2013). Again, there seemed to be a correlation between the extent of poverty and students scoring below the U.S. national average.

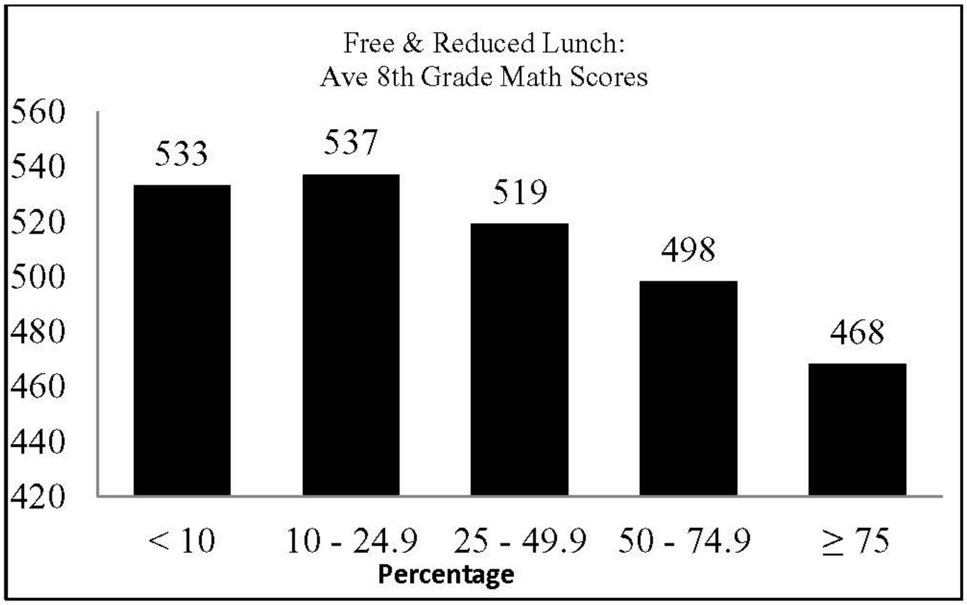

Figure 4. Average mathematics scores of U.S. 8th grade students, by percentage of free/reduced lunch. *Source:* Trends in International Mathematics and Science Study, (NCES, 2013).

Student attitudes pertaining to mathematics. Students' attitudes about how mathematics was taught, impacted their learning experiences and achievement (Borasi, 1990; Schoenfeld, 1985). According to Borasi (1990) and Schoenfeld (1985), in many instances students experienced mathematics as procedural and rule-oriented. This approach could prevent the student from developing mathematical competence.

Attitude towards mathematics was thought to be possibly gender related. For years, the stereotypical perception in the United States seemed to have been that boys performed better at mathematics than girls. It was thought that a girl's attitude towards mathematics significantly affected her confidence. Farooq and Shah (2008) completed a study of male and female students in Pakistan and found no significant difference in the children's confidence levels. The conclusion was students' mathematical success was dependent on attitude, rather than gender. Nonetheless, many studies have found male students more confident in mathematics than female students and that girls perceived mathematics as being dominated by males (Mubeen, Saeed, & Ariff, 2013).

A more recent trend to improve mathematics comprehension was to increase the perceived fun from mathematics. Students who believed they enjoyed learning mathematics and considered it like play, were thought to be more likely to devote time to learning the concepts (Yara, 2009). As explained, the students' gender, ethnicity, attitude, and expectation of fun regarding mathematics could interact with their abilities to learn mathematics.

Teacher Characteristics

As Chinese students continuously outperformed U.S. students on international mathematics competency assessments, the question was, 'Why?' U.S. teachers received more formal schooling than Chinese teachers. In fact, U.S. teachers completed between 16 and 18 years of schooling and received a bachelor's degree, in addition to furthering their education one or two years beyond the degree (Ma, 1999).

It was suggested that Chinese teachers' understanding of elementary mathematics far surpassed that of U.S. elementary teachers (Ma, 1999). Chinese teachers continued to develop throughout their professional careers. International studies of mathematics achievement found that Asian countries, typically China and Japan, outperformed their United States counterparts. Researchers described several factors that impacted the 'learning gap'. Cultural differences, parental expectations, school organization, mathematics curricula, and allotted time for learning mathematics were factors that were explored (Ma).

Ma (1999) refuted the learning gap as attributed to students and factors outside of the classroom. She advocated, "What is attributable to poor student performance in the United States is the lack of teachers' mathematical knowledge, which affects teaching and learning. This factor can be changed easier than cultural issues" (Ma, 1999, p. xix).

U.S. teachers may have lacked "pedagogical content knowledge" (Shulman 1986, p. 9), specifically the teacher's knowledge to represent and formulate mathematics for students to comprehend. Excellent teaching strategies represent the combination of content and pedagogy presented for instruction to diverse learners with different interests and abilities. Thus, in the researcher's opinion, teaching should begin with a clear understanding of what must be learned and how it should be taught. Although learning is the responsibility of the students, teachers must provide instruction and opportunities for students to learn. Teaching ends with the acquisition of new comprehension for both teacher and student.

Howe (1999) explained how Chinese mathematics teachers outperformed U.S. mathematics teachers. Learning mathematics procedures with no understanding affects the students' ability to determine which specific calculations are needed. According to Howe, Chinese teachers had the ability to teach their students how to use both, because one supports the other. Chinese teachers placed an emphasis on the learning goal of "knowing how and knowing why" (Howe, p. 884).

U.S. teacher preparation did not ensure teachers acquired the necessary skills to teach for understanding. Factors that exemplified Chinese teachers were: early training in mathematics; mathematic teachers as specialists; and Chinese teachers provided time to study teaching materials and interact with colleagues. Chinese teachers focused on teaching excellence, known as, "profound understanding of fundamental mathematics [PUFM]" (Howe, 1999, p. 885). By focusing on two major ingredients, the subject matter and the students, PUFM involved communicating the subject matter for student learning. As students learned the subject matter, the art of teaching was evident (Howe).

Teacher knowledge of mathematics. Ball (2003) explained that knowledge was paramount for the use of instructional material, assessing students, and making sound decisions about presentation. Improvement of students' learning was dependent on quality teaching, and quality teaching was dependent on skilled teachers. Teachers' knowledge of the subject matter improved the quality of teaching. Yet, U.S. teachers were deficient in mathematical understanding and skill. Teachers and other adults in the U.S. received the same mathematics education during their school experience. Requiring teachers to take more mathematics courses was not the solution. Teachers must acquire the mathematics knowledge and skill to achieve the ultimate goal: improve students' learning (Ball).

Teacher attitude towards mathematics. Another factor relating to high performance, as reported by Schofield (1981) was the correlation between positive teacher attitude and high achievement of students. Bridget, Vemberg, Twemlow, Fonag, and Dill (2008) studied teachers' attitude towards mathematics and how it impacted students' performance. Teachers were role models to their students, whose behaviors were observed and emulated by students. How teachers exhibited their attitudes towards the teaching of mathematics significantly affected their students' learning. Teachers must be cognizant of the important issue at hand. It is not what they teach, but how they teach their behavior and interaction with students (Yara, 2009).

Teachers' emotional and behavioral responses towards mathematics reflect their attitudes towards the subject matter. Clarke, Thomas, and Vidakovic (2009) suggested the attitudes and practices related to teaching mathematics were intricately affected by emotions, beliefs, social context, and content knowledge. Studies confirmed any inhibitions teachers may exhibit towards mathematics were characterized by their emotional responses, anxiety, and self-confidence associated with mathematics (Brady & Bowd, 2005, Henderson & Rodrigues, 2008, Philippou & Christou, 1998). Henderson and Rodrigues (2008) studied teachers' self-esteem and its connection to mathematics. They found half of both pre-service teachers and highly qualified showed low self-esteem in mathematics. Burks, Heidenburg, Leoni, and Ratliff (2009) specified that learners were motivated to achieve in mathematics, based on the disposition or self-confidence exhibited by the teacher when teaching mathematics. Learners developed their own attitudes and beliefs about mathematics, based on the role model teacher.

Philippou and Christou (1998), found a correlation between a teachers' beliefs and attitude towards mathematics, be it positive or negative. A teacher who sees no relevance or connection of mathematics and its' relationship in the real world believes students should learn mathematics as memorized procedures, rules, and algorithms without meaning. This was how many students developed a negative attitude towards mathematics. Also, a teacher's perception of gender ability could negatively impact girls' self-confidence. Yara (2009) emphasized that students developed a positive attitude towards mathematics based on several teacher-related factors: teachers' thorough knowledge of mathematics, resourcefulness, and enthusiasm, ability to make mathematics interesting and fun through the eyes of a child.

Teacher professional development. At the time of Yoon's (2007) writings, there were more than 1,300 studies examining the effectiveness of professional development on student achievement. The results indicated that teachers receiving professional development an average of 49 hours could increase student achievement by 21 percentile points. Meaning, professional development had an effect on student achievement. Teachers receiving more than 14 hours of professional development had a positive effect on student achievement. Those receiving 5-14 hours showed no significant effect (Yoon, 2007, p. iv).

There are three steps on how professional development affects student achievement:

1. Professional development enhances teacher knowledge and skills.

   Professional development must be of high quality in its theory of action, planning, design, and implementation.

2. Better knowledge and skills improve classroom teaching.

   Teacher must have the motivation, belief, and skills to apply the professional development to classroom teaching.

3. Improved teaching raises student achievement.

   Teaching improved by professional development raises student achievement. The challenge was evaluating the gains. (Yoon, 2007, p. 4)

If one step was not applied, improved student learning could not be achieved. If the teacher did not apply the new knowledge gained from professional development in the classroom, then the student did not benefit (Yoon, 2007).

Birman et al. (2007) reported a small number of teachers received professional development in mathematics that was intensive, on-going, and content-focused. Teachers received on average 8.3 hours of professional development on mathematics instruction and approximately 5.2 hours of comprehensive study in mathematics content during the school year and summer. Professional development in mathematics for elementary teachers focused more on instructional strategies than in-depth mathematics study. At the secondary level, teachers received more in-depth mathematics study. However, both elementary and secondary mathematics teachers received less than 24 hours of professional development within a school year, which was an insufficient amount of study to improve student achievement (Birman et al.).

Family Variables

It was interesting to note that, according to Stevenson (1986), by fifth grade both Japanese and Chinese children outperformed U.S. children mathematically. However, there was no difference in the cognitive abilities of the children from those three countries. The differences existed in the time spent practicing mathematics, parental beliefs, and parental involvement. It was also noted that boys and girls showed no statistically significant differences in average scores at the fifth grade levels (Stevenson).

Parents' beliefs about success may have influenced the experiences they provided their children. Parents who believed a child's ability was a requisite for success may not have emphasized the importance of working hard, in contrast to a parent who believed success was contingent on effort. Culturally, there were differences in beliefs regarding the relative factors that may lead to student success in school. American mothers believed success in school was attributable to ability, while Japanese and Chinese mothers believed student success was due to hard work and effort (Stevenson, 1986).

Family Structure and Student Achievement

The student population in schools at the time of Sweet and Bumpass (1990) was much different than in the previous 50 years. More than half of the children born in the United States resided in a single-parent household. The transformation in family structure has made an impact on children attending schools and student achievement (Sweet & Bumpass). In 1960, 8% of children resided in single-parent households headed by the mother. In 1992, single-parent households increased to 23 % (DaVanzo & Rahman, 1993, p. 560). In 1970, 12% of children under 18-years-of-age were living with a single-parent. By 1992, there were 27% of 18 year olds living with a single-parent (U.S. Bureau of the Census, 1992, p. ix). Not only were the majority of families in the U.S. single-parent, but the number of stepfamilies were increasing.

Astone and McLanahan (1991) and Downey (1994) suggested there was increased evidence that children living in single-parent families did not perform well on standardized tests, with less possibility of completing high school or attending college, in comparison to children living with both biological parents. Also, children from single-parent families tended to exhibit behavioral problems.

Findings by Astone and McLanahan (1991) and Downey (1994) implied a correlation existed between family structure and children's future welfare. Schooling affected future employment opportunities, which meant children from single-parent families were more likely to attain lower socioeconomic status into adulthood. Socioeconomic and educational disadvantages then became a cycle, passed on from generation to generation. Focused attention should be placed on the increase in single-parent families and the effect on children and the school environment (Pong, 1997).

McLanahan's (1985) findings indicated that children living in a female-headed family were most likely at risk of poverty. Educational attainment and family income were related factors, and nearly one-half of U.S. families were single-parent, living below poverty. Female-headed families with children had a poverty rate five times that of married families.

Family structure, along with educational expectations, were associated with socioeconomic status, ethnicity, and the academic performance of children on standardized tests. Research on the demographic breakdown of single-parent households indicated 15% of Caucasian children, 27% of Hispanic children, and 54% of African-American children lived with a single-parent. In addition, there was a strong relationship between socioeconomic status and the cognitive scores of children (Lee & Burkam, 2002).

Income differences between single-parent and two-parent families can be connected to the academic achievement gap in children's standardized tests scores, high school graduation rates, and college enrollments. Low-income mothers in single-parent families were likely to work, which resulted in less supervision of children at home, in some cases leading to behavioral problems in school (McLanahan & Sandefur, 1994). Less parental supervision at home also may have contributed to lower performance at school (McLanahan & Sandefur).

Parental involvement. Parental involvement was significantly important, as was socioeconomic status in the academic performance of children living in single-parent households. There was a distinct parallel between parental involvement and school achievement. Yet, parental involvement from single-parent families remained low. Differences in parenting set a precedent over economic resources. The comparative lack of single-parent involvement with the daily supervision of children's schooling led to poor academic behaviors and school failures (Mulkey, Crain, & Harrington, 1992). In light of socioeconomic status, Astone and McLanahan (1991) found the relationships and interactions between parent and child were less frequent in reference to monitoring school work and general supervision. The educational aspirations and expectations single-parent households held for children were low compared to two-parent families contributing to poor school achievement.

A high proportion of enrollment by students from single-parent families can affect overall school building and district achievement overall. First, schools with a high concentration of single-parent families become low socioeconomic status schools, poorly financed with fewer learning resources than the higher socioeconomic status counterparts (Gamoran, 1992; Williams, 1992). Low socioeconomic families most likely lived in poor neighborhoods, and in the school environment, teachers and staff may have exhibited low morale and low student expectations. Consequently, economically disadvantaged families and schools produced low achieving students (Gamoran; Williams). Second, these schools had limited social relations among single-parents, which lessened parental involvement, and stronger relationships among families and school personnel. Schools with strong parental involvement produced student and school success.

Research showed a correlation between parental involvement and student success in school. Further studies demonstrated a link between parental involvement and the positive effect on children's educational development and academic motivation (Gottfried, Fleming, & Gottfried, 1994). Assessing academic motivation showed a child's positive home environment had greater emphasis on student success than socioeconomic status. Children's development and intrinsic motivation to learn was strongly influenced by parents who set high expectations and beliefs for learning (Gottfried et al.).

Even though some parents were not highly educated and of low-socioeconomic status, children could still develop positive attitudes and motivation towards academics through parental encouragement, support, and expectations. While lack of resources for low-socioeconomic parents limited their ability to expose children to new experiences outside of the home or increase parental involvement in school activities, parents could still be supportive of children's academic progress (Grolnick, Friendly, & Bellas, 2009).

Family background factors. For over a decade, closing the achievement gap between low-socioeconomic families and more advantaged families and different racial backgrounds, was a major goal of school reform (U.S. Department of Education, 2010b). These gaps in academic performance and cognitive skills were evident from the beginning of children's school experiences and continued as children aged. There were four key components to the socioeconomic well-being of children: income, education, family structure, and neighborhood conditions. It was expected that the achievement gap would continue to widen until the four components were addressed (Rouse, Brooks-Gunn, & McLanahan, 2005; Timar & Maxwell-Jolly, 2012; U.S. Department of Education, 2010b).

School Procedures

Time allotted to mathematics. An important factor in learning mathematics was the time spent practicing the material. U.S. first-graders' engagement in mathematics activities was less than that of Chinese and Japanese children. U.S. children spent 69.8% engaged in mathematics, while Chinese children spent 85.1% and Japanese children 79.2%. By fifth grade, the amount of time engaged in mathematics activities was lower for U.S. children compared to Chinese and Japanese children. U.S. children spent 64.5% of instructional time learning mathematics. Chinese fifth-graders spent 91.5% and Japanese fifth-graders 87.4%. (Stevenson, 1986, p. 695).

U.S. children in both first and fifth grades on average spent less than 20% of instructional time studying mathematics. One attribute to the low achievement of U.S. children was the smaller amount of mathematic instruction compared to their counterparts. Chinese and Japanese children also attended school on Saturdays for half a day and recognized fewer holidays than U.S. children. As a result, U.S. children's academic school year was approximately 180 days; Chinese and Japanese children attended school 240 days (Stevenson, 1986, p. 696).

Departmentalizing in fifth grade. Traditionally, elementary schools were organized as self-contained classrooms, based on the assumption that elementary teachers were proficient in several disciplines. Students received academic instruction from one classroom teacher responsible for teaching four or more subjects. It became evident most teachers were not specialized to teach many of the subjects required of them. Therefore, to address the instructional quality of core subjects, departmentalization at the elementary level needed to be considered (Chan & Jarman, 2004; Chan, Terry, & Bessette, 2009).

Although some researchers suggested the emotional needs of students were not addressed in a departmentalized structure, there were a number of advantages to that type of organization. Advantages included: (1) students received instruction from teachers who specialized in a particular subject; (2) increased teacher satisfaction with a focus on subject and lesson planning; (3) increased instruction time on task; (4) retention of highly qualified teachers and (5) stronger preparation for students transitioning to middle school (Chan & Jarman, 2004; Chan et al., 2009).

A 2011 study was conducted by Yearwood at Liberty University to determine the reading and mathematics achievement on the state assessment of fifth-grade students taught in a departmentalize setting as opposed to a traditional setting. A causal-comparative design was used to determine if there was any difference in fifth-grade student reading and mathematics achievement measured by the 2010 Georgia Criterion Referenced Competency Test. Although each group in the study was ethnically diverse, the majority of the participants were Caucasian (72%), Asian (1.2%), African-American (7.1%), Hispanic (16.8%), Multi-Racial (1.7%) and American Indian (0.3%). The results from the study indicated a significant difference in the reading and mathematics scale scores based on organizational structure. Students' mathematics achievement increased by 5.63, while reading increased by 1.89 points (Yearwood, 2011, p. 110).

How curriculum is launched. Implementing a new mathematics curriculum did not mean equal delivery was assumed. There were three key factors that were important (1) various actions to support teachers; (2) identification of the person or department responsible facilitating for the changes; and (3) understanding that change takes time, under any circumstance. Implementation could take several years (Hord, 1986).

In order to effectively implement a new mathematics curriculum, interventions must be provided by the school principal as the 'change facilitator'. The success or failure of implementing a new mathematics curriculum was contingent on examining the quality of the program (Hord, 1986). Staff development and in-service training has been viewed as important for teachers implementing a new curriculum. But, educators found that helping teachers change their practices was important and a process. To accomplish this, teachers must be provided individualized and on-going assistance (Hord). Successful implementation of a mathematics curriculum required an extensive amount of consultation and reinforcement, during the first two years (Hord).

Choice of Mathematics Curriculum

It was the researcher's opinion that proficiency in mathematics at the elementary level was the foundation for fifth-graders to become algebra-ready by eighth grade. Early elementary mathematics was an important prerequisite for solving unknowns in algebraic thinking. This component was paramount since educators knew this direction was most appropriate. In order to improve the mathematics proficiency of students, more focus must be placed on children's early mathematics experiences at the elementary level. Children's early learning experiences in the first six years, provided positive results in building acquired knowledge and developing a strong mathematics foundation (NAEYC & NCTM, 2002).

It became a prerequisite for elementary teachers to prepare students to become proficient in algebraic thinking and comfortable using variables and solving simple equations [ex. $8 – 2 = \square$]. Using the base-ten number system, teachers could build on students' algebraic knowledge (Massachusetts Department of Education, 2007).

The federal program NCLB mandated that all students in the USA would be proficient in mathematics by the year 2014 (U. S. Department of Education, 2010b). This projected goal seemed overly optimistic when we examine the results of state standardized tests at the time of this writing. However, many school districts hoped to get better results in the future from a particular mathematics curriculum program. At the time of this study *EveryDay* Mathematics and *EnVision* Mathematics at the fifth grade level were core curriculum choices to possibly improve student achievement (Bell et al, 2007; Caldwell et al., 2012).

***EveryDay* Mathematics.** *EveryDay* Mathematics was created at the University of Chicago in Illinois USA and published by the Wright Group of McGraw-Hill (UCSMP, 2013). *EveryDay* Mathematics was a pre-kindergarten through six grade program focusing on real-life problem solving, student communication of mathematical thinking, and use of technology (UCSMP). The poor results of U.S. mathematics performance on international tests during the 1980's caused the NCTM to develop a new approach of teaching mathematics, focusing more on problem-solving, reasoning, and conceptual understanding (NCES, 2013; UCSMP).

Following development of the 1989 NCTM Standards, funded by the National Science Foundation (NSF), the *EveryDay* Mathematics curriculum was implemented. A longitudinal study of the *EveryDay* Mathematics curriculum followed, funded by the NSF, to look at children's development and achievement using a standards-based curriculum (Carroll, 2001).

The results of a fifth grade international comparison showed that *EveryDay* Mathematics fifth-graders' mean score was 75%, the Japanese was 80%, the Chinese was

76%, and U.S. fifth-graders using traditional instruction had a mean score of 44% (Carroll, 2001, p. 36). The results also showed that from first to fifth grade, *EveryDay* Mathematics students maintained mathematics performance, as did the Japanese and Chinese students. The U.S. comparison sample continued to fall behind from 21% at first grade, to 36% by fifth grade (Carroll, p. 36). *EveryDay* Mathematics students more than doubled their mean score compared to the comparison group (Carroll, 2001). In 2010, the U.S. Department of Education, Institute of Education Sciences, published the program description, research, and effectiveness of EveryDay Mathematics. *EveryDay* Mathematics was found to have a potentially positive effect on mathematics achievement with an 'improvement index' of +11 percentile points (U.S. Department of Education, 2010a, p. 2).

***EnVision* Mathematics** *EnVision* Mathematics was published by Pearson Education (2007). *EnVision* Mathematics was a kindergarten-through-sixth grade program focused on reasoning and modeling. In 2013, the U.S. Department of Education, Institute of Education Sciences, published the *EnVision* Mathematics program description, research, and effectiveness. The programs' rating of effectiveness was found to have potentially positive effects on mathematics achievement for elementary students with an 'improvement index' of +1 to +9 percentile points (Caldwell et al., 2012; U.S. Department of Education, 2013b, p. 1).

EnVision Mathematics met the needs of students and teachers without minimizing the strength of the curriculum. It contended to be the first program to use interactive and visual learning to develop students' mathematic concepts. *EnVision* Mathematics was a data-driven program, designed to provide differentiated instruction to address the individual needs of each student. The program was organized by providing teachers with color-coded mathematics strands and focused on a 20-topic teacher edition (Resendez, 2009).

A two-year study was conducted in 2009, by Planning, Research, and Evaluation Services (PRES) to examine the effectiveness of the *EnVision* Mathematics program and the performance of elementary students (Resendez, 2009). *EnVision* Mathematics (2009) was published in alignment with the NCTM curriculum focal points. The results over the two-year study period showed significant growth in mathematics knowledge and skills across all grade levels. Student improvement was identified in mathematics concepts, computation, problem-solving, and math vocabulary. The study contended that during the second year of *EnVision* Mathematics and following, substantial growth rates would become evident (Resendez). The study also suggested that all subpopulations in the lower and upper primary grades showed significant gains in mathematics skills and concepts, including special education students, students receiving free and reduced lunch, males and females. (Resendez).

Summary

During the timespan accessed by this literature review, 1981 – 2013, school districts throughout the U.S. continued to seek effective standards-based mathematics programs to improve student achievement and maintain compliance with the No Child Left Behind Act. This study will provide information to those school districts presently using or considering *EveryDay* Mathematics or *EnVision* Mathematics curriculum materials. This study analyzed the collected data and attempted to determine the effectiveness of both standards-based programs and measured fifth grade student achievement using the Missouri Assessment Program.

The review of literature identified factors that impacted children's mathematics achievement, such as characteristics of the child, the family, the school, the teacher, and the structure of the U.S. education system. Chapter Three describes the methodology used in this study. The participants, instruments, procedures and research design used in this study are identified and discussed.

Chapter Three: Methods

Identifying whether or not one set of mathematics curriculum materials results in stronger academic outcomes than another and significantly improves students' mathematics performance, may provide school districts with useful information to improve student achievement. For this study, a comparison of student achievement outcomes allowed the researcher to decide if a difference in performance existed between students studying with *EveryDay* Mathematics and students studying with *EnVision* Mathematics.

The purpose of this study was to determine if there was a significant difference in the mathematical achievement of two urban Midwestern fifth-grade schools using the *EveryDay* Mathematics standards-based program and two urban Midwestern fifth-grade schools using the *EnVision* Mathematics standards-based program.

This study examined each mathematics programs and determined the level of student performance on the annual Missouri Assessment Program (MAP) state mathematics assessments, over the span of eight years.

This chapter describes the design, methods, and procedures used to conduct the study. It includes description of the participants, instruments developed, data collection, and analysis procedures used.

Overview of Research Methods

This quantitative study examines the mathematics achievement levels of fifth-grade students receiving instruction using the EDM program and the *EnVision* Mathematics program measured by the MAP test and compares the achievement levels of both the experimental and control groups. Chapter Four will describe the results of the statistical analysis.

Federal School Improvement Grant 2010-2011. Though more than $17.3 million was awarded to assist 32 struggling schools in Missouri, neither of the School Districts contributing mathematics student outcomes data to this study received portions of the federal money (Infozine, 2010, p. 1). Therefore, a number of Missouri school districts continued to find avenues to improve student achievement in areas such as mathematics using low-cost strategies. One avenue schools have is to carefully consider curriculum study materials. This study compares outcomes of the use of *EveryDay* Mathematics and *EnVision* Mathematics study materials. The Federal School Improvement Grant funding was for school improvement initiatives over a period of three years. Missouri school eligibility for these funds was based on low achievement on state reading and mathematics assessments over the three years preceding award of the funds, or on the schools' graduation rates. Schools selected to receive the grant awards was by the Missouri Department of Elementary and Secondary Education (MODESE). Under the direction of the U.S. Department of Education, one of four school reform models would be identified and implemented: turnaround, restart, school closure or transformation (Infozine, 2010).

Seventeen Missouri schools implemented the transformation model which includes: replacing the principal, reforming the curriculum, providing extensive professional development, and extended learning time. The other 15 schools implemented the turnaround model which includes: transforming strategies in addition to requiring adoption of a new governance structure, screening existing staff and rehiring half the teachers. None of the schools in this study were identified as struggling schools. Therefore, federal school improvement grants were not awarded (Infozine, 2010, p. 1).

Research Setting

The setting for this study consisted of two Midwestern urban public school districts in the state of Missouri. Two schools were selected from within each district. The student population of each school consisted of pre-kindergarten through fifth grade. The two urban public schools from the larger school district, identified as School District B, had a combined student population of 180 students. The two urban public schools from the smaller school district, identified as School District A, had a combined student population of 180 students.

The mathematics standards for both districts and schools were the same, based on the Missouri State Standards. Although each district used a different mathematics curriculum represented by the publishers' versions of *EveryDay* and *EnVision* mathematics, it was a state requirement that all teachers align their mathematics instruction with the Missouri State Standards (MODESE, 2009b).

Research Premises

There were two fundamental premises for this research, based on the design of the study. Certain variables were selected in the study to highlight any true significant differences due to the experimental variables. The experimental independent variable was the curriculum choice of *EveryDay* Mathematics for one district and *EnVision* Mathematics for the other. The dependent variable used for the eight-year period of secondary data collection was student achievement, measured by student scores on the mathematics portion of the Missouri Assessment Program for fifth-grade students.

Years of curriculum implementation were similar. This research was built to have more power, precision of measurement, by studying mathematics curriculum for eight years. The data collected was from MAP assessment scores for the years 2006 - 2013. The first research premise in this study was that the particular years of data collection do not matter. This meant that there was no expected effect on student mathematics achievement related to earlier or experienced or later years of using a mathematics instruction program. Thus, null hypotheses were designed to check for no difference in average student scores, within the particular populations chosen for this study.

Schools chosen within the districts were similar. The second research premise in this study was the schools in each of the two districts were alike. Again, for research power, precision in comparing the curriculum, two schools were utilized in each of two urban districts. The schools were chosen to be matched on ethnicity, socio-economic status, location, and other previously described characteristics. The schools chosen were comparable between the districts, and between each other. However, each district chose a different mathematics curriculum. Because of the school similarity, there was no expected significant difference between the schools in the same district. The level of student mathematics achievement in schools W and N of district A was expected to be the same. Likewise, the level of student mathematics achievement in schools D and H of district B was expected to be the same. Continued discussion of similarities is in Chapter Four (Tables 21 – 31). The null hypotheses for the second research premise checked for differences in student achievement and independence of the curriculum chosen by the study school districts.

Research Design

Using a 2x2x8 across quantitative design through use of two study school districts, each with two schools represented, throughout an eight-year data collection, this study examined the MAP performance level of two groups of fifth-graders using the *EveryDay* Mathematics program and two groups of fifth-graders using the *EnVision* Mathematics program. This study examined the potential differences in the MAP achievement levels between two groups of fifth-grade students representing two urban school districts with similar demographics. Information about the districts and schools selected for this study were obtained from the Missouri Comprehensive Data System (MCDS), which provided demographic and financial information about public schools and districts operating in the state of Missouri.

Mathematics Curriculum by District

Table 2 shows the mathematics curriculum used by each district and school in this study. Schools W and N from Study School District A used *EveryDay* Mathematics and was treated as the experimental group. Schools D and H from Study School District B used *EnVision* Mathematics and was treated as the control group for purposes of this study. The use of *EveryDay* Mathematics and *EnVision* Mathematics was in place in each of the respective districts for the eight-year duration of the secondary student achievement data used for analysis.

Table 2.

District Mathematics Curriculum Materials

District	Curriculum	Schools
A	*EveryDay* Mathematics	W and N
B	*EnVision* Mathematics	D and H

Research Question

Is there a difference in fifth grade students' mathematics achievement levels on the Missouri Achievement Program (MAP) test when comparing the use of *EveryDay* Mathematics to the *EnVision* Mathematics program?

Subjects from School Districts

The population that generated secondary data for the study consisted of approximately 180 fifth grade students using the *EveryDay* Mathematics program and a group of approximately 180 fifth grade students using the *EnVision* Mathematics program. Data for the study was gathered through use of convenience sampling. Four fifth grade classes were chosen, two from each of two different districts. Randomization was not utilized. The sample population selection criteria included the following characteristics:

Similarity of Districts

1. Two urban public schools in Midwestern Missouri similar in demographics with two districts in Midwestern Missouri listed on the Missouri Comprehensive Data System.
2. School District A receiving *EveryDay* Mathematics instruction for three consecutive years prior to the mathematics MAP; since third grade.

   School District B receiving *EnVision* Mathematics instruction for three consecutive years prior to the MAP; since third grade.
3. Majority of the student populations received free and reduced lunch.

Table 3 shows the demographics of School District A, a smaller urban public school district using the *EveryDay* Mathematics program with a student enrollment of approximately 99% Black.

Table 3.

School District A Enrollment Demographics

	2006	2007	2008	2009	2010	2011	2012	2013
Total	3,264	3,314	3,325	3,110	3,009	2,906	2,740	2,508
Asian	*	*	0	0	0	0	0	0
Black %	97.8	98.4	98.7	99.2	98.9	98.5	97.7	99.2
Hispanic	*	0	0	0	*	0	*	*
Indian	*	0	0	0	0	0	0	0
White	*	*	*	*	*	*	*	*

Source: District demographic data was obtained from MODESE, 2013d.
* Indicates the percent has been suppressed due to a potential small sample size.

Table 4 shows the demographics of School District B, a larger urban public school district using the *EnVision* Mathematics program with a student enrollment of approximately 81% Black.

Table 4.

School District B Enrollment Demographics

	2006	2007	2008	2009	2010	2011	2012	2013
Total	35,361	32,135	27,574	26,108	25,046	23,576	22,516	25,200
Asian	*	*	*	*	*	*	*	*
Black %	81.8	81.7	81.4	81.0	80.6	80.5	80.0	82.3
Hispanic	*	*	*	*	*	*	*	*
Indian	*	*	*	*	*	*	*	*
White %	14.0	13.6	13.6	13.7	13.7	13.5	13.6	11.7

Source: District demographic data was obtained from MODESE, 2013d.
* Indicates the percent has been suppressed due to a potential small sample size.

Similarity of Schools

Both groups for this study received departmentalize instruction by assigning mathematics teaching responsibilities to classroom teachers who teach only mathematics for the school building. School District A consisted of Schools W and N using *EveryDay* Mathematics and School District B consisted of Schools D and H using *EnVision* Mathematics. The ethnicities of the student population of both districts and schools were a majority of African-American.

Table 5 shows the similar demographics with regard to fifth grade students eligible for free and reduced lunch. All four participating schools in the study showed a large majority of students eligible. Each of the four schools were classified as Title I, based on the large proportions eligible for free and reduced lunch. The student populations were of low-socioeconomic status.

Table 5.

Demographic Data 2006-2013 Percentage of Free/Reduced Lunch

Year	2006	2007	2008	2009	2010	2011	2012	2013
School D	90	97	87	84	94	97	99	99.6
School H	93	91	89	80	93	95	92	92.5
School W	89	94	97	91	89	83	90	88.9
School N	85	89	91	93	92	90	89	91.8

Source: Building level data. Data was obtained from MODESE, 2013c.

Participants from Two Districts

There were approximately 360 fifth grade students enrolled each year in the two study school districts, in this eight year study. Of this number, approximately 180 students attended an urban public school district implementing the *EveryDay* Mathematics program This school district had been in existence for over 125 years and had an approximate annual enrollment of 3,000 K-12 students (MODESE, 2012a).

There were six elementary schools, one junior high, and one high school. Table 6 indicates the enrollment and staff data for School District A at the elementary, junior high, and high school levels. The table also indicates the academic level of 251 certified teachers and approximately 2,500 students. School District A was the smaller of the two study school districts (MODESE, 2012a).

Table 6.

School District A Enrollment

	Schools	Cert. Staff	Residents	Non-Res	Total
Elementary	6	142	1,476	0	1,476
Middle Schools	0	0	0	0	0
Jr. High Schools	1	41	419	0	419
High Schools	1	68	658	0	658
Total	8	251	2,553	0	2,553

Source: Data was obtained from MODESE, 2013c.

Of the approximate 360 fifth grade students generating data for this study, 180 students attended an urban public school district implementing the *EnVision* Mathematics program, located in a Midwestern urban area with a student population of approximately 27,000. This district was in existence for over 170 years. It was established in 1837, with the building of two schools known as the North School and the South School. By the turn of the 20th century the district had 95 schools, an enrollment of 63,000 students, and employment of more than 1,600 teachers (Study School District; MODESE, 2013b).

During the span of this study, there were 49 elementary schools, 9 middle schools, 1 junior high school, and 15 high schools (MODESE, 2012a). Table 7 indicates the enrollment and staff data for School District B on the elementary, middle, junior high, and high school levels.

Table 7.

School District B Enrollment

	Schools	Cert. Staff	Residents	Non-Res	Total
Elementary	49	1,279	15,670	7	15,677
Middle Schools	9	251	3,528	3	3,531
Jr. High Schools	1	26	391	0	391
High Schools	15	788	7,623	5	7,628
Total	74	2,344	27,212	15	27,227

Source: Data was obtained from MODESE, 2013c.

Table 7 also indicates the academic level of the 2,344 certified teachers and approximately 27,000 students. School District B was the larger school district from which data for this study was obtained (MODESE, 2012a).

Table 8 indicates the ethnicity of Schools D, H, W, and N. Each school had a majority Black student population of approximately 98%. Schools D and H were a part of Study School District B using *EnVision* Mathematics, and Schools W and N were a part of Study School District A using *EveryDay* Mathematics.

Table 8.

Percentage of Black 5th Grade Students 2006-2013

Year	2006	2007	2008	2009	2010	2011	2012	2013
School D	100	99.1	99	99.7	98.9	97.2	99.5	99.5
School H	92.2	91.2	93.8	91.3	96.7	95.3	90.8	89.2
School W	98	98.6	99.6	99.2	97.7	98.2	97.4	98.4
School N	96.6	98.2	98.8	99.1	99.5	98.6	97.8	99

Source: Data was obtained from MODESE, 2013c.

Similarity of Teachers

Fifth grade teachers. A total of four fifth-grade teachers delivered mathematics curriculum to the students who generated the secondary data for this study. Two used the *EveryDay* Mathematics and two used the *EnVision* Mathematics. In both School District A and School District B fifth-grade mathematics instruction was departmentalized. In this particular setting, teachers were specialized in teaching specific core subjects. Students received instruction throughout the school day from multiple teachers for multiple subjects of study. A teacher may have been responsible for teaching one specific subject or several subjects (Chan & Jarman, 2004; 2009; Moore, 2008).

Table 9 indicates the certification status of teachers for the four study schools. Schools W and N had a larger percentage of certified teachers throughout the 2006-2013 school years, at 100%.

Table 9.

Certification Status of Teachers: 2006 - 2013

Percent of Teachers With Regular Certificates								
Year	2006	2007	2008	2009	2010	2011	2012	2013
School D	100	100	95.7	75	100	96	75	N/A
School H	93.8	84.6	100	100	85	100	100	N/A
School W	100	100	100	100	100	100	97	N/A
School N	100	100	100	100	100	100	100	N/A

Source: Building level data. Data was obtained from MODESE, 2012a. N/A denotes Not Available.

Table 10 shows the percentage of teachers with advanced degrees in all four study schools. Schools W and N had the larger percentage of teachers acquiring advanced degrees.

Table 10.

Teachers with Advanced Degrees: 2006 - 2013

Percentage with Advanced Degrees								
Year	2006	2007	2008	2009	2010	2011	2012	2013
School D	43.5	47.6	46.8	42.9	43.2	33.3	36.4	51.4
School H	41.2	34	36	38.5	31.3	15.6	22.2	30.8
School W	58.1	65.6	79.8	82.2	85.4	94.5	96.2	91.3
School N	82.5	87	91.7	93.1	93.2	92.1	91.7	76.5

Source: Building level data. Data was obtained from MODESE, 2013a.

Table 11 shows the years of teaching experience for all teachers in the study schools. Schools D and H using *EnVision* Mathematics and Schools W and N using *EveryDay* Mathematics. Results show little difference in teaching experience to support similar teaching environment for classroom data generated for this study. The average experience for the four schools is approximately 15 years.

Table 11.

Teacher Average Years of Experience: 2006 - 2013

Average Years of Experience								
Year	2006	2007	2008	2009	2010	2011	2012	2013
School D	20	20	17	16	20	18	18	14
School H	13	17	14	16	12	15	14	15.4
School W	10	10	15	15	13	16	15	14
School N	10	12	13	14	16	19	18	16.5

Source: Building level data. Data was obtained from MODESE, 2013a.

Table 12 shows the teacher-to-student ratio of Schools W and N from Study District A and Schools D and H from Study District B. Teacher-to student ratio was determined by student enrollment at each grade level.

Table 12.

Teacher to Student Ratio: 2006 - 2013

Student per Classroom Teacher Ratio								
Year	2006	2007	2008	2009	2010	2011	2012	2013
School D	17	20	17	17	19	17	17	14
School H	13	15	13	16	14	18	16	17
School W	16	17	19	16	14	18	16	18
School N	25	19	22	19	16	20	21	20

Source: Building level data. Data was obtained from MODESE, 2013c.

Table 13 shows the attendance rate of the participating schools. The attendance rate for both Schools D and H using *EnVision* Mathematics and Schools W and N using *EveryDay* Mathematics were similar.

Table 23.

Teacher Classroom Attendance Rate: 2006 - 2013

Percentage Rate of Attendance								
Year	2006	2007	2008	2009	2010	2011	2012	2013
School D	92	90.5	90.6	92	91	93	94	83
School H	91.7	91	91.9	92	93	92	93	79
School W	94.8	94	93.2	93	93	92	96	91
School N	95.9	95.1	94.7	95	95	95	95	92

Source; Building level data. Data was obtained from MODESE, 2013c.

Table 14 shows the average teacher salary among the study schools. Teachers in the smaller school district, Schools W and N received a larger salary on the average than teachers from the larger school district, Schools D and H. The districts included in this study did not offer merit pay based on student performance in mathematics.

Table 14.

Average Teacher Salary

Faculty Information 2006-2013 Average Teacher Salary								
Year	2006	2007	2008	2009	2010	2011	2012	2013
School D	$47,536	$49,491	$50,971	$47,129	$57,049	$53,350	$52,673	$50,700
School H	$40,816	$43,570	$46,469	$47,986	$46,954	$47,200	$44,937	$49,487
School W	$54,848	$55,392	$60,849	$68,549	$62,458	$62,484	$64,829	$63,516
School N	$55,290	$60,332	$64,338	$66,749	$65,857	$68,155	$68,395	$64,403

Source: Building level data. Data was obtained from MODESE, 2013a.

MAP Testing

The MAP test was administered annually during the spring to measure fifth-grade students' mathematics ability in the content domains of numbers and operation, measurement, geometry, algebra, data, and probability (MODESE, 2007).

Missouri Assessment Program (MAP). The state education department (MODESE), along with educators, parents, and the business community throughout the state worked together to develop the Show-Me Standards and the MAP. The MAP was created to comply with educational reforms mandated by the Outstanding School Act of 1993 and to evaluate student achievement (MODESE, 2014).

Validity

The MAP test was a mandatory state assessment, administered annually during the spring to all students, grades 3-8 and 10, enrolled in Missouri public schools. MAP test scores were used to demonstrate students' ability in mathematics, communication arts, science, and social studies in the state of Missouri. MAP test scores were used to classify students, schools, districts, and the state in order to demonstrate student achievement in each subject area (MODESE, 2007).

Each MAP mathematics assessment operated with a testing time of approximately three hours, using three types of test items: multiple choice, constructed-response, and performance events. The multiple choice component of the mathematics assessment was the Terra Nova, a normed-referenced test. The constructed-response portion of the assessment required students to show their work when providing an appropriate answer. Performance event items allowed students to use their choice of different algorithms available to reach a correct answer. All three testing components measured students' ability to apply what they have learned.

The MAP test was designed to measure what students were taught and what they learned at specific grade levels. In fact, the MAP test was developed using items similar to questions and activities used by teachers in the classroom (MODESE, 2007). Therefore, the research design of is study is considered valid by the researcher. A population threat exists because mathematics achievement data was analyzed for only the fifth grade level.

Reliability

A reliable test should produce scores that are relatively stable when a test is administered repeatedly under similar conditions. Known as internal consistency, this type of reliability provides an estimate of how consistently examinees perform across items on a test during a single test administration (Crocker & Algina, 1986).

Using Cronbach's Alpha, the reliability of MAP tests scores were evaluated. The closer the value of the reliability coefficient is to 1, the more consistent the scores. When reliability coefficients are equal to or greater than 0.9, they are considered acceptable for tests of lengths similar to the MAP. The reliability coefficients for the MAP mathematics testing were between .915 and .929 (MODESE, 2007).

Instruments

This study examined the achievement levels of fifth grade students using the *EveryDay* Mathematics and *EnVision* Mathematics programs for eight consecutive years to determine if a significant difference was evident. MAP scores for 2006 - 2013 were used to examine the achievement levels of both programs. The MAP tests were administered annually during the months of April and May throughout the state of Missouri. Students in grades 3 - 8 and 10 were required to take the mathematics assessments.

Test administration time for each assessment was approximately three to five hours. Three tests items were assessed on the MAP: multiple-choice, constructed-response, and performance events. Specific directions and conditions were followed when administering the test (MODESE, 2007).

The 2013, Grade-Level Assessment Test Blueprint for grade five had a point range and emphasis percentage for each mathematics standard. Table 15 lists these values for each mathematics strand included on the assessment.

Table 15.

Grade 5-Mathematics 2013, Grade-Level Assessment Test Blueprint

Standard	Point Range	Emphasis
Number and Operations	16 – 20	25 – 30%
Geometric and Spatial Relationships	10 – 12	15 – 18%
Measurement	10 – 12	15 – 18%
Data and Probability	10 – 12	15 – 18%
Algebraic Relationships	14 - 17	20 – 25%

Source: Grade level data. Missouri Department of Elementary and Secondary Education, 2013e.

Student performance was reported based on four achievement and performance levels: below basic, basic, proficient, and advanced. Achievement level scores described what students could do in relationship to mathematics content and skills. Scores were used to compare test results with standards of academic performance (MODESE, 2007). Table 16 provides an overview of the fifth grade mathematics achievement-level descriptors.

Table 16.

Fifth Grade Mathematics Achievement-Level Descriptors

Achievement Level	Descriptor
Below Basic	Students recognize equivalent representations of numbers by composing and decomposing numbers up to 5 digits; order decimals to thousandths place; interpret place value to hundred-thousands; determine operations used in numeric patterns; use symmetry to complete figures; make generalizations about geometric patterns; describes attributes of 2-D shapes; identify data on a line graph; make and justify predictions using data; describe, compare, and organize data in a bar graph. MAP score range: 480-604.
Basic	Students identify place value to the millions place; read, write, and compare unit fractions and decimals to the thousandths place; identify lines of symmetry; identify appropriate units of area; identify appropriate units of measure; use data to create a graph and perform calculations using numbers between given intervals. MAP score range: 605-667
Proficient	Students multiply decimals to the hundredths place; use estimation in computations; divide 3-digit by 2-digit numbers; add fractions with like denominators; solve problems involving rates of change; extend numeric patterns; complete number sentences; identify faces of 3-D and similar figures; interpret direction on a coordinate grid; calculate area using a grid; compute elapsed time in hours; analyze data in line graphs and tables; explain the probability of a simple event. MAP score range: 668-705.
Advanced	Students use addition/subtraction of money in a real-world situation; explain and justify the results of calculations; justify and model the results of calculations involving constant rates; use number sentences to model a mathematical situation; analyze characteristics of and identify 3-D figures, quadrilaterals, and angle measures; use a coordinate grid to describe paths and determine distances between points; convert between standard units of measurements. MAP score range: 706-830.

Source: Missouri Department of Elementary and Secondary Education, 2012a

At the conclusion of testing, booklets were collected and secured by test administrators. District administrators collected booklets from each school site and mailed testing materials to the designated scoring company. Test results were available to state, districts, and schools during the summer following the spring testing period.

MAP achievement level data for both groups were identified for the 2006 - 2013, testing periods. Although the researcher examined all four achievement levels, particular focus was on the proficient and advanced levels, based on the NCLB mandate stipulating 100% of students to achieve at this level by 2014.

Table 17 shows the MAP achievement levels for School D, which used *EnVision* Mathematics. Achievement for the 2010 and 2011 years was exceptionally high. The other seven testing years showed an inconsistency in performance. A large percentage of fifth graders remained at the basic level throughout the eight-year period.

Table 17.

Mathematics MAP Achievement for School D: 2006-2013

School D = C1				
Year	Below Basic %	Basic %	Prof./Adv. %	# of Students
2006	2.3	72.1	25.6	43
2007	29.3	36.6	34.1	41
2008	2.8	77.8	19.4	36
2009	10	67.5	22.5	40
2010	2	32.7	65.3	49
2011	7.1	40.5	52.4	42
2012	22.5	57.5	20	40
2013	22.2	55.6	22.2	27

Note: 5^{th} grade level data.

Table 18 shows the MAP achievement levels for School H, which used *EnVision* Mathematics. Achievement for the 2006 and 2013 years was relatively high, above 40%.

Proficient-advanced achievement from 2007-2012 was low. A large percentage of fifth graders remained at the basic level throughout the eight-year period.

Table 18.

Mathematics MAP Achievement for School H: 2006-2013

School H = C2				
Year	Below Basic %	Basic %	Prof./Adv. %	# of Students
2006	10	43.3	46.7	30
2007	4.8	71.4	23.8	21
2008	23.8	66.7	9.5	21
2009	10.5	78.9	10.5	19
2010	13	60.9	22.7	23
2011	34.8	52.2	6.3	23
2012	43.8	43.8	12.5	16
2013	12.5	43.8	43.8	16

Note: 5th grade level data.

Table 19 shows the MAP achievement levels for experimental School W, which used *EveryDay* Mathematics. Although, achievement throughout the eight-year period was not exceptional, achievement at the proficient-advanced levels remained consistent. A large percentage of fifth-graders remained at the basic level throughout the eight-year period.

Table 19.

Mathematics MAP Achievement for Experimental School W: 2006-2013

School W = E1				
Year	Below Basic %	Basic %	Prof./Adv. %	Total # of Students
2006	14.3	60.7	25	84
2007	21.5	50.5	28	107
2008	18.2	55.8	26	77
2009	16.3	57.5	26.3	80
2010	30	57.5	12.6	80
2011	25	57.4	17.6	68
2012	12.9	59.7	26.2	62
2013	24.6	59.4	15.9	69

Note: 5th grade level data.

Table 20 shows the MAP achievement levels for experimental School N, which used *EveryDay* Mathematics. Achievement at the proficient-advanced levels fluctuated throughout the eight-year period. Fifth graders did relatively well in 2011 and 2013, above 40%: Overall, a large percentage of fifth graders remained at the basic level throughout the eight period.

Table 20.

Mathematics MAP Achievement for Experimental School N; 2006-2013

School N = E2				
Year	Below Basic %	Basic %	Prof./Adv. %	Total # of Students
2006	14.3	61.4	24.3	70
2007	14.7	70.6	14.7	68
2008	11.5	29.2	7.3	192
2009	27	52.7	19.6	74
2010	17.1	52.9	28.7	70
2011	6.1	53	40.9	66
2012	5.6	76.4	18.1	72
2013	4.3	46.4	49.2	69

Note: 5^{th} grade level data.

The alternate hypotheses described for this study in Chapter One were analyzed through use of the following null hypotheses.

Year-to-Year Differences: Below Basic, Basic and Proficient-Advanced

Null Hypothesis 1. Among the study schools, there will be no difference in year-to-year proportions of students scoring Below Basic, Basic, and Proficient-Advanced on the 2006 – 2013 Missouri Assessment Program (MAP) fifth grade mathematics exams. A Chi-Square test for Homogeneity to compare proportions of Below Basic, Basic, and Proficient-Advanced students for each individual school, year-to-year, for the years between 2006 and 2013 was applied.

Null Hypothesis 2. Within the study schools, student achievement measured by the MAP fifth grade mathematics exam, will be independent of the school building and use of the *EveryDay* and *EnVision* study materials.

To establish mathematics student achievement independence of or dependence upon the implementation of the mathematics program, based on the school attended, a Chi-Square test for Independence was applied to proportions of achievement in the Below Basic, Basic, and Proficient-Advanced ratings for the years 2006 through 2013.

Null Hypothesis 3. Among the study districts, there will be no difference in year-to-year proportions of students scoring Below Basic, Basic, and Proficient-Advanced on the 2006 – 2013 Missouri Assessment Program (MAP) fifth grade mathematics exams.

A Chi-Square test for Homogeneity to compare proportions of Below Basic, Basic, and Proficient-Advanced students for each individual district, year-to-year, for the years between 2006 and 2013 was applied.

Year-to-Year Differences: Proficient-Advanced

Null Hypothesis 4. Among the study schools, there will be no difference in year-to-year proportions of students scoring Proficient-Advanced on the 2006 – 2013 Missouri Assessment Program (MAP) fifth grade mathematics exams.

Data for each of the four schools was first tested for year-to-year differences in Below Basic, Basic, and Proficient-Advanced categories with a Chi-Square test for Homogeneity. This was followed by *z*-tests for difference in proportion. And then, data was tested for differences specifically in the Proficient-Advanced categories.

Null Hypothesis 5. Among the study districts, there will be no difference in year-to-year proportions of students scoring Proficient-Advanced on the 2006 – 2013 Missouri Assessment Program (MAP) fifth grade mathematics exams.

Data for each of the two districts was first tested for year-to-year differences in Below Basic, Basic, and Proficient-Advanced categories with a Chi-Square test for Homogeneity. This was followed by *z*-tests for difference in proportion. And then, data was tested for differences specifically in the Proficient-Advanced categories.

First-Year to Last-Year Comparisons: Proficient-Advanced

Null Hypothesis 6. Among the study schools, there will be no difference in proportion of students scoring Proficient-Advanced on the first year of the study, 2006, when compared to the last year of the study, 2013, measured by the Missouri Assessment Program (MAP) fifth grade mathematics exams.

A *z*-test for difference in proportion was used to compare the proportion of Proficient-Advanced students at the school level.

Null Hypothesis 7. Among the study districts, there will be no difference in proportion of students scoring Proficient-Advanced on the first year of the study, 2006, when compared to the last year of the study, 2013, measured by the Missouri Assessment Program (MAP) fifth grade mathematics exams.

A *z*-test for difference in proportion was used to compare the proportion of Proficient-Advanced students at the district level.

Null Hypothesis 8. Student achievement in the Proficient-Advanced category on the Missouri Assessment Program mathematics exam is independent of the curriculum in use: *EveryDay* Mathematics or *EnVision* Mathematics, when considering the first year of study, 2006 and the last year of study, 2013.

A Chi-Square test for Independence was applied to percentages of students in the Proficient-Advanced categories from two schools where students used *EveryDay* Mathematics curriculum materials and two different schools that used *EnVision* Mathematics curriculum materials.

Early Implementation to Late Implementation Comparisons: Student Achievement

Null Hypothesis 9. Within the study schools, student achievement measured by the MAP fifth grade mathematics exam, will be independent of the phase of implementation of mathematics curriculum. The early phase was 2006-2008; the latter phase was 2009-2013.

A Chi-Square test for Independence was applied to proportions of achievement in the Below Basic, Basic, and Proficient-Advanced ratings for the early years, 2006 through 2008, and the latter years, 2009 – 2013, at the school level.

Null Hypothesis 10. Within the study districts, student achievement measured by the MAP fifth grade mathematics exam, will be independent of the phase of implementation of mathematics curriculum. The early phase was 2006-2008; the latter phase was 2009-2013.

A Chi-Square test for Independence was applied to proportions of achievement in the Below Basic, Basic, and Proficient-Advanced ratings for the early years, 2006 through 2008, and the latter years, 2009 – 2013, at the district level.

District Comparisons

Null Hypothesis 11. Within the study districts, student achievement measured by the MAP fifth grade mathematics exam, will be independent of the district attended and use of the *EveryDay* and *EnVision* study materials.

A Chi-Square test for Independence was applied to proportions of achievement in the Below Basic, Basic, and Proficient-Advanced ratings for the years 2006 through 2013.

Null Hypothesis 12. When comparing districts, there is no difference between average proportion in the Below Basic category and in the Proficient-Advanced category, measured by the fifth grade mathematics MAP.

A *z*-test for difference in means was applied to test the mean difference in proportions between the two districts in the category of Below Basic throughout the eight-year span of the study. Also, a *z*-test for difference in means was applied to test the mean difference in proportions between the two districts in the category of Proficient-Advanced throughout the eight-year span of the study.

Null Hypothesis 13. There will be no difference in overall district proportion of students scoring Proficient-Advanced on the 2006 – 2013 Missouri Assessment Program (MAP) fifth-grade mathematics exams, when comparing District A, which prepared its students through use of *EveryDay* Mathematics, to District B, which prepared its students through use of *EnVision* Mathematics.

A *z*-test for difference in means was applied to test the mean difference in overall district proportions between the two districts in the categories of Below Basic and Proficient-Advanced throughout the eight-year span of the study.

Data Collection Process

Prior to conducting this study, the researcher was granted approval by the Institutional Review Board (IRB). The purpose for this quantitative study was to determine if there was a significant difference in the mathematics achievement levels of fifth-grade students receiving instruction using the *EveryDay* Mathematics program as and fifth-grade students receiving instruction using the *EnVision* Mathematics program.

Secondary data on mathematic performance of students enrolled in schools participating in this study were readily accessible on the Missouri Comprehensive Data System (MCDS) website. The researcher verified students received instruction using the *EveryDay* Mathematics or *EnVision* Mathematics program, depending on the respective school attended during fifth grade, for at least three consecutive years since third grade.

Confidentiality

Schools and districts in this study were given a pseudonym to maintain anonymity during the reporting phase of the dissertation. Participating schools were assured all information would be held in strict confidence.

Procedures

Prior to the collection or analysis of data permission from the study school districts was obtained by the researcher to conduct the study. It was agreed, the results of the study would be shared with both school districts providing secondary data for analysis. Next, the researcher sought approval to conduct the study by submitting an application to Lindenwood University's Institutional Review Board.

Upon IRB approval, the researcher conducted the quantitative study. The purpose of the quantitative study was to examine and compare both the *EveryDay* Mathematics program and *EnVision* Mathematics program to determine if either program made a difference in the mathematics achievement levels of fifth-grade students receiving instruction through use of those materials. The statistical data were measurements of student achievement using the Missouri Assessment Program (MAP) mathematics results for the 2006 - 2013 school years. (MODESE, 2012b).

Limitations of the Study

There were limitations to the generalizability of the results of this study. Limitations include: (a) This study was limited to only fifth grade students in the Midwestern state of Missouri; (b) This study included only four urban public schools; (c) Schools in this study implemented departmentalize mathematics instruction; (d) Teachers are not certified in mathematics and may not have the comprehensive knowledge of the mathematics content; (e) Every day delivery of mathematics curriculum and coverage of standards may have been different, and the instructional program may not have been followed by all teachers; and (f) Missouri Assessment Program was an effective measure of student achievement, yet the only measure used for this study.

Summary

This quantitative study examined a comparison of the mathematics achievement levels of fifth grade students receiving instruction using the EveryDay Mathematics program and the EnVision Mathematics program, measured by the Missouri Assessment Program. Chapter Three provided information on the research design for the study, the research question and null hypotheses, analysis of the data, validity and reliability of the measurement tools, and limitations of generalizability of the study. Chapter Four will describe the results of the Missouri Assessment Program data.

Chapter Four: Results

Introduction

The purpose of this quantitative study was to determine if there is a significant difference in the achievement level of fifth-grade students receiving mathematics instruction using the *EveryDay* Mathematics program in comparison to fifth grade students receiving instruction using the *EnVision* Mathematics program, as measured by the 2006-2013 mathematics MAP test scores.

This chapter presents the applied statistics, including the appropriate tests conducted and results. The results were examined and presented to provide evidence as to whether or not the independent variables, use of EveryDay Mathematics and *EnVision* Mathematics instructional materials, had an effect on the dependent variable, student achievement as measured by the mathematics Missouri Assessment Program (MAP).

Year-to-Year Differences: Below Basic, Basic, and Proficient-Advanced

Schools.

Null Hypothesis 1. Among the study schools, there will be no difference in year-to-year proportions of students scoring Below Basic, Basic, and Proficient-Advanced on the 2006 – 2013 Missouri Assessment Program (MAP) fifth grade mathematics exams.

A Chi-Square test for Homogeneity to compare proportions of Below Basic, Basic, and Proficient-Advanced students for each individual school, year-to-year, for the years between 2006 and 2013 was applied. In general, the majority of the students at every school scored at levels lower than the Proficient/Advanced levels.

Years at School D. Since the Chi-Square test value of 166.392 was larger than the Critical value of 23.685, the Null Hypothesis 1 was rejected. For School D, there was a difference in values from year-to-year in the proportions of fifth grade students scoring in the Below Basic, Basic, and Proficient-Advanced categories on the fifth grade mathematics MAP assessment. Individual z-tests for difference in proportion were applied to identify where the differences exist. Observably, the first year compared to the last year indicated potential change in the Basic category, with a decrease from 72.1% to 55.6%, while a comparison in the Proficient-Advanced category indicated no change in achievement. Thus, as shown in Table 21, there was no significant difference in the Proficient-Advanced category of the fifth grade students across the years at school D. Table A10 summarizes overall mathematics MAP results for District B.

Table 21.

District B: School D

Year	Below Basic	Basic	Prof./Adv.
2006	2.3	72.1	25.6
2007	29.3	36.6	34.1
2008	2.8	77.8	19.4
2009	10.0	67.5	22.5
2010	2.0	32.7	65.3
2011	7.1	40.5	52.4
2012	22.5	57.5	20.0
2013	22.2	55.6	22.2

Note: Note: 5^{th} grade level data. Average Prof. /Adv. Students: 32.69

Years at School N. Since the Chi-Square test value of 35.341 was larger than the Critical value of 23.685, the Null Hypothesis 1 was rejected. For School N, there was a difference in values from year-to-year in the proportions of fifth grade students scoring in the Below Basic, Basic, and Proficient-Advanced categories on the fifth grade mathematics MAP assessment. Individual *z*-tests for difference in proportion were applied to identify where the differences existed. Observably, the first year compared to the last year indicated potential change in the Basic category, with a decrease from 61.4%

to 46.4%, and in the Proficient-Advanced category, with an increase from 24.3% to 49.2%. The highest proportion throughout the eight years is represented by the Basic category for the year 2012 (76.4%). Thus, as shown in Table 22, there was some significant difference in the Proficient-Advanced category of the fifth grade students across the years at school N. Table A9 summarizes overall mathematics MAP results for District A.

Table 22.

District A: School N

Year	Below Basic	Basic	Prof./Adv.
2006	14.3	61.4	24.3
2007	14.7	70.6	14.7
2008	11.5	29.2	7.3
2009	27	52.7	19.6
2010	17.1	52.9	28.7
2011	6.1	53	40.9
2012	5.6	76.4	18.1
2013	4.3	46.4	49.2

Note: *Note:* 5th grade level data. Average Prof./Adv. Students: 25.35

Years at School H. Since the Chi-Square test value of 76.210 was larger than the Critical value of 23.685, the Null Hypothesis 1 was rejected. For School H, there was a difference in values from year-to-year in the proportions of fifth grade students scoring in the Below Basic, Basic, and Proficient-Advanced categories on the fifth grade mathematics MAP assessment. Individual *z*-tests for difference in proportion were applied to identify where the differences exist. Observably, the first year compared to the last year indicated no change in achievement. The highest proportion throughout the eight years is represented by the Basic category for the year 2009 (78.9%). Thus, as shown in Table 23, there was significant difference in mathematics performance of the fifth grade students across the years at school H. Table A10 summarizes overall mathematics MAP results for District B.

Table 23.

District B: School H

Year	Below Basic	Basic	Prof./Adv.
2006	10	43.3	46.7
2007	4.8	71.4	23.8
2008	23.8	66.7	9.5
2009	10.5	78.9	10.5
2010	13	60.9	22.7
2011	34.8	52.2	6.3
2012	43.8	43.8	12.5
2013	12.5	43.8	43.8

Note: Note: 5th grade level data. Average Prof./Adv. Students: 21.98

Years at School W. Since the Chi-Square test value of 7.486 was smaller than the Critical value of 23.685, the Null Hypothesis 1 was not rejected. Thus, as shown in Table 24, for School W, there was no significant difference in values from year-to-year. Results were supported for the same hypothesis statement by the ANOVA (F-test = 0.000134; F-critical = 2.657). Table A9 summarizes overall mathematics MAP results for District A.

Table 24.

District A: School W

Year	Below Basic	Basic	Prof./Adv.
2006	14.3	60.7	25
2007	21.5	50.5	28
2008	18.2	55.8	26
2009	16.3	57.5	26.3
2010	30	57.5	12.6
2011	25	57.4	17.6
2012	12.9	59.7	26.2
2013	24.6	59.4	15.9

Note: *Note:* 5th grade level data. Average Prof./Adv. Students: 22.13

Null Hypothesis 2: Within the study schools, student achievement measured by the MAP fifth grade mathematics exam, will be independent of the school building and use of the *EveryDay* and *EnVision* study materials.

To establish mathematics student achievement independence of or dependence upon the implementation of the mathematics program, based on the school attended, a Chi-Square test for Independence was applied to proportions of achievement in the Below Basic, Basic, and Proficient-Advanced ratings for the years 2006 through 2013. The mathematics material used to support curriculum in School W and School N was *EveryDay* Mathematics, while the mathematics material used in School D and School H was *EnVision* Mathematics. Table 25 lists the average proportions of students, overall, who scored in each of the categories of Below Basic, Basic, and Proficient-Advanced throughout the entire eight-year span of secondary data gathered.

Table 25.

Schools: Overall Proportion of Students

School	Below Basic	Basic	Prof/Adv.
D	11.6	54.1	34.3
H	20.4	56.9	22.6
N	12.5	50.7	22.2
W	18.3	57.4	24.3

Note: 5th grade level data.

Since the Chi-Square test value of 6.018 was smaller than the Critical value of 12.591, the Null Hypothesis 2 was not rejected. Student achievement measured by the proportions of fifth grade students scoring in the Below Basic, Basic, and Proficient-Advanced categories on the fifth grade mathematics MAP assessment was independent of the school building attended and use of the *EveryDay* and *EnVision* study materials. Student achievement was not dependent upon mathematics study based on the school of attendance. Observably, School D from District B yielded the highest proportion of

Proficient-Advanced students, with 34.3%. This is in comparison to School H in District B and Schools N and W from District A, with 22.6%, 22.2%, and 24.3%, respectively.

Districts.

Null Hypothesis 3: Among the study districts, there will be no difference in year-to-year proportions of students scoring Below Basic, Basic, and Proficient-Advanced on the 2006 – 2013 Missouri Assessment Program (MAP) fifth grade mathematics exams.

A Chi-Square test for Homogeneity to compare proportions of Below Basic, Basic, and Proficient-Advanced students for each individual district, year-to-year, for the years between 2006 and 2013 was applied. Table 26 lists the proportions of students enrolled in Schools W and N who scored in each of the categories of Below Basic, Basic, and Proficient-Advanced, year-to-year, for the eight-year span of secondary data gathered.

Table 26.

District A: Schools W & N - EveryDay Mathematics

Year	Below Basic	Basic	Prof./Adv.
2006	14.3	61.0	24.7
2007	18.9	58.3	22.9
2008	13.4	36.8	12.6
2009	21.4	55.2	23.4
2010	24.0	55.3	20.7
2011	15.7	55.2	29.1
2012	9.0	68.7	22.4
2013	14.5	52.9	32.6

Note: *Note:* 5^{th} grade level data... Average Prof./Adv. Students: 23.55

Since the Chi-Square test value of 17.347 was smaller than the Critical value of 23.685, the Null Hypothesis 3 was not rejected. For District A, there was no significant difference in values from year-to-year in the proportions of fifth grade students scoring in the Below Basic, Basic, and Proficient-Advanced categories on the fifth grade mathematics MAP assessment. This result was supported by the ANOVA (F-test value = 0.123; critical value = 2.657).

Observably, the first year compared to the last year indicated potential change in the Basic category, with a decrease from 61.0% to 52.9%, while a comparison in the Proficient-Advanced category indicated a change in achievement from 24.7% to 32.6%. The highest proportion throughout the eight years is represented by the Basic category for the year 2012 (68.7.7%).

Table 27 lists the proportions of students enrolled in Schools D and H who scored in each of the categories of Below Basic, Basic, and Proficient-Advanced, year-to-year, for the eight-year span of secondary data gathered.

Table 27.

District B: Schools D & H – EnVision Math

Year	Below Basic	Basic	Prof./Adv.
2006	5.5	60.3	34.2
2007	20.1	48.4	30.6
2008	10.5	73.7	15.8
2009	10.2	71.2	18.6
2010	5.6	41.7	52.8
2011	16.9	44.6	38.5
2012	28.6	53.6	17.9
2013	18.6	51.2	30.2

Note: Note: 5th grade level data. Average Prof. Adv. Students: 29.83

Since the Chi-Square test value of 84.909 was larger than the critical value of 23.685, the Null Hypothesis 3 was rejected. For District B, there was a difference in values from year-to-year in the proportions of fifth grade students scoring in the Below Basic, Basic, and Proficient-Advanced categories on the fifth grade mathematics MAP assessment. Individual *z*-tests identified where the differences existed. Observably, the first year compared to the last year indicated potential change in the Basic category, with an increase from 60.3% to 51.2%, while a comparison in the Proficient-Advanced category indicated a change in achievement from 34.2% to 30.2%. The highest proportion throughout the eight years is represented by the Basic category for the year 2008 (73.7%).

Year-to-Year Differences: Proficient-Advanced

Schools.

Null Hypothesis 4: Among the study schools, there will be no difference in year-to-year proportions of students scoring Proficient-Advanced on the 2006 – 2013 Missouri Assessment Program (MAP) fifth grade mathematics exams.

Data for each of the four schools was first tested for year-to-year differences in Below Basic, Basic, and Proficient-Advanced categories with a Chi-Square test for Homogeneity. This was followed by *z*-tests for difference in proportion. And then, data was tested for differences specifically in the Proficient-Advanced categories. The Chi-Square test for Homogeneity (Null Hypothesis 1) found differences, year-to-year for all schools except School W. The researcher examined consecutive potential year-to-year changes. A *z*-test for difference in proportions was applied to the proportions of Proficient-Advanced students by comparing consecutive years between 2006 and 2013, as well as comparing the first year of 2006 to the last year of the study, 2013.

Table 28.

District B: School D

Year-to-Year	*z*-test value	Reject null?	Movement
2006 to 2007	0.852	no	up
2007 to 2008	1.466	no	down
2008 to 2009	0.331	no	up
2009 to 2010	4.030	yes	up
2010 to 2011	1.249	no	down
2011 to 2012	3.045	yes	down
2012 to 2013	0.217	no	up
2006 to 2013	0.323	no	down

Note: 5th grade level data.

Table 28 records the *z*-test values of the year-to-year comparisons of Proficient-Advanced proportions for District B, School D. For School D, a comparison of the proportions of Proficient-Advanced students, year-to-year resulted in rejection of the Null Hypothesis 4 for 2009 to 2010 (*z*-test value = 4.030; critical value = ±1.96) and 2011 to 2012 (*z*-test value =3.045; critical value = ±1.96). Therefore, there was a significant change in the proportion of proficient-advanced scoring on the fifth grade mathematics MAP from 2009 to 2010 and from 2011 to 2012. The change from 2009 to 2010 indicated a significant rise in proportion, while the change from 2011 to 2012 indicated a decline in proportion.

Table 29.

District B: School H

Year-to-Year	*z*-test value	Reject null?	Movement
2006 to 2007	1.665	no	down
2007 to 2008	1.244	no	down
2008 to 2009	0.105	no	up
2009 to 2010	1.043	no	up
2010 to 2011	1.580	no	down
2011 to 2012	0.671	no	up
2012 to 2013	1.969	yes	up
2006 to 2013	0.188	no	down

Note: 5th grade level data.

Table 29 records the *z*-test values of the year-to-year comparisons of Proficient-Advanced proportions for District B, School H.

For School H, a comparison of the proportions of Proficient-Advanced students, year-to-year resulted in rejection of the Null Hypothesis 4 for 2012 to 2013 (*z*-test value = 1.969.; critical value = ±1.96). Therefore, there was a significant change in the proportion of proficient-advanced scoring on the fifth grade mathematics MAP from 2012 to 2013. The change from 2012 to 2013 indicated a rise in proportion.

Table 30 records the *z*-test values of the year-to-year comparisons of Proficient-Advanced proportions for District A, School N.

Table 30.

District A: School N

Year-to-Year	*z*-test value	Reject null?	Movement
2006 to 2007	1.421	no	down
2007 to 2008	1.811	no	down
2008 to 2009	2.906	yes	up
2009 to 2010	1.278	no	up
2010 to 2011	1.495	no	up
2011 to 2012	2.948	yes	down
2012 to 2013	3.916	yes	up
2006 to 2013	3.046	yes	up

Note: 5^{th} grade level data.

For School N, a comparison of the proportions of Proficient-Advanced students year-to-year, resulted in rejection of the Null Hypothesis 4 for 2008 to 2009 (*z*-test value = 2.906; critical value = ±1.96), 2011 to 2012 (*z*-test value =2.948; critical value = ±1.96), and 2012 to 2013 (*z*-test value =3.916; critical value = ±1.96). Therefore, there was a significant change in the proportion of proficient-advanced scoring on the fifth grade mathematics MAP from 2008 to 2009, from 2011 to 2012, and from 2012 to 2013.

The change from 2008 to 2009 indicated a significant rise in proportion, 2011 to 2012 indicated a decline in proportion, while the change from 2012 to 2013 indicated a rise in proportion.

For School W, a comparison of the proportions of Proficient-Advanced students year-to-year, resulted in rejection of the Null Hypothesis 4 for 2009 to 2010 (*z*-test value = 2.189.; critical value = ±1.96). Therefore, there was a significant change in the proportion of proficient-advanced scoring on the fifth grade mathematics MAP from 2009 to 2010. The change from 2009 to 2010 indicated a significant rise in proportion. Table 31 records the *z*-test values of the year-to-year comparisons of Proficient-Advanced proportions for District A, School W.

Table 31.

District A: School W

Year-to-Year	z-text value	Reject null?	Movement
2006 to 2007	0.465	no	up
2007 to 2008	0.301	no	down
2008 to 2009	0.043	no	up
2009 to 2010	2.189	yes	down
2010 to 2011	0.851	no	up
2011 to 2012	1.188	no	up
2012 to 2013	1.451	no	down
2006 to 2013	1.378	no	down

Note: 5^{th} grade level data.

Districts.

Null Hypothesis 5: Among the study districts, there will be no difference in year-to-year proportions of students scoring Proficient-Advanced on the 2006 – 2013 Missouri Assessment Program (MAP) fifth grade mathematics exams.

Data for each of the two districts was first tested for year-to-year differences in Below Basic, Basic, and Proficient-Advanced categories with a Chi-Square test for

Homogeneity. This was followed by *z*-tests for difference in proportion. And then, data was tested for differences specifically in the Proficient-Advanced categories. The Chi-Square test for Homogeneity found differences, year-to-year for District B, but not for District A. To identify differences, a z-test for difference in proportions was applied to the proportions of Proficient-Advanced students by comparing consecutive years between 2006 and 2013, as well as comparing the first year of 2006 to the last year of the study, 2013.

District A.

Table 32 indicates the *z*-test values obtained in year-to-year comparison of Proficient-Advanced proportions for District A, represented by the combined performance of Schools W and N.

Table 32.

School District A: Schools W & N – Everyday Mathematics

Year-to-Year	z-text value	Reject null?	Movement
2006 to 2007	0.383	no	down
2007 to 2008	2.846	yes	down
2008 to 2009	2.877	yes	up
2009 to 2010	0.568	no	down
2010 to 2011	1.639	no	up
2011 to 2012	1.254	no	down
2012 to 2013	1.882	no	up
2006 to 2013	1.494	no	down

Note: 5^{th} grade level data.

For School District A, a comparison of the proportions of Proficient-Advanced students year-to-year, resulted in rejection of the Null Hypothesis 5 for 2007 to 2008 (*z*-test value = 2.846.; critical value = ±1.96) and 2008 to 2009 (*z*-test value = 2.877; critical value = ±1.96). Therefore, there was a significant change in the proportion of proficient-advanced scoring on the fifth grade mathematics MAP from 2007 to 2008 and from 2008 to 2009. The change from 2007 to 2008 indicated a decline in proportion, and the change from 2008 to 2009 indicated a rise in proportion.

District B.

Table 33 indicates the *z*-test values obtained in year-to-year comparison of Proficient-Advanced proportions for District B, represented by the combined performance of Schools D and H.

Table 33.

School District B: Schools D & H – EnVision Mathematics

Year-to-Year	z-text value	Reject null?	Movement
2006 to 2007	0.445	no	down
2007 to 2008	1.902	no	down
2008 to 2009	0.399	no	up
2009 to 2010	4.025	yes	up
2010 to 2011	1.677	no	down
2011 to 2012	2.491	yes	down
2012 to 2013	1.436	no	up
2006 to 2013	0.443	no	down

Note: 5^{th} grade level data.

For School District B, a comparison of the proportions of Proficient-Advanced students year-to-year, resulted in rejection of the Null Hypothesis 5 for 2009 to 2010 (z-test value = 4.025; critical value = ±1.96) and 2011 to 2012 (*z*-test value =2.491; critical value = ±1.96). Therefore, there was a significant change in the proportion of proficient-advanced scoring on the fifth grade mathematics MAP from 2009 to 2010 and from 2011 to 2012. The change from 2009 to 2010 indicated a significant rise in proportion, while the change from 2011 to 2012 indicated a decline in proportion. This result supports the results found in the year-to-year comparison for each individual school in the *EnVision* Mathematics district.

First-Year to Last-Year Comparisons: Proficient-Advanced

Schools.

Null Hypothesis 6: Among the study schools, there will be no difference in proportion of students scoring Proficient-Advanced on the first year of the study, 2006, when compared to the last year of the study, 2013, measured by the Missouri Assessment Program (MAP) fifth grade mathematics exams.

School D. Comparison of the first year of use of *EnVision* Mathematics to the last year of use of *EnVision* Mathematics, for duration of this study resulted in non-rejection (z-test value = 0.323; critical value = ±1.96) of the Null Hypothesis 6. Therefore, there was no significant difference in the proportion of proficient-advanced scoring on the fifth grade mathematics MAP from the beginning to the end of the eight-year span. The change in proportion of proficient-advanced observably declined.

School H. Comparison of the first year of use of *EnVision* Mathematics to the last year of use of *EnVision* Mathematics, for duration of this study resulted in non-rejection (z-test value = 0.188; critical value = ±1.96) of the Null Hypothesis 6. Therefore, there was no significant difference in the proportion of proficient-advanced scoring on the fifth grade mathematics MAP from the beginning to the end of the eight-year span. The change in proportion of proficient-advanced observably declined.

School N. Comparison of the first year of use of *EveryDay* Mathematics to the last year of use of *EveryDay* Mathematics, for duration of this study resulted in rejection (z-test value = 3.046; critical value = ±1.96) of the Null Hypothesis 6. Therefore, there was a significant difference in the proportion of proficient-advanced scoring on the fifth grade mathematics MAP from the beginning to the end of the eight-year span. The change in proportion of proficient-advanced significantly increased.

School W. Comparison of the first year of use of *EveryDay* Mathematics to the last year of use of *EveryDay* Mathematics, for duration of this study resulted in non-rejection (*z*-test value = 1.378; critical value = ±1.96) of the Null Hypothesis 6. Therefore, there was no significant difference in the proportion of proficient-advanced scoring on the fifth grade mathematics MAP from the beginning to the end of the eight-year span. The change in proportion of proficient-advanced observably declined.

Districts.

Null Hypothesis 7: Among the study districts, there will be no difference in proportion of students scoring Proficient-Advanced on the first year of the study, 2006, when compared to the last year of the study, 2013, measured by the Missouri Assessment Program (MAP) fifth grade mathematics exams.

District A. Comparison of the first year of use of *EveryDay* Mathematics to the last year of use of *EveryDay* Mathematics, for duration of this study resulted in non-rejection (*z*-test value = 1.494; critical value = ±1.96) of the Null Hypothesis 7. Therefore, there was no significant difference in the proportion of proficient-advanced scoring on the fifth grade mathematics MAP from the beginning to the end of the eight-year span. The change in proportion of proficient-advanced observably declined.

District B. Comparison of the first year of use of *EnVision* Mathematics to the last year of use of *EnVision* Mathematics, for duration of this study resulted in non-rejection (*z*-test value = 0.443; critical value = ±1.96) of the Null Hypothesis 7. Therefore, there was no significant difference in the proportion of proficient-advanced scoring on the fifth grade mathematics MAP from the beginning to the end of the eight year span, when examining district data for the *EnVision* Mathematics group. The change in proportion of proficient-advanced observably declined.

Null Hypothesis 8: Student achievement in the Proficient-Advanced category on the Missouri Assessment Program mathematics exam is independent of the curriculum in use: *EveryDay* Mathematics or *EnVision* Mathematics, when considering the first year of study, 2006 and the last year of study, 2013.

A Chi-Square test for Independence was applied to percentages of students in the Proficient-Advanced categories from two schools where students used *EveryDay* Mathematics curriculum materials and two different schools used *EnVision* Mathematics curriculum materials. Table 34 displays the proportions of Proficient-Advanced students for each of the four study schools during the first year of analysis for this study, including notation of the program of mathematics study used.

Table 34.

Proficient-Advanced Percentages: First year – 2006

EveryDay Mathematics	W: 25.0	N: 24.3
EnVision Mathematics	D: 24.0	H: 46.7

Note: Schools W and N used *EveryDay*; D and H used *EnVision*.

Since the Chi-Square test value of 3.378 was smaller than the critical value of 3.841, the Null Hypothesis 8 was not rejected. Student achievement in the Proficient-Advanced category on the Missouri Assessment Program mathematics exam was independent of the curriculum in use: *EveryDay* Mathematics or *EnVision* Mathematics, when considering the first year of study. Student achievement was not dependent upon the mathematics curriculum materials, which was based on the school of attendance. Observably, School H from District B yielded the highest proportion of Proficient-

Advanced students, with 46.7%. This is in comparison to School D in District B and Schools N and W from District A, with 24.0%, 24.3%, and 25.0%, respectively.

Table 35 displays the proportions of Proficient-Advanced students for each of the four study schools during the last year of analysis for this study, including notation of the program of mathematics study used.

Table 35.

Proficient-Advanced Percentages: Last year – 2013

EveryDay Mathematics	W: 15.9	N: 49.2
EnVision Mathematics	D: 22.2	H: 43.8

Note: Schools W and N used *EveryDay*; D and H used *EnVision*.

Since the Chi-Square test value of 1.349 was smaller than the critical value of 3.841, the Null Hypothesis 8 was not rejected. Student achievement in the Proficient-Advanced category on the Missouri Assessment Program mathematics exam was independent of the curriculum in use: *EveryDay* Mathematics or *EnVision* Mathematics, when considering the last year of study. Student achievement was not dependent upon the mathematics curriculum materials, which was based on the school of attendance. Observably, School N from District A yielded the highest proportion of Proficient-Advanced students, with 49.2%, while District B, School H yielded 43.8%. This is in comparison to School D in District B and School W from District A, with 22.2% and 15.9%, respectively.

Early Phase to Late Phase Comparisons: Student Achievement

Null Hypothesis 9: Within the study schools, student achievement measured by the MAP fifth grade mathematics exam, will be independent of the phase of implementation of mathematics curriculum. The early phase was 2006-2008; the latter phase was 2009-2013.

To establish mathematics student achievement independence of or dependence upon the phase of the implementation of the mathematics program offered by each of the two study districts, a Chi-Square test for Independence was applied to proportions of achievement in the Below Basic, Basic, and Proficient-Advanced ratings for the early years, 2006 through 2008, and the latter years, 2009 – 2013. The mathematics material used to support curriculum in School W and School N was *EveryDay* Mathematics, while the mathematics material used in School D and School H was *EnVision* Mathematics.

Since the Chi-Square test value of 3.607 was smaller than the critical value of 5.991, the Null Hypothesis 9 was not rejected. For School D, student achievement measured by the proportions of fifth grade students scoring in the Below Basic, Basic, and Proficient-Advanced categories on the fifth grade mathematics MAP assessment was independent of the phase of implementation of mathematics curriculum. Student achievement was not dependent upon mathematics study during the early phase of implementation, as opposed to the later phase. Observably, the early phase compared to the later phase indicated potential change in the Proficient-Advanced category, with an increase from 26.7% to 38.9%.

Table 36 provides the proportions of students enrolled in study School D scoring in the Below Basic, Basic, and Proficient-Advanced categories on the MAP for the early phase of the study (2006-2008) and the later phase of the study (2009-2013).

Table 36.

School D: Proportion of Students

District Used *EnVision* Mathematics			
Year	Below Basic	Basic	Prof/Adv.
2006-2008	11.7	61.7	26.7
2009-2013	11.6	49.5	38.9

Table 37 provides the proportions of students enrolled in study School H scoring in the Below Basic, Basic, and Proficient-Advanced categories on the MAP for the early phase of the study (2006-2008) and the later phase of the study (2009-2013).

Table 37.

School H: Proportion of Students

District - Used *EnVision* Mathematics			
Year	Below Basic	Basic	Prof/Adv.
2006-2008	12.5	58.3	29.2
2009-2013	22.7	56.7	20.6

Since the Chi-Square test value of 4.463 was smaller than the critical value of 5.991, the Null Hypothesis 9 was not rejected. For School H, student achievement measured by the proportions of fifth grade students scoring in the Below Basic, Basic, and Proficient-Advanced categories on the fifth grade mathematics MAP assessment was independent of the phase of implementation of mathematics curriculum. Student achievement was not dependent upon mathematics study during the early phase of implementation, as opposed to the later phase. Observably, the early phase compared to the later phase indicated potential change in the Proficient-Advanced category, with a decrease from 29.2% to 20.6%.

Table 38 provides the proportions of students enrolled in study School N scoring in the Below Basic, Basic, and Proficient-Advanced categories on the MAP for the early phase of the study (2006-2008) and the later phase of the study (2009-2013).

Table 38.

School N: Proportion of Students

District - Used *EveryDay* Mathematics			
Year	Below Basic	Basic	Prof/Adv.
2006-2008	12.7	44.5	12.4
2009-2013	12.3	56.4	31.3

Since the Chi-Square test value of 4.272 was smaller than the critical value of 5.991, the Null Hypothesis 9 was not rejected. For School N, student achievement , measured by the proportions of fifth grade students scoring in the Below Basic, Basic, and Proficient-Advanced categories on the fifth grade mathematics MAP assessment was independent of the phase of implementation of mathematics curriculum. Student achievement was not dependent upon mathematics study during the early phase of implementation, as opposed to the later phase. Observably, the early phase compared to the later phase indicated potential change in the Proficient-Advanced category, with an increase from 12.4% to 31.3%.

Table 39 provides the proportions of students enrolled in study School W scoring in the Below Basic, Basic, and Proficient-Advanced categories on the MAP for the early phase of the study (2006-2008) and the later phase of the study (2009-2013).

Table 39.

School W: Proportion of Students

District - Used *EveryDay* Mathematics			
Year	Below Basic	Basic	Prof/Adv.
2006-2008	18.3	55.2	26.5
2009-2013	22.0	58.2	19.8

Since the Chi-Square test value of 1.388 was smaller than the critical value of 5.991, the Null Hypothesis 9 was not rejected. For School W, student achievement , measured by the proportions of fifth grade students scoring in the Below Basic, Basic, and Proficient-Advanced categories on the fifth grade mathematics MAP assessment was independent of the phase of implementation of mathematics curriculum. Student achievement was not dependent upon mathematics study during the early phase of implementation, as opposed to the later phase. Observably, the early phase compared to the later phase indicated potential change in the Proficient-Advanced category, with a decrease from 26.5% to 19.8%.

Null Hypothesis 10: Within the study districts, student achievement measured by the MAP fifth grade mathematics exam, will be independent of the phase of implementation of mathematics curriculum. The early phase was 2006-2008; the later phase was 2009-2013.

A Chi-Square test for Independence was applied to aggregate proportions representing the early phase of implementation, 2006-2008 to the later phase of implementation, 2009-2013 to compare the two districts. The mathematics materials used to support curriculum in District A was *EveryDay* Mathematics, while the mathematics materials used in District B was *EnVision* Mathematics. Table 40 provides the proportions of students enrolled in study District A scoring in the Below Basic, Basic, and Proficient-Advanced categories on the MAP for the early phase of the study (2006-2008) and the later phase of the study (2009-2013).

Table 40.

District A: Proportion of Students

Year	Below Basic	Basic	Prof/Adv.
2006-2008	15.2	49.3	18.7
2009-2013	17.2	57.3	25.5

Since the Chi-Square test value of 0.231 was smaller than the critical value of 5.991, the Null Hypothesis 10 was not rejected. For District A, student achievement measured by the proportions of fifth grade students scoring in the Below Basic, Basic, and Proficient-Advanced categories on the fifth grade mathematics MAP assessment was independent of the phase of implementation of mathematics curriculum. Student achievement was not dependent upon mathematics study during the early phase of implementation, as opposed to the later phase. Observably, the early phase compared to the later phase indicated potential change in the Proficient-Advanced category, with an increase from 18.7% to 25.5%.

Since the Chi-Square test value of 1,484 was smaller than the critical value of 5.991, the Null Hypothesis 10 was not rejected. For District B, Student achievement measured by the proportions of proportions of fifth grade students scoring in the Below Basic, Basic, and Proficient-Advanced categories on the fifth grade mathematics MAP assessment was independent of the phase of implementation of mathematics curriculum. Student achievement was not dependent upon mathematics study during the early phase of implementation, as opposed to the later phase. Observably, the early phase compared to the later phase indicated potential change in the Proficient-Advanced category, with an increase from 27.6% to 32.9%. Table 41 provides the proportions of students enrolled in study District B scoring in the Below Basic, Basic, and Proficient-Advanced categories on the MAP for the early phase of the study (2006-2008) and the later phase of the study (2009-2013).

Table 41.

District B: Proportion of Students

District - Used *EnVision* Mathematics			
Year	Below Basic	Basic	Prof/Adv.
2006-2008	12.0	60.4	27.6
2009-2013	15.2	51.9	32.9

District Comparisons

Null Hypothesis 11: Within the study districts, student achievement measured by the MAP fifth grade mathematics exam, will be independent of the district attended and use of the *EveryDay* and *EnVision* study materials.

To establish mathematics student achievement independence of or dependence upon the implementation of the mathematics program, based on the district attended, a Chi-Square test for Independence was applied to proportions of achievement in the Below Basic, Basic, and Proficient-Advanced ratings for the years 2006 through 2013. The mathematics material used to support curriculum in District A was *EveryDay* Mathematics, while the mathematics material used in District B was *EnVision* Mathematics. Table 42 provides the overall average proportions of students enrolled in study Districts A and B scoring **in** the Below Basic, Basic, and Proficient-Advanced categories on the MAP for the eight-year span of the secondary data gathered for the study (2006-2013).

Table 42.

Districts: Overall Proportion of Students

District	Below Basic	Basic	Prof/Adv.
A	14.0	55.2	30.8
B	16.3	53.7	22.4

Since the Chi-Square test value of 1.223 was smaller than the critical value of 5.991, the Null Hypothesis 11 was not rejected. Student achievement measured by the proportions of fifth grade students scoring in the Below Basic, Basic, and Proficient-Advanced categories on the fifth grade mathematics MAP assessment was independent of the district attended and use of the *EveryDay* and *EnVision* study materials. Student achievement was not dependent upon mathematics study based on the district of attendance. Observably, District A to District B comparison yielded a difference of 30.8% to 22.4%, with District A yielding the highest proportion of Proficient-Advanced students.

Null Hypothesis 12: When comparing districts, there is no difference between average proportion in the Below Basic category and in the Proficient-Advanced category, measured by the fifth grade mathematics MAP.

A *z*-test for difference in means was applied to test the mean difference in proportions between the two districts in the category of Proficient-Advanced throughout the eight-year span of the study. Proportions of Proficient-Advanced for the eight-years included in the study are recorded in Table 43, with respect to the mathematics programs used by students. Results of the *z*-test are recorded in Table 44.

Table 43.

Proficient & Advanced

Year	*EnVision*: P&A	*EveryDay*: P&A
2006	34.2	24.7
2007	30.6	22.9
2008	15.8	12.6
2009	18.6	23.4
2010	52.8	20.7
2011	38.5	29.1
2012	17.9	22.4
2013	30.2	32.6

Table 44.

z-Test: Two Sample for Means

	EnVision: P&A	*EveryDay: P&A*
Mean	29.825	23.55
Known Variance	155.4	34.8
Observations	8	8
z	1.286	
P(Z<=z) two-tail	0.198	
z Critical two-tail	1.959	

Since the *z*-test value of 1.286 was smaller than the critical value of 1.959, the Null Hypothesis 12 was not rejected. There was no significant difference between the overall average proportions of proficient-advanced students between districts, for the years 2006 through 2013.

A *z*-test for difference in means was applied to test the mean difference in proportions between the two districts in the category of Below Basic throughout the eight-year span of the study. Proportions of Below Basic for the eight years included in the study are recorded in Table 45, with respect to the mathematics programs used by students. Results of the *z*-test are recorded in Table 46.

Table 45.

Below Basic

Year	*EnVision*: BB	*EveryDay*: BB
2006	5.5	14.3
2007	20.1	18.9
2008	10.5	13.4
2009	10.2	21.4
2010	5.6	24.0
2011	16.9	15.7
2012	28.6	9.0
2013	18.6	14.5

Table 46.

z-Test: Two Sample for Means

	EnVision: BB	*EveryDay: BB*
Mean	14.5	16.4
Known Variance	63.9	23
Observations	8	8
z	0.576	
P(Z<=z) two-tail	0.564	
z Critical two-tail	1.959	

Since the z-test value of 0.576 was smaller than the critical value of 1.959, the null hypothesis 12 was not rejected. There was no significant difference between the overall average proportions of Below Basic students between districts, for the years 2006 through 2013.

Null Hypothesis 13: There will be no difference in overall district proportion of students scoring Proficient-Advanced on the 2006 – 2013 Missouri Assessment Program (MAP) fifth-grade mathematics exams, when comparing District A, which prepared its students through use of *EveryDay* Mathematics, to District B, which prepared its students through use of *EnVision* Mathematics.

Overall eight-year average proportions of proficient-advanced are recorded in Table 47, as well as the *z*-test value as a result of the z-test for difference in proportion applied to the data.

Table 47.

District A vs. District B: Overall Proficient-Advanced: 2006-2013

District	Proficient-Advanced %	
A – *Everyday* Mathematics	22.4	
B – *EnVision* Mathematics	30.8	
z-test value	3.670	
Rejection Result	Reject	Difference was Significant

Note: Critical value = ±1.96.

Comparison of the District A use of *EveryDay* Mathematics to the District B use of *EnVision* Mathematics measured by Overall District proportion of Proficient-Advanced students for the duration of the eight years of study resulted in rejection (*z*-test value = 3.670; critical value = ±1.96) of the Null Hypothesis 13. Therefore, there was a significant difference in the proportion of proficient-advanced scoring on the fifth grade mathematics MAP from the beginning to the end of the eight-year span. The difference in proportion of proficient-advanced for District B, through use of *EnVision* Mathematics, was significantly higher than the proportion of proficient-advanced for District A, through use of *EveryDay* Mathematics.

Summary of Results

This quantitative study conducted data analysis and computed statistics for 2006-2013 MAP mathematics scores for both comparison groups. Table 48 displays rejection or non-rejection results for each Null Hypothesis for the district or building level, as appropriate. Discussion of the detail of results follows the table.

Table 48.

Rejection or Non-Rejection of Null Hypotheses

	District		School			
Null Hypothesis #	A	B	N	W	D	H
1			yes	no	yes	yes
2			no	no	no	no
3	no	no				
4			no	no	no	no
5	no	no				
6			yes	no	no	no
7	no	no				
8			no	no	no	no
9			no	no	no	no
10			no	no	no	no
11	no	no				
12	no	no				
13	yes	yes				

An application of the Chi-Square test for Homogeneity to compare proportions of Below Basic, Basic, and Proficient-Advanced students for each individual school, year-to-year, found that data rejected Null Hypothesis 1 for Schools D, N, and H. For School W, significant differences were found for some categories throughout the study span.

Application of the Chi-Square test for Independence applied to proportions of achievement in the Below Basic, Basic, and Proficient-Advanced categories resulted in non-rejection of Null Hypothesis 2 for all study schools. Student outcomes in mathematics achievement were independent of the study School attended.

A Chi-Square test for Homogeneity to compare proportions of Below Basic, Basic, and Proficient-Advanced students for each individual district, year-to-year, resulted in non-rejection of Null Hypothesis 3, for the years spanned by the study.

A *z*-test for difference in proportion to compare proportions of Proficient-Advanced students for each individual school, year-to-year, resulted in rejection of Null Hypothesis 4, for individual years by each school. Significant difference was found for the following mathematics achievement outcomes: School D, 2009-to-2010 moved up, 2011-to-2012 moved down; School H, 2012-to-2013 moved up; School N, 2008-to-2009 moved up; 2011-to-2012 moved down; School H, 2012-to-2013 moved up; first year-to-last year moved up; School W, 2009-2010 moved down.

A Chi-Square test for Homogeneity was applied to data for each of the two districts to check for year-to-year differences in Below Basic, Basic, and Proficient-Advanced categories with a Chi-Square test for Homogeneity. This was followed by *z*-tests for difference in proportion. And then, data was tested for differences specifically in the Proficient-Advanced categories. Null Hypothesis 5 was rejected for a few specific instances during the comparisons. Differences in Proficient-Advanced proportions were found for District A for 2008-to-2009 with movement down and for 2008-to-2009 with movement up. Differences were found for District B for 2009-to-2010 with movement up and for 2011-to-2012 with movement down.

For Null Hypothesis 6 a *z*-test for difference in proportion was used to compare the first year of study to the last year of study for the proportion of Proficient-Advanced students at the school level. The Null Hypothesis 6 was not rejected for Schools W, D, and H. However, data for School N indicated significant movement upward when comparing 2006 to 2013. The school, from District A used *EveryDay* Mathematics curriculum study materials.

For Null Hypothesis 7 a *z*-test for difference in proportion was used to compare the first year of study to the last year of study for the proportion of Proficient-Advanced students at the district level. Null Hypothesis 7 was not rejected.

A Chi-Square test for Independence was applied to percentages of students in the Proficient-Advanced categories to check for independence of the school of enrollment. Schools W and N used *EveryDay* Mathematics curriculum materials and Schools D and H used *EnVision* Mathematics curriculum materials. Null Hypothesis 8 was not rejected.

To check for changes in student achievement possibly affected by potential improvement in the implementation of the use of *EveryDay* Mathematics *EnVision* Mathematics curriculum materials, a Chi-Square test for Independence was applied to proportions of achievement in the Below Basic, Basic, and Proficient-Advanced ratings for the early years, 2006 through 2008, and the latter years, 2009 – 2013, at the school level. Null Hypothesis 9 was not rejected.

To check for changes in student achievement possibly affected by potential improvement in the implementation of the use of *EveryDay* Mathematics *EnVision* Mathematics curriculum materials, a Chi-Square test for Independence was applied to proportions of achievement in the Below Basic, Basic, and Proficient-Advanced ratings for the early years, 2006 through 2008, and the latter years, 2009 – 2013, at the district level. Null Hypothesis 10 was not rejected.

To compare student mathematics outcomes between the study districts, Null Hypothesis 11 was tested with a Chi-Square test for Independence applied to proportions of achievement in the Below Basic, Basic, and Proficient-Advanced ratings for the years 2006 through 2013. Null Hypothesis 11 was not rejected.

To compare student mathematics outcomes between the study districts, Null Hypothesis 12 was tested with a *z*-test for difference in means was applied to test the mean difference in proportions between the two districts in the categories of Below Basic throughout the eight-year span of the study. Also, a z-test for difference in means was applied to test the mean difference in proportions between the two districts in the category of Proficient-Advanced throughout the eight-year span of the study. Null Hypothesis 12 was not rejected.

To compare student mathematics outcomes between the study districts, Null Hypothesis 13 was tested with a *z*-test for difference in means applied to the mean difference in overall district proportions between the two districts in the category of Proficient-Advanced throughout the eight-year span of the study. Null Hypothesis 13 was rejected.

When both district and school data were computed, fifth grade students using *EveryDay* Mathematics and *EnVision* Mathematics showed no significant difference in achievement levels on the MAP. Statistical data analysis for each group resulted in not rejecting the null hypothesis. An alpha of .05 was used to determine the statistical significance.

Chapter Five summarizes the previous chapters and presents a discussion of the findings, including recommendations and future research.

Chapter Five: Discussion

Introduction

The purpose of this quantitative study was to compare two sets of mathematics curriculum materials, *EveryDay* Mathematics and *EnVision* Mathematics, and examine whether there was a difference in the mathematics achievement level of fifth-grade students on the mathematics MAP test throughout the years 2006 – 2013. This study consisted of and examination of secondary data generated by fifth grade students from four urban elementary schools in Midwestern Missouri. The eight years of analyzed data for this study was retrieved from the Missouri Comprehensive Data System (MCDS, 2013).

To measure whether the independent variable of study materials choice had any effect on the dependent variable of achievement outcomes in this study, several tests were applied, such as; Chi Square test for Homogeneity, Chi Square test for Independence, and z-test for difference in proportions.

Chapter Five provides a brief summary of the research study and a discussion of the results. Also discussed and organized are the following sections: (a) statement of the problem and purpose; (b) literature review; (c) review of the methodology; (d) discussion of the findings; (e) implications and discussions; (f) limitations; and, (g) recommendations for future research.

Summary of the Study

Approximately 180 fifth-grade students from each of two urban school districts located in Midwest Missouri were selected for this study. This quantitative comparison was to determine if either of two different mathematics programs, *EveryDay* Mathematics or *EnVision* Mathematics, would significantly improve student achievement on the Missouri annual state assessment, MAP. The results of the statistical analysis found neither mathematics program made a significant difference in student achievement. Therefore, study hypotheses were rejected.

Statement of the problem and purpose. No Child Left Behind (NCLB) mandated that all children would achieve proficiency in reading and mathematics by 2014. Highly qualified teachers would be hired in core subject areas. Each state would be held accountable for developing its own standards-based assessments to measure student achievement and attain adequate yearly progress (AYP). Title I funds would be allotted for schools with a large proportion of low-income students to provide additional academic resources and assistance. School districts would implement their own standards-based mathematics curriculums based on research (U.S. Department of Education, 2010b).

Examining Missouri Assessment Program (MAP) test data at the beginning of this study indicated that the projected goals of (NCLB) were not likely to be met. By fifth grade, the mathematics achievement level of students in this study were well below the projected timetable established by (NCLB). Based on the data of this study, all students would not achieve 100% proficiency in mathematics by the end of the 2013-14 school year as mandated. At the time of this writing, the timetable had completed, and the state of Missouri, as well as other states, did not meet the mandated 100% proficiency in mathematics, as required by the original demands of NCLB.

The purpose of this quantitative study was to compare two different mathematics programs, *EveryDay* Mathematics and *EnVision* Mathematics to determine if either made a significant contribution to differences in fifth-grade students' achievement on the mathematics MAP test during a consecutive eight-year period, 2006-2013.

Review of the methodology. This study examined data to test for difference in mathematics achievement outcomes, measured by the MAP achievement levels of two urban public schools, two using the *EveryDay* Mathematics program and two using the *EnVision* Mathematics. The mathematics achievement of the students was measured using the 2006 - 2013 MAP test results. All four schools in the study were similar in demographics, and mathematics instruction was departmentalize in all four schools. The participating districts, and the schools selected to represent them, in this study were obtained from the Missouri Comprehensive Data System (MCDS).

The sample population for this study consist of approximately 180 fifth-grade students using the *EveryDay* Mathematics program, as the experimental group, and a control group of approximately 180 fifth-grade students using the *EnVision* Mathematics program. The dependent variable in this study was the student mathematics scores on the mathematics MAP test, which was administered annually during the spring of each year. All fifth-grade students in Missouri were required to take the MAP test.

To measure and compare the MAP test results, the following statistical measures were used: A Chi-Square test for Independence, A Chi-Square test for Homogeneity, *z*-test for difference in proportion, and *z*-test for difference in means.

Hypotheses addressed during this quantitative study were:

Hypothesis A1. Among the study schools and study districts, there will be no difference in year-to-year proportions of students scoring Below Basic, Basic, and

Proficient-Advanced on the 2006 – 2013 Missouri Assessment Program (MAP) fifth grade mathematics exams (Null Hypotheses 1 & 3).

Hypothesis A2: Within the study schools and study districts, student achievement measured by the MAP fifth grade mathematics exam, will be dependent on the school building and use of the *EveryDay* and *EnVision* study materials (Null Hypotheses 2 & 11).

Hypothesis A3: Among the study schools and study districts, there will be no difference in year-to-year proportions of students scoring Proficient-Advanced on the 2006 – 2013 Missouri Assessment Program (MAP) fifth grade mathematics exams (Null Hypotheses 4 & 5).

Hypothesis A4: Among the study schools and study districts, there will be no difference in proportion of students scoring Proficient-Advanced on the first year of the study, 2006, when compared to the last year of the study, 2013, measured by the Missouri Assessment Program (MAP) fifth grade mathematics exams (Null Hypotheses 6 & 7).

Hypothesis A5: Student achievement in the Proficient-Advanced category on the Missouri Assessment Program mathematics exam is dependent on the curriculum in use: *EveryDay* Mathematics or *EnVision* Mathematics, when considering the first year of study, 2006 and the last year of study, 2013 (Null Hypothesis 8).

Hypothesis A6: Within the study schools and study districts, student achievement measured by the MAP fifth grade mathematics exam, will be dependent on the phase of implementation of mathematics curriculum. The early phase was 2006-2008; the latter phase was 2009-2013 (Null Hypotheses 9 & 10).

Hypothesis A7: When comparing districts, there is no difference between average proportion in the Below Basic category and in the Proficient-Advanced category, measured by the fifth grade mathematics MAP (Null Hypothesis 12).

Hypothesis A8: There will be no difference in overall district proportion of students scoring Proficient-Advanced on the 2006 – 2013 Missouri Assessment Program (MAP) fifth grade mathematics exams, when comparing District A, which prepared its students through use of *EveryDay* Mathematics, to District B, which prepared its students through use of *EnVision* Mathematics (Null Hypothesis 13).

Discussion of the findings. The findings in this study were unable to support a significant difference in fifth-grade students' mathematics achievement on the MAP test, in consideration of the use of either the *EveryDay* Mathematics program or the *EnVision* Mathematics program. Although mathematics instruction in this study was departmentalized, there was no evidence of unusual student achievement. However, in prior studies of fifth-grade mathematics, students showed significant improvement when taught in a departmentalize setting (Moore, 2008)

None of the four schools in this study showed consecutive consistency in student performance over the eight-year period examined, and teachers had no specific specialized training in mathematics. They were generalists, teaching in a departmentalized setting. The fifth-grade students and teachers in the experimental group of this study, using the *EveryDay* Mathematics program were from a smaller school district. It was assumed, the smaller district would outperform the larger district.

Table 49 displays results of the support or non-support of hypotheses for this study for the district-level and building-level comparisons of fifth grade mathematics

MAP achievement data for the span of years from 2008 through 2013. A discussion of details follows the table.

Table 49.

Support or Non-Support of Hypotheses

		District		School			
Hypothesis #	Related Null	A	B	N	W	D	H
A1	1 & 3	no	no	no	no	no	no
A2	2 & 11	no	no	no	no	no	no
A3	4 & 5	no	no	no	no	no	no
A4	6 & 7	no	no	no	no	no	no
A5	8	no	no	no	no	no	no
A6	9 & 10			no	no	no	no
A7	12	no	no				
A8	13	yes	yes				

Hypothesis A1 was tested by Null Hypotheses 1 and 3. Analysis of data resulted in rejection of Null Hypothesis 1 for Schools D, N, and H. For School W, which used *EveryDay* Mathematics, significant differences were found for some categories through the study span. Differences could have been generated by variables other than the choice of mathematics materials used district-wide, such as individual delivery strategies chosen. This variable was not explored in this study. Overall, no differences found in comparison on the school level. Analysis resulted in non-rejection of Null Hypothesis 3, for the years spanned by the study. No significant difference was found in comparison of district mathematics achievement. Therefore, data does not support Hypothesis A1.

Hypothesis A2 was tested by Null Hypotheses 2 and 11. Analysis of data resulted in non-rejection of Null Hypothesis 2 for all study schools. Student outcomes in mathematics achievement were independent of the study School attended. Therefore, mathematics achievement may not have been affected by the choice of *EveryDay*

Mathematics or *Envision* Mathematics as the curriculum study materials used. In comparison of study districts, Null Hypothesis 11 was not rejected. Achievement in mathematics, measured by the proportion of students in the Below Basic, Basic, and Proficient-Advanced categories on the MAP was independent of the study district and the use of *EveryDay* Mathematics *EnVision* Mathematics curriculum materials when comparing the early phase of implementation to the late phase. Data does not support Hypothesis A2.

Hypothesis A3 was tested by Null Hypotheses 4 and 5. Analysis of data resulted in rejection of Null Hypothesis 4. Schools D, N, and H showed significant movement in achievement for a few years throughout the study span; however School W showed no significant movement. The only school to show improvement from the first year to the last year was School H from District B, which used the *EnVision* Mathematics program. School D from District B and School N from District A shared common movement of mathematics achievement scores for the years 2011-to-2012 and 2012-to-2013, showing significant downward movement followed by significant upward movement. However, District A used the *EveryDay* Mathematics, while District B used the *EnVision* Mathematics program. Since schools N and W were from District A, while schools D and H were from District B there was no consistency in change in achievement level of fifth grade students when compared to the type of mathematics program using, making the result for support of Hypothesis A3 nonconclusive. Analysis of data indicated Null Hypothesis 5 was rejected for two of the eight years for each district. There was no consistent pattern to indicate the either *EveryDay* Mathematics or *EnVision* Mathematics provided stronger student outcomes in achievement. Therefore, data does not support Hypothesis A3.

Hypothesis A4 was tested by Null Hypotheses 6 and 7. Analysis of data indicated Null Hypothesis 6 was not rejected for Schools W, D, and H. However, data for School N indicated significant movement upward when comparing 2006 to 2013. The school, from District A used *EveryDay* Mathematics curriculum study materials. The upward movement could have been attributed to individual delivery strategies chosen by teachers. Null Hypothesis 7 was not rejected. There was no significant difference found in the proportion of students achieving Proficient-Advanced from the beginning of the study to the end, on the district level. Data does not support Hypothesis A4.

Hypothesis A5 was tested by Null Hypothesis 8. Analysis of data indicated Null Hypothesis 8 was not rejected. Achievement in mathematics, measured by the proportion of students in the Proficient-Advanced categories on the MAP, was independent of the school and enrollment and the study curriculum materials used. Data does not support Hypothesis A5.

Hypothesis A6 was tested by Null Hypotheses 9 and 10. Analysis of data indicated Null Hypothesis 9 was not rejected. Achievement in mathematics at the school level, measured by the proportion of students in the Below Basic, Basic, and Proficient-Advanced categories on the MAP, was independent of the phase of implementation for each study school use of *EveryDay* Mathematics *EnVision* Mathematics curriculum materials. Analysis of data indicated Null Hypothesis 10 was not rejected. Achievement in mathematics at the district level, measured by the proportion of students in categories on the MAP was independent of the phase of implementation for each study district use of *EveryDay* Mathematics *EnVision* Mathematics curriculum materials. Therefore, data does not support Hypothesis A6.

Hypothesis A7 was tested by Null Hypothesis 12. Analysis of data resulted in the non-rejection of Null Hypothesis 12. There were no significant differences in district average proportions of Below Basic, nor in district average proportions of Proficient-Advanced, achievement on the mathematic MAP throughout the study span. Therefore, data does not support Hypothesis A7.

Hypothesis A8 was tested by Null Hypothesis 13. Null Hypothesis 13 was rejected. Data supported a significant difference in the overall mean proportion of Proficient-Advanced for the study years 2006 – 2013, with District B proportions higher than District A. Students enrolled in District B received mathematics preparation with *EnVision* curriculum study materials. Data supports Hypothesis A8.

Hypothesis A8 was the only hypothesis supported by the longitudinal data offered throughout the eight-year span of mathematics achievement data. Therefore, the overall conclusion was there was no significant difference in achievement between fifth-grade students prepared for the mathematics MAP through use of study materials related to *EveryDay* Mathematics and *EnVision* Mathematics.

Reech and Stevens (1996) concluded that a mathematics deficit exited among Black students in the U.S., and in order to meet the educational needs of those students, more research was needed in order to identify the characteristics that affected the significant amount of variables impacting student achievement. This study attempted to add to the literature by choosing schools, and the districts they represented, with a high percentage of Black population enrolled.

Implications and Discussion

After conducting statistical analysis, the researcher concluded the comparison of both mathematics programs, *EveryDay* Mathematics and *EnVision* Mathematics, used by fifth-grade students made no significant difference in student achievement on MAP tests. Additionally, one program was not indicated to offer stronger preparation than the other. It can be assumed that neither mathematics program alone can improve student achievement.

Limitations

Instructional strategies nor teachers' knowledge of content were a part of this study. The amount of time allocated for professional development in mathematics was not considered in this study. Teachers' certification levels in mathematics were not considered in this study. Future research should consider these variables in research design.

Recommendations

Recommendations for future research. Improving the mathematics achievement of students, particularly at the elementary level will continue to be a major concern of public schools. While this study examined and compared the effectiveness of two mathematics programs on student achievement, it was assumed that no mathematics program alone could improve student achievement. It is imperative to conduct research on other variables that may impact student mathematics achievement and closing the achievement gap. Ladd (2011) concluded one major variable was socioeconomic status. This issue must be addressed if public schools have a chance of closing the achievement gaps. Policies must be established in order to reduce poverty and other attributes of low-socioeconomic status. Aggressive steps must be taken to reduce income disparity.

Future research on departmentalization of fifth-grade mathematics should be conducted to compare student mathematics achievement based on instruction received from specialized trained teachers and generalized teachers. Longitudinal research should be conducted examining grades three, four, and five consecutively considering student achievement on state assessments, measuring whether student mathematics achievement increased or decreased. More urban public schools within different districts in Missouri should be studied. Fifth-grade mathematics in both a departmentalized and traditional setting should be studied to examine student achievement. A study should be conducted to examine the effect of content quality mathematics professional development on student achievement. And, teaching programs need to expand mathematics courses for elementary teachers, with an emphasis on content knowledge.

Conclusions

Based on the No Child Left Behind Act (2001), public school districts throughout the U.S. were trying to find a standards-based mathematics curriculum that would improve student achievement. Fifth-grade students in this study received instruction using the *EveryDay* Mathematics program and the *EnVision* Mathematics program. Both mathematics programs were compared with regard to contribution to measurement of student achievement on the Missouri Assessment Program standardized-test.

The quantitative evidence in this study showed that neither mathematics program, within the setting of this study, contributed to a significant difference in the achievement level of fifth-grade students. While conducting this study, the review of literature revealed that the type of curriculum alone did not improve student achievement. There were significant variables that existed in urban public schools that adversely affected students' mathematics achievement. Until the correlations between such variables as family background, low-socioeconomic status, poverty, and income inequality are addressed, and actions are taken for improvement, the achievement gaps in mathematics will continue to exist (Ladd, 2011).

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Appendix A

Table A1.

School D: Number of Students

District - Used *EnVision* Mathematics				
Year	Below Basic	Basic	Prof/Adv.	Total
2006-2008	14	74	32	120
2009-2013	23	98	77	198

Table A2.

School H: Number of Students

District - Used *EnVision* Mathematics				
Year	Below Basic	Basic	Prof/Adv.	Total
2006-2008	9	42	21	72
2009-2013	22	55	20	97

Table A3.

School N: Number of Students

District - Used *EveryDay* Mathematics				
Year	Below Basic	Basic	Prof/Adv.	Total
2006-2008	42	147	41	330
2009-2013	43	198	110	351

Table A4.

School W: Number of Students

District - Used *EveryDay* Mathematics				
Year	Below Basic	Basic	Prof/Adv.	Total
2006-2008	49	148	71	268
2009-2013	79	209	71	359

Table A5.

District A: Number of Students

District - Used *EveryDay* Mathematics				
Year	Below Basic	Basic	Prof/Adv.	Total
2006-2008	91	295	112	598
2009-2013	122	407	181	710

Table A6.

District B: Number of Student

District - Used *EnVision* Mathematics				
Year	Below Basic	Basic	Prof/Adv.	Total
2006-2008	23	116	53	192
2009-2013	45	153	97	295

Table A7.

Schools: Overall Number of Students

School	Below Basic	Basic	Prof/Adv.	Total
D	37	172	109	318
H	128	357	142	627
N	85	345	151	681
W	31	97	41	169

Table A8.

Districts: Overall Number of Students

District	Below Basic	Basic	Prof/Adv.	Total
A	68	269	150	487
B	213	702	293	1308

Table A9.

District A: Fifth Grade Mathematics MAP

School W		
Year	% Basic-Below	% Proficient-Advanced
2006	75	25
2007	72	28
2008	74	26
2009	73.8	26.3
2010	87.5	12.6
2011	82.4	17.6
2012	72.6	26.2
2013	84.1	15.9
School N		
Year	% Basic-Below	% Proficient-Advanced
2006	75.7	24.3
2007	85.3	14.7
2008	40.6	7.3
2009	79.7	19.6
2010	70	28.7
2011	59.1	40.9
2012	81.9	18.1
2013	50.7	49.2

Table A10.

District B: Fifth Grade Mathematics MAP

School D		
Year	% Basic-Below	% Proficient-Advanced
2006	74.4	25.6
2007	65.9	34.1
2008	80.6	19.4
2009	77.5	22.5
2010	34.7	65.3
2011	47.6	52.4
2012	80	20
2013	77.8	22.2
School H		
Year	% Basic-Below	% Proficient-Advanced
2006	53.3	46.7
2007	76.2	23.8
2008	90.5	9.5
2009	89.5	10.5
2010	73.9	22.7
2011	87	6.3
2012	87.5	12.5
2013	56.3	43.8

Vitae

Michael Starks is a military veteran, with 25 years of teaching and administrative experience in public education. He holds a Bachelor of Science from Washington University, a Master of Education from the University of Missouri, and is a Doctorate of Education student at Lindenwood University with a projected graduation date of 2014.

Michael is a Mathematics Coach and Academy Director with a charter school district. His interest and goal is to improve students' mathematics skills in preparation for advanced mathematics study.