THE INFLUENCE OF THE COMMON CORE STATE STANDARDS IN MATHEMATICS ON MATHEMATICS SELF-EFFICACY: A MIXED METHOD APPROACH

A Doctoral Research Project
Presented to
Assistant Professor Janice White
Doctoral Research Committee Chair
School of Education
The Sage Colleges

In Partial Fulfillment of the
Requirements for the
Degree of Doctor of Education
In Educational Leadership

Kenneth A. Lein

November 2014

We represent to Sage Graduate School that this thesis/dissertation and abstract are the original work of the author and do not infringe on the copyright or other rights of others.

_____ _____

Kenneth A. Lein Date of Signature

_____ _____

Dr. Janice White Date of Signature
Assistant Professor of Education
Dissertation Chair

THE INFLUENCE OF THE COMMON CORE STATE STANDARDS IN MATHEMATICS ON MATHEMATICS SELF-EFFICACY: A MIXED METHOD APPROACH

Abstract

Most states have adopted the Common Core State Standards in Mathematics (CCSSM) in response to concerns that United States' students are not competitive in international mathematics achievement. The demands on teachers and expectations for students have increased with its implementation.

The purpose of this mixed method study was to explore the effect of the implementation of the Common Core State Standards in Mathematics on elementary teachers' perceptions of mathematics self-efficacy. In addition, the study examined teachers' perceptions of principal readiness to lead the implementation, and principals' perceptions of teacher readiness to implement the changes. The study also examined principals' self-perceptions of mathematics efficacy and principals' perceptions of central office support for the implementation.

Quantitative data were collected from 162 teachers from three urban districts and three suburban districts using a modification of the Mathematics Teaching Efficacy Beliefs Instrument. The qualitative data were collected from semi-structured interviews with 11 building principals and focused on principals' perceptions of teacher, self, and central office readiness to implement the CCSSM.

The findings of this study provided evidence that the implementation of the CCSSM has resulted in a decrease in teacher efficacy in mathematics instruction. Principals perceived that teacher readiness for the implementation of the CCSSM depended upon Common Core-aligned text books. Conclusions state the need to increase efficacy for both teachers and principals.

Keywords: central office, Common Core State Standards in Mathematics, efficacy, instructional leadership, professional development, reform mathematics, traditional mathematics

Acknowledgements

It would have been difficult to complete this process without the support and inspiration of many people. I would like to acknowledge the following. Thank you to Dr. Janice White. She seemed to always know when I needed to be lifted up. Much appreciation to Dr. Bob Bradley for his wisdom and keen eye. I would also like to thank early mentors who may never know how much our time together shaped who I am as an educator: Hank and Jeannette Boehning, and Frank Hodge.

Thank you to the members of Cohort Six for their friendship, support, and the laughter. I must acknowledge Dawn Hochsprung, an important member of our cohort. I knew her for so short a time, but she dedicated her life to the work we do. May we all help keep her legacy alive. While we are all worse off without her, I am certainly a better person for having known her for even a brief time.

I thank my wife Jill. When I was tired and ready to stop, she gave me the push to continue, despite the many Sundays that she gave up so I could do the work. Now that it is complete, I will clean up the mess. Please teach me to relax.

Although my daughters Erin and Meaghan are out on their own, I hope I continue to model the work ethic that my father taught me.

So finally, I thank my dad, Terry Lein who I lost during this process. Education was never really a choice for me. It was an expectation. Thank you for all of your sacrifices. I know you were proud of my successes, and I will be thinking of you when I cross that stage.

TABLE OF CONTENTS

Chapter One: Introduction……..1

Background……. 1

Statement of the Problem…… 3

Purpose and Research Questions…… 3

Significance of the Study…… 4

Definition of Terms…… 6

Delimitations and Limitations…… 7

Organization……... 8

Chapter Two: Literature Review…… 9

Mathematics Reform…….. 10

Historical perspective…….. 10

Regents Reform Agenda……. 14

Race to the Top…….. 14

Common Core State Standards in Mathematics…… 16

Reform: A Change Process…… 17

Efficacy…….. 20

Historical perspective……. 20

Teacher efficacy and mathematics reform……... 25

Professional development and teacher efficacy……. 26

Teacher collective efficacy…….. 28

Central Office Support……. 29

Principal efficacy……. 30

Professional development and principal efficacy…… 32

Principal professional learning communities…….. 33

Summary……. 34

Chapter Three: Methodology…….. 35

Purpose…… 35

Research Design…….. 36

Population and Sampling……. 37

Instrumentation…… 38

Data Collection…… 39

Data Analysis……... 41

Validity and Reliability…… 43

Researcher Bias…… 44

Chapter Four: Analysis of Data……... 46

Participant Characteristics…… 46

Research Question One…… 49

Personal mathematics teaching efficacy…….. 50

Mathematics teaching outcome expectancy……. 56

Research Question Two…… 60

Research Question Three…….. 68

Research Question Four…… 73

Findings……. 83

Chapter Five: Summary of Findings, Conclusions, and Recommendations…… 85

Summary of Findings…… 85

Research question one and findings…….. 85

Research question two and findings…….. 88

Research question three and findings…… 90

Research question four and findings……..92

Conclusions……93

Recommendations for Policy Makers……... 95

Recommendations for Systems Leaders…… 97

Recommendations for Future Studies……... 98

References…… 100

Appendix A: Letter Requesting Permission to Use and Modify the Survey…… 115

Appendix B: Modified MTEBI…… 117

Appendix C: Principal Interview Questions…… 120

Appendix D: Teacher Demographic Questions…… 121

Appendix E: Principal Demographic Questions…….. 122

Appendix F: Interview/Research Matrix……. 123

Appendix G: Superintendent Introduction/Permission Letter……. 124

Appendix H: Informed Consent Letter for Principal…… 126

Appendix I: Informed Consent Letter for Teachers…… 127

Appendix J: Informed Consent Form for Teachers……. 128

Appendix K: Informed Consent Form for Principals…….. 130

Appendix L: Confidentiality Agreement…….. 132

Appendix M: Knowledge of CCSSM…….. 133

Table M1: Knowledge of CCSSM: A Comparison of Means and Standard Deviations in Rank Order by School

Table M2: Knowledge of CCSSM: Percentages of High Levels of Efficacy ……. 134
in Rank Order

Appendix N: Change in Practice……. 135

Table N1: Change in Practice Due to the Implementation of the CCSSM in
Rank Order by School

Appendix O: Principal Leadership…….. 136

Table O1: Teacher Perception of Principals' Leadership for CCSSM

List of Tables

Table 1: Major Components of the New York State Race to the Top Application……. 15

Table 2: School and District Characteristics Based on Size and Free and Reduced…… 47
Lunch Rates

Table 3: Percentage of Teachers by District Type and Gender…… 48

Table 4: Percentage of Teachers by Level…… 48

Table 5: Teaching Experience by District Type…….. 49

Table 6: Survey Items Measuring Personal Teaching Mathematics Efficacy (PMTE)…… 50
from the MTEBI

Table 7: Additional Survey Statements Measuring Personal Teaching Mathematics……. 51
Efficacy (PTME)

Table 8: Personal Mathematics Teaching Efficacy and PMTE for the CCSSM…….. 52
by School

Table 9: Results of One-Way ANOVA Tests: Personal Mathematics Teaching…… 53
Efficacy and Schools

Table 10: Results of One-Way ANOVA Tests: Personal Mathematics Teaching……... 54
Efficacy and District-Type

Table 11: Mean Values: Personal Mathematics Teaching Efficacy and PMTE…… 55
for the CCSSM by District-Type

Table 12: Changes in Personal Mathematics Teaching Efficacy at the School Level……. 56

Table 13: Survey Items Measuring Mathematics Teaching Outcome Expectations……..... 57
from the MTEBI

Table 14: Mathematics Teaching Outcome Expectancy (MTOE)……... 58

Table 15: Results of One-Way ANOVA: Mathematics Teaching Outcome……... 59

Expectations (MTOE) and Teaching Experience

Table 16: Teaching Experience and Outcome Expectancy for Agree and Strongly…… 60
Agree

Table 17: Survey Items Measuring Mathematics Knowledge of the Common Core…… 61
State Standards in Mathematics

Table 18: School Level Results of One-Way ANOVA: Knowledge of Common Core….. 61
State Standards in Mathematics

Table 19: Relationship between Teacher Knowledge of the CCSSM and Teacher……. 63
Perception of Change in Instructional Practice

Table 20: Survey Items Measuring Teachers' Perceptions of Principals' Leadership…….. 69
for CCSSM

Table 21: Teacher Perception of Principal Leadership for CCSSM…… 69

Table 22: Relationship between Teacher Perception of Principal Efficacy and…….. 70
Teacher PMTE for CCSSM

Table 23: Principal Demographics……... 71

Table 24: Delivery of Professional Development…… 82

Table M1: Knowledge of CCSSM: A Comparison of Means and Standard …….. 133
Deviations in Rank Order by School

Table M2: Knowledge of CCSSM: Percentages of High Levels of Efficacy……. 134
in Rank Order

Table N1: Change in Practice Due to the Implementation of the CCSSM in Rank…….. 135
Order by School

Table O1: Teacher Perception of Principals' Leadership for CCSSM……. 136

List of Figures

Figure 1: Expectations Model…….. 22

Figure 2: Concurrent Embedded Design……... 36

Chapter One: Introduction

This study explored the effect of the implementation of the Common Core State Standards in Mathematics on elementary teachers' perceptions of mathematics self-efficacy. It examined teachers' and principals' readiness to implement the new standards. The chapter presents background information, and states the purpose of the study and the research questions that guided the study. The chapter also describes the significance of the study and defines terms used throughout the study. Finally, it addresses delimitations and limitations.

Background

The Common Core State Standards Initiative (CCSSI) was developed in a continuing effort to improve student achievement in language arts and mathematics to enable United States' students to compete in a global market. The initiative was launched in 2009 by the National Governors Association Center for Best Practices and the Council of Chief State School Officers (CCSSI, 2010). State school chiefs and governors recognized inequities among states' standards and realized the value of consistent, real-world learning goals. The New York State Education Department (NYSED) joined in the adoption of the Common Core State Standards in 2010. In remarks to business and community leaders on May 28, 2014 about high school graduation, NYSED Commissioner Dr. John King stated that "More than a quarter of the students who entered New York State colleges were required to take remedial classes" (NYSED, 2014).

The adoption of the Common Core State Standards in Mathematics (CCSSM) has increased the demands on teachers due to changes in both content and pedagogy (CCSSI, 2010). Elementary teachers often teach more than one subject and are typically not certified in a content area. According to teach.org (2014), only four states, Idaho, North Dakota, South Dakota and Wyoming, require a content major for elementary teaching certification. Mathematics teaching

in the United States has traditionally emphasized the memorization of procedures (Stigler and Hiebert, 1999). The new expectations of the CCSSM emphasize deeper conceptual understanding (CCSSI, 2010). Schmidt and Houang (2012) noted that the actual implementation of the standards, "the degree to which the topics in the state's standards were actually being taught in the classrooms at the appropriate grades by the teachers" (p. 306) is a critical factor because standards depend on fidelity of implementation.

Rotter (1966) described teachers' beliefs in terms of internal control which is contingent upon one's own action, versus external control, which is contingent upon the action of others. Rooted in social cognitive theory, Bandura (1977; 1997) defined efficacy as a process where people constructed beliefs about their capacity to perform. Bandura suggested that teachers with higher levels of efficacy felt they could affect motivation and performance regardless of circumstances. He further suggested that decisions teachers made about instructional practice were directly guided by their sense of efficacy. Gibson and Dembo (1984) described a teacher's sense of personal teaching efficacy (PTE) as the belief that they had the knowledge (skills and abilities) to positively affect student achievement, and general teaching efficacy as a belief that effectiveness was limited by external, environmental sources. Tschannen-Moran, Woolfolk Hoy, and Hoy (1998) created a model that integrated Bandura's four sources of efficacy (i.e., verbal persuasion, vicarious experience, psychological arousal and mastery experience) to include the context of any situation, because teachers were not equally efficacious in all contexts.

Recent research funded by the Wallace Foundation (Honig, Copland, Rainey, Lorton, & Newton, 2010; Louis, Leithwood, Wahlstrom, & Anderson, 2010) has focused on the importance of principal instructional leadership to support improved teaching. Principals are "a professional group largely overlooked by the various educational reform movements of the past two decades.

Evidence suggests that, second only to the influences of classroom instruction, school leadership strongly affects student learning" (Davis, Darling-Hammond, LaPointe, & Meyerson, 2005, p. 3). Improving principal efficacy positively affects student learning (Louis et al., 2010). Central office plays an important role in support of principals' instructional leadership (Honig, 2012).

Statement of the Problem

On July19, 2010 the New York State Education Department adopted the Common Core State Standards in Mathematics (CCSSM). The new standards required key shifts in instruction. These shifts included greater focus on fewer topics, linking topics across grade levels, and rigor. Rigor consisted of conceptual understanding, procedures, fluency, and application (CCSSI, 2010). Changes in instructional practice required in reform mathematics are a departure from traditional mathematics instruction (Stigler & Hiebert, 1999).

Klassen et al (2011) noted that there has been an overall increase in studies on efficacy, but proportionally there has been no statistically significant change among the types of studies. The bulk of studies remain quantitative in nature. Klassen et al. (2011) pointed to the need for additional qualitative, mixed-method, and content-specific studies in mathematics. The intent of this study was to add to that body of research with an additional focus on the CCSSM.

Purpose and Research Questions

The purpose of this concurrent, embedded, mixed-methods research study was to examine the effect of the implementation of the Common Core State Standards in Mathematics (CCSSM) on elementary teachers' perceptions of mathematics efficacy. In addition, the study examined teachers' perceptions of principals' readiness to lead the implementation of the CCSSM, and teachers' and principals' perceptions of change in instruction in mathematics as a

result of the implementation. The study also examined principals' perceptions of mathematics efficacy, and principals' perceptions of central office support for the implementation.

Four research questions frame the study:

1. Has there been a change in teachers' sense of efficacy in teaching mathematics as a result of the implementation of the Common Core State Standards in Mathematics (CCSSM)?
2. What are teachers' perceptions of their own knowledge of the CCSSM and changes in instructional practices in teaching mathematics due to the adoption of the CCSSM, and principals' perceptions of teachers' readiness for implementation?
3. Is there a relationship between teachers' perceptions of the efficacy of their principals' mathematics leadership for the implementation of the CCSSM and teachers' sense of self-efficacy in teaching Common Core mathematics?
4. Do building leaders' perception of the role of central office support influence their sense of self-efficacy for instructional leadership in the implementation of the Common Core State Standards in Mathematics?

Significance of Study

This research on efficacy and the CCSSM is timely and unique. This study addressed a national reform movement, the Common Core State Standards in Mathematics while in its beginning stages. It addressed the gap in the literature through content specificity (mathematics) and a mixed-method approach. The results of this study will inform the field in developing next steps to support changes in teacher instruction and principal instructional leadership.

U. S. Secretary of Education Duncan noted that "a number of nations are out-educating us today in the STEM disciplines - and if we as a nation don't turn that around, those nations will

soon be out-competing us in a knowledge-based, global economy" (USDOE, 2012, p. 1). Efficacy is an important factor affecting teacher effectiveness (Gibson & Dembo, 1984; Tschannen-Moran, et al., 1998) and principal effectiveness (Louis, Leithwood, Wahlstrom, & Anderson, 2010). Understanding the factors that affect both efficacy and changes in efficacy due to the implementation of the CCSSM can inform the field regarding support systems for both teachers and principals to raise their levels of efficacy.

While much research on efficacy in teaching has been focused on pre-service teachers, this study focused on changes to the self-efficacy of elementary mathematics teachers who are currently working in the field, and principals' self-efficacy for instructional leadership in mathematics since the implementation of the CCSSM. Raising levels of teacher efficacy supports the research for improved student achievement. Research by Honig (2012) pointed to the importance of principals' instructional leadership as a means to build teacher capacity.

Klassen, Tze, Betts, & Gordon (2011) conducted a study that examined twelve years of efficacy studies (1998 – 2009). While numerous studies have been conducted on teacher efficacy, they reported a gap between the large number of quantitative studies, and the dearth of qualitative or mixed-methods studies. The gap also suggested the need for more content-specific studies.

The topic is important to improving principal instructional leadership, teacher instruction, and student achievement in mathematics in the immediate future. In order to see improved achievement in students, principals must provide the instructional leadership for improved teacher efficacy to support the implementation of the CCSSM. In turn, central office must provide the support to principals to improve their efficacy in instructional leadership. This study

has the potential to guide system leadership in a partnership that focuses on student achievement at all levels of leadership.

Definition of Terms

The following terms and definitions are used for the purpose of this study and are used throughout the research:

Central Office refers to district-level administrators who report directly to the superintendent (Honig et al., 2010).

Collective Efficacy refers to a group's shared belief in its capabilities to perform an action to produce results (Bandura, 1997).

Common Core State Standards in Mathematics are the recently adopted mathematics reform standards in New York State (CCSSI, 2010).

Efficacy is one's belief in his/her capability to perform a task at a given level of attainment (Bandura, 1977).

Embedded Professional Development refers to professional development within the context of the work (City, Elmore, Fiarman, & Teitle, 2009).

Gross Domestic Product (GDP) measures national income and output for a given country's economy. The gross domestic product (GDP) is equal to the total expenditures for all final goods and services produced within the country in a stipulated period of time (Trading Economics, 2013).

In-service teachers are teachers who are currently working in the field.

Instructional leadership refers to the support and development of teachers to grow in effectiveness (Davis, Darling-Hammond, LaPointe, & Meyerson, 2005).

Mathematical knowledge is defined as content, pedagogical, and mathematics process knowledge in relation to mathematics (Hill, Rowan, & Ball, 2005).

Mathematics proficiency refers to student performance that demonstrates an understanding of mathematics content expected at a particular grade level (NYSED, 2012).

Mathematics teaching outcome expectations (MTOE) is a teacher's belief that effective teaching can result in positive student learning outcomes regardless of external factors (Enochs, Smith & Huniker, 2000).

Personal mathematics teaching efficacy (PMTE) a teacher's belief in his or her teaching effectiveness (Enochs et al., 2000).

Pre-service teachers are students enrolled in a teacher education program.

Race to the Top is a competitive federal grant to fund education reform (NYSED, 2009).

Reform mathematics is a change in mathematical curriculum, pedagogy and assessment that focuses on mathematical understanding over memorization of procedures (NCTM, 1989).

Regents Reform Agenda refers to the educational reform initiative that was adopted by the Board of Regents in New York (NYSED, 2009).

Traditional mathematics is defined as instruction that focuses on procedural mathematics (Wu, 1996).

Delimitations/Limitations

A delimitation of the study was the limited scope on teachers from six districts and 11 principals in near proximity to the researcher. The delimitation to this geographic region and the use of convenience sampling limits the generalizability of the study. Another delimitation was the exclusion of rural districts, and a focus on elementary teachers. A larger pool of interview participants from across New York State would benefit the research.

A limitation is that the survey was based on perceptions and not actual implementation. While the mixed method approach enriched the data, the decision to interview principals instead of teachers did not allow teachers to expand on the self-reporting of the survey and may have limited the analysis. Low sample sizes from individual schools also limited the ability to generalize the results.

Organization

This dissertation is organized in five chapters. Chapter One is the introduction which describes the background of the study. The background includes previous studies and findings, presents the statement of the problem, and research questions to study the problem. It addresses the relevance of the study and what gaps exist in current research. Chapter One also defines key terms and addresses the significance of the study. Chapter Two is a literature review of mathematics reform and the Common Core State Standards in Mathematics, the change process, and teacher and principal efficacy. Chapter Two also explores professional development to increase levels of teacher and principal efficacy. Chapter Three includes the purpose statement and research questions, describes the design, population and sample, the units of analysis, setting and demographic data, instrumentation, and data collection procedures. Chapter Four is an analysis of the collected data which includes demographics, survey responses and response to interview questions. Finally, Chapter Five presents findings, conclusions and recommendations, including recommendations for future research.

Chapter Two: Review of Literature

The purpose of the chapter is to present an historical perspective on mathematics reform, literature on teacher and principal efficacy, and factors that affect efficacy. The chapter is divided into four main sections: (a) mathematics reform, (b) reform as a change process, (c) efficacy, and (d) central office support.

The Trends in International Mathematics and Science Studies (TIMSS) indicates steady growth in fourth grade mathematics achievement in the United States since the first TIMSS (1995), but eighth grade achievement in the United States remains stagnant (Provasnik et al., 2012). Forty-three percent of Singapore students, and 39 percent of Korean students, reached the highest benchmark in the TIMSS as compared with just 13 percent of United States' students with the most noticeable gap in achievement seen at grade eight where almost 50% of students from South Korea, Singapore, and Chinese Taipei (Taiwan) reached the most advanced level compared to just 7% of eighth grade students from the United States (NCES, 2012).

The demands on mathematics education are great for the current employment market. McKinsey's Global Institute reported that by 2008 "foreign born workers accounted for 17% of employment in STEM (science, technology, engineering, and math) occupations in the United States" (Dobbs et al., 2012, p.4). One measure of economic strength is the Gross Domestic Product (GDP). According to Peterson, Woessmann, Hanushek, & Lastra- Anadón (2011) raising proficiency rates of U.S. students in mathematics from 32% to the mid-50% range would result in a growth in the GDP of about $75 trillion over an 80 year period.

The changes called for in the Common Core State Standards in Mathematics (CCSSM) place increased demands for content knowledge and changes in pedagogy directly on the teacher (CCSSI, 2010). Meeting these expectations demands instructional leadership from principals.

Increasing teachers' and principals' sense of efficacy, a belief about one's capability to successfully carry out a particular course of action (Bandura, 1997), is instrumental in accomplishing an increase in student learning and achievement.

The review of literature behind this thesis will be presented through four main headings: (a) mathematics reform, (b) reform as a change process, (c) efficacy, and (d) central office support.

Mathematics Reform

Mathematics reform will be organized into four subsections: (a) historical perspective, (b) Regents Reform Agenda, (c) Race to the Top, and (d) Common Core State Standards in Mathematics.

Historical perspective. The most common approach to teaching mathematics in the United States has been a traditional approach that focuses on teacher demonstration of problems and emphasis on procedure based on computation, rules, and algorithms (Smith, 1996; Stigler & Hiebert, 1999). In the traditional approach to mathematics, teaching meant telling students how to perform the procedures emphasizing algorithms for the students to memorize and mimic over conceptual development and understanding (Wu, 1996; Battista, 1999). Traditional mathematics addressed many topics emphasizing breadth of content over depth of content (Battista, 1999; NCTM, 1989), and each school year revisited previously taught material (Raptis & Baxter, 2006). Many researchers agree that U.S. mathematics content is often repetitive with mastery of content and application not being an expectation (McKnight, 1987; Valverde & Schmidt, 1997-1998).

For over a half century in the United States, there have been continued calls for reform of mathematics, first in content, then in pedagogy (NRC, 2001). These calls have been occurring

since the post-World War II era, but the Soviet Union's launch of Sputnik in 1957 is often seen as the event that rekindled a call to improve our mathematics and science education (Herrera & Owens, 2001). The New Math of the 1960s expanded the view of instruction from arithmetic to mathematics, while the 1970s brought the Back to Basics Movement, a strong counter movement calling for a return to the basics of computation, resulting in the diluting of the mathematics curriculum (Carpenter, Hiebert, Fennema, & Fuson 1997; Wu, 1996). These decisions were not always made based upon sound research and opponents of mathematics reform often persuaded parents, educational decision makers and legislators to act in opposition to the current research and return to the failures of traditional mathematics (Battista, 1999). Entering the 1980s, the pendulum began to swing back and there was once again a de-emphasis on problem solving and application in mathematics learning.

The National Council of Teachers of Mathematics (NCTM) has long been a proponent of a standards-based reform movement as seen in an *Agenda for Action* (NCTM, 1980), a position paper from over 30 years ago. NCTM (1980) developed new recommendations for the teaching of mathematics. This work from NCTM was a step toward reform. The report set "problem solving as the curricular focus, recommended that the definition of 'basic skills' be broadened to include such mathematical skills as estimation and logical reasoning, and promoted the use of calculators and computers in the classroom at all grade levels" (Herrera and Owens, 2001, p. 88).

In 1989 NCTM published *Curriculum and Evaluation Standards for School Mathematics*. This work envisioned classrooms that stressed conceptual understanding, reasoning, and problem solving. It discussed the nature of mathematics, what mathematics should be taught, and how mathematics should be taught. In these classrooms students would have numerous opportunities to solve and discuss complex problems, to construct ideas and draw

conclusions, and to use demonstration and argument to support their solutions. The National Research Council (NRC) also released a report in 1989, *Everybody Counts: A Report to the Nation on the Future of Mathematics Education* (NRC, 1989). It reported that mathematics instruction had continued to teach our children using methods that were ineffective.

NCTM followed their 1989 work with three other works: (a) *The Professional Standards for Teaching Mathematics* (1991), (b) *Assessment Standards for School Mathematics* (1995), and (c) *Principles and Standards for School Mathematics* (2000). These works addressed the key components of mathematics reform: curriculum; assessment; and pedagogy, and the possibility of reform seemed a reality.

The National Research Council (NRC) report entitled *Adding It Up: Helping Children Learn Mathematics* (NRC, 2001) was in response to growing concerns of globalization, and the perceived inability of U.S. students to compete in a world market.

> Public concern about how well U.S. schoolchildren are learning mathematics is abundant and growing. The globalization of markets, the spread of information technologies, and the premium being paid for workforce skills all emphasize the mounting need for proficiency in mathematics. Media reports of inadequate teaching, poorly designed curricula, and low test scores fuel fears that young people are deficient in the mathematical skills demanded by society. (NRC, 2001, p. xiii)

The U.S. Department of Education's Office of Educational Research and Improvement charged the NRC to form a committee to:

- To synthesize the rich and diverse research on pre-kindergarten through eighth-grade mathematics learning;

- To provide research-based recommendations for teaching, teacher education, and curriculum for improving student learning and to identify areas where research is needed; and
- To give advice and guidance to educators, researchers, publishers, policy makers, and parents (NRC, 2001, p.3).

The report served two important functions. It defined mathematical proficiency and addressed teaching for mathematical proficiency.

The NRC (2001) defined mathematical proficiency through five strands. These strands included conceptual understanding, procedural fluency, strategic competence, adaptive reasoning, and productive disposition. The NRC noted that these strands were not discrete, but intertwined. Conceptual understanding included knowledge of concepts and relationships. Procedural fluency addressed skill in procedures including efficiency and accuracy. Strategic competence meant the application in problem solving. Adaptive reasoning addressed explanation and justification. Procedural disposition was an attitude about the usefulness of mathematics (NRC, 2001).

Adding It Up: Helping Children Learn Mathematics (NRC, 2001) went beyond the standards and addressed pedagogy, stating that "the effectiveness of mathematics teaching and learning is a function of teachers' knowledge and use of mathematical content, of teachers' attention to and work with students, and of students' engagement in and use of mathematical tasks" (NRC, 2001, p. 8). To teach effectively, mathematical knowledge must go beyond knowledge of content, and must be defined in terms of content, assessment, and pedagogy (NCTM, 1989; NCTM, 1991; NCTM, 1995). The NCTM was calling for a fundamental change in both the content of school mathematics and in the way teaching and learning was viewed.

Regents Reform Agenda. From 1995 through June of 2009, Richard P. Mills was the Commissioner of the New York State Education (NYSED). Under his leadership, New York set out to reform their educational system to raise the achievement of all students by establishing higher standards, developing curriculum and assessments, and an accountability system for all schools (NYSED, 2008). His successor, David Steiner was "convinced that our current system leaves far too many students behind" (NYSED, 2009, p.1) and continued the work on reform.

The NYSED reform work begun under Steiner's leadership was called the Regents Reform Agenda. This agenda addressed the next generation of assessments, expanded curricular offerings, a redesign of both teacher and principal pre-service training (higher education), use of data to link student performance to teacher effectiveness, and the turnaround of failing schools (NYSED, 2010). As part of the Regents Reform Agenda, NYSED adopted the Common Core State Standards (CCSS) in both English language arts and mathematics. The CCSS in Mathematics (CCSSM) defined both the mathematics content that is expected to be taught and learned from grades kindergarten through twelve, and the mathematical practices that were common across all grade levels.

The Regents Reform Agenda created a renewed sense of urgency for the students that the system was failing, and the challenges faced due to the difficult fiscal times (NYSED, 2010). The agenda was tied directly to NYSED's application for federal monies through a competitive grant titled Race to the Top (RTTT).

Race to the Top. Race to the Top is a competitive federal grant offered by the United States Department of Education (USDOE). The Race to the Top state competition is designed to reward states that are leading the way in comprehensive, coherent, statewide education reform across four key areas:

- Adopting standards and assessments that prepare students to succeed in college and workplace;
- Building data systems that measure student growth and success, and inform teachers and principals how to improve instruction;
- Recruiting, developing, rewarding, and retaining effective teachers and principals, especially where they are needed most; and
- Turning around their lowest-performing schools (NYSED, 2009).

New York was selected for one of ten awards in Phase 2 of the application process and received $700 million from the USDOE (NYSED, 2010). The money was slated to be used to continue the work described in the Regents Reform Agenda. Half of the money was sent to school districts directly and the other half continues to be used to implement state-level initiatives to benefit all districts (NYSED, 2009). A key component in the New York RTTT application was the implementation of the Common Core State Standards as their enhanced learning standards. Table 1 presents a quick overview of New York's application.

Table 1

Major Components of the New York State Race to the Top Application

Component	District Commitments
Standards and Assessment	Adopt enhanced learning standards as required by the State. Implement new, high-quality assessments as required by the State.
Data Systems to Support Instruction	Use data to improve instruction, which will entail collecting data as required as required by the State, providing professional development to staff in how to use the data to improve instruction, and making the data available to researchers, consistent with federal and state privacy rules and regulations.
Great Teachers and Leaders	Conduct annual evaluations using the new statewide evaluation system, then use the results to inform promotion, retention, tenure

	determination, termination and supplemental compensation (consistent with the new State law on teacher and principal evaluation). Use the results of the new annual evaluation system and student performance data to tailor high-quality professional development and other effective supports to teachers and principals (consistent with the new State law on teacher and principal evaluation).
Turning Around Struggling Schools	For those participating districts that have school(s) identified by the State Education Department as persistently low-achieving, adopt one of four school turnaround models.

Note: Adapted from "The Regents Education Reform Plan and New York State's Race to the Top (RTTT) Application," NYSED, 2010. Retrieved from http://usny.nysed.gov/rttt/application/summary.html.

Common Core State Standards in Mathematics. In 2010, New York joined 44 states, four territories and the District of Columbia by signing off on a memorandum of agreement with the National Governors Association (NGA) and Council of Chief State School Officers (CCSSO) committing to the Common Core State Standards Initiative (CCSSI). Currently, 43 of the 50 states in the United States are implementing the Common Core standards (CCSSI, 2014). Achieve, Inc., an education reform organization, in coordination with NGA and CCSSO, led in the development of the CCSS. Led by a cross-section of governors and business leaders from within and across states, Achieve provides a different perspective that has enabled them "to set a bold and visionary agenda over the past 15 years, leading Education Week in 2006 to rank Achieve as one of the most influential education policy organizations in the nation" (Achieve, 2010).

The Common Core State Standards in Mathematics are comprised of Standards of Mathematical Practice and Standards of Mathematics Content. The Common Core State Standards (CCSS) were born of the NCTM process standards of problem solving, reasoning and proof, communication, representation, and connections, and the National Research Council's

strands of proficiency including adaptive reasoning, strategic competence, conceptual understanding, procedural fluency, and productive disposition (CCSSI, 2010).

Alberti (2012) noted three main shifts in the standards: (a) greater focus on fewer topics, (b) linking topics across grades, and (c) rigorous pursuit of conceptual understanding, procedural skill, and application. The New York State Education Department defined six key shifts as focus, coherence, fluency, deep understanding, application and dual intensity (EngageNY, 2010). Burns (2012) described both the Standards for Mathematics Practice and the Standards for Mathematical Content as equally important and believes that while the CCSSM help students make sense of mathematics, arithmetic is still the foundation of the Standards for Mathematics Content through grade five.

Reform: A Change Process

Adopting standards does not guarantee a successful reform (Stigler & Hiebert, 1999). Marzano (2003) emphasized a guaranteed and viable curriculum, but beyond the curriculum, the quality of teaching is the most important variable in raising student achievement (Marzano, 2003; Waters, Marzano, & McNulty, 2003). Stigler and Hiebert (1999) agree that teaching is an important variable when it comes to raising achievement, and that teaching reform mathematics requires a significant change in instructional practice.

Fullan (1991) noted that large-scale, government-initiated reforms are often unsuccessful because they may ignore how people experience change. Fullan (1991) stated that if attending to individual needs around change are not addressed, change efforts often fail. Before attending to the change process, it is important to look at how individuals may be affected during a change process.

There are numerous theories on change. Fullan (2008) defines six secrets of change. Kotter (2002) describes an eight-step path to successful change, while Bridges (2009) describes three phases of transition: letting go, the neutral zone and a new beginning. Regardless of definition or number of steps for creating and sustaining change, change can play a role in reform efforts.

Whether it is described as complacency, immobilization or a pessimistic attitude (Kotter, 2002) or denial, anger or anxiety (Bridges, 2009), attitudes and emotions can hinder change. Bridges (2009) agrees that change is multifaceted and affects people differently. He sees change as an outcome, and the process as how one transitions toward that outcome. "While the first task of *change management* is to understand the desired outcome and how to get there, the first task of *transition management* is to convince people to leave home" (p. 37). Kotter's (2002) eight steps appeal to the affective domain making the point that it is emotional reactions not intellectual analysis that influences change. "In successful change efforts, the first step is making sure sufficient people act with sufficient urgency" (p.15). Kotter describes four sets of behavior that typically derail change: (a) complacency driven by false pride, (b) immobilization driven by fear, (c) refusal driven by anger, and (d) a pessimistic attitude leading to hesitation and cynicism (p. 17).

Bridges, Kotter, and Schein discuss communication and trust as ways to break down the barriers to change. Bridges' (2009) neutral zone, the creation of guiding teams (Kotter, 2002), or connecting peers with purpose (Fullan, 2008) are steps in the change process that make intragroup connections to build trust. "Good communication is not just data transfer. You need to do something that addresses their anxieties, that accepts anger, that is credible in a very gut-level sense, and that evokes faith in the vision" (Kotter, 2002, p. 84). Schein (2010) states that

creating “psychological safety” can help break down barriers to change that are based on fear and denial. This safety includes a compelling vision, formal and informal training that addresses individual needs, coaching, and feedback. In summary, building an effective guiding group with the right abilities, respect, sense of urgency, and who have a sense of trust in each other can help develop the end state, the vision. Once established, Kotter (2002) believes that simple, clear, sincere communication goes a long way toward creating buy-in.

Barker (2006) notes that without structure, sustained change can be derailed. Short-term wins can “emotionally reward hard workers, keep the critics at bay, and build momentum” (Kotter, 2002, p. 123), but to keep the momentum going supportive structures must be in place to make the change stick. Within each phase of Bridges (2009) are numerous components that one finds within Kotter’s work. A transition starts with an ending. An old way of doing something is being let go. Urgency is part of letting go. Both theories recognize barriers to successful change efforts.

Fullan (2008) organizes his theory on change through six secrets. The secrets were (a) love your employees, (b) connect peers with purpose, (c) capacity building prevails, (d) learning is the work, (e) transparency rules, and (f) systems learn. Fullan recognizes the balance between focusing on children first while realizing that that can only happen through teacher quality. The first secret is about “helping all employees find meaning, increased skill development, and personal satisfaction in making contributions that simultaneously fulfill their own goals and the goals of the organization” (p. 25). The leader must craft the following conditions to create focus and cohesion with the desired result of positive peer interactions:

- The larger values of the organization and those of individuals and groups mesh;

- Information and knowledge about effective practices are widely and openly shared; and
- Monitoring mechanisms are in place to detect and address ineffective actions while also identifying and consolidating practices (p. 45).

Connecting peers to meet organizational and individual goals allows them to build capacity collectively. Each individual possesses skills, but they collectively and continuously develop further knowledge and skills (Fullan, 2008). The first three steps describe that "consistency and innovation can and must go together, and you achieve them through organized learning in context. Learning is the work" (Fullan, 2008, p. 79). A focus on collective capacity building is important because "a key reason why organizations do not sustain learning is that they focus on *individual* leaders" (Fullan, 2008, p. 107).

Schein (2010) describes three stages of learning or change that closely align with Bridges' phases of transition. Stage one is creating the motivation for change; Bridges' first transition is letting go of the old. Stage two is where new learning occurs and solutions are considered, much like the creativity of the neutral zone (Bridges, 2009). Finally, stage three is the internalization of the new ideas. According to Bridges (2009) the change goal must be clear, but not everyone need get there the same way.

Efficacy

This section on efficacy will be organized into four subsections: (a) historical perspective, (b) teacher efficacy for mathematics reform (c), professional development for teacher efficacy, and (d) teacher collective efficacy.

Historical perspective. The studies on efficacy have grown from the work of John Rotter and Albert Bandura. Rotter (1966) studied efficacy in terms of internal control which is

contingent upon one's own action, and external control which is contingent upon the action of others. His social learning theory explored the extent to which the control of student motivation and performance lay within teachers or the environment with the assumption that student motivation and performance were important for reinforcing teacher behavior. Teachers with high levels of efficacy could influence student achievement and motivation. Student achievement and student motivation offers reinforcement for teaching activities as internal or within their control. Conversely, teachers with low efficacy believed that environmental factors overwhelm teacher ability or that the control of reinforcement is external.

The Rand Corporation conducted a study to identify characteristics of successful reading programs (Berman, McLaughlin, Bass, Pauly, & Zellman, 1977). The study included two efficacy items in a questionnaire. The impetus for the addition of the two efficacy questions was Rotter's social learning theory (Tschannen-Moran et al., 1998). The items addressed teacher beliefs regarding external control versus internal control. Item one addressed the belief in external control "When it comes right down to it, a teacher can't do much because of a student's motivation and performance depends on his or her home environment" (Armor et al., 1976, p.14). Item one addressed what is now called general teaching efficacy (GTE), the general belief about external factors and teacher influence. Item two was "If I try really hard, I can get through to even the most difficult or unmotivated students" and addressed internal control, a belief that is more personal to the individual teacher and is often based on successful past experiences. Armor et al. (1976) found that teachers' "sense of being able to 'get through' to students, their commitment and morale, help to determine how much children learn (p. 52).

Bandura's (1977) social cognitive theory identified efficacy as a process about one's belief in his/her ability to perform at a given level. Bandura hypothesized that expectations of

personal efficacy determine whether coping behavior will be initiated, how much effort will be expended, and how long it will be sustained in the face of obstacles and aversive experiences. He described outcome expectations as the consequences of performing the task. An outcome expectation is a person's estimate that a given behavior will lead to an expected outcome (Figure 1).

Figure 1 Expectations Model

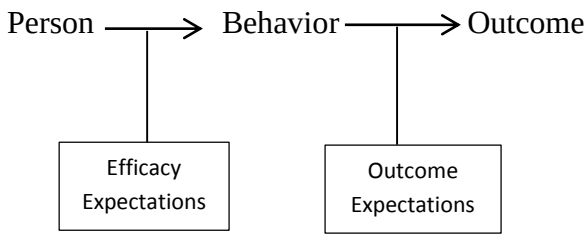

Figure 1. "Diagrammatic representation of the difference between efficacy expectations and outcome expectations," by A. Bandura, 1977, *Psychological Review, 84,* p. 193.

"The strength of people's convictions in their own effectiveness is likely to affect whether they will try to cope with given situations (Bandura, 1977, p.193). Bandura points out that expectation alone is not enough, and outcomes will likely go unattained if there is no expectation that one's actions will lead to the outcome.

Bandura outlined four major sources of information that supports personal efficacy: (a) performance accomplishments, (b) vicarious experiences, (c) verbal persuasion, and (d) emotional arousal. Performance accomplishments are based on personal mastery, one's capabilities, which are linked to successes and failures. Vicarious experiences build efficacy through observation of others. The effect of simply describing outcome expectations through verbal persuasion contributes to efficacy, but not to the level of personal accomplishments and

capabilities. Finally, aversive emotional arousal is more likely to lead to failure thus lowering one's sense of efficacy.

Guskey (1981) developed a 30-item instrument called the Responsibility for Student Achievement (RSA) to expand the thinking around what was and was not within the teacher's immediate control. Rose and Medway (1981) developed the Teacher Locus of Control (TLC) that assigned responsibility for student successes and failures. Gibson and Dembo (1984) expanded upon the work of the Rand Corporation and categorized efficacy in terms of personal teaching efficacy and general teaching efficacy. Gibson and Dembo (1984) describe the difference between general teaching efficacy (GTE) and personal teaching efficacy (PTE). A teacher's sense of personal teaching efficacy is the belief that they have the knowledge (skills and abilities) to positively affect student achievement. General teaching efficacy is a belief that effectiveness is limited by external, environmental sources.

> One would predict that teachers who believe student learning can be influenced by effective teaching, and who also have confidence in their own teaching abilities, should persist longer, provide a greater academic focus in the classroom, and exhibit different types of feedback than teachers who have a lower expectation concerning their ability to influence student learning. (Gibson & Dembo, 1984, p. 570)

A teacher with high PTE believes he or she can influence student learning. Dweck (2006) calls this a growth mindset which is based on the belief that "everyone can change and grow through application and experience" (p. 7). Teachers with high PTE exhibit the willingness and the confidence to persevere with students who are failing, believing in their ability to learn.

Guskey (1987) described and studied three context variables that may affect measures of teacher efficacy. These context variables are:

- Teachers in more effective schools had a stronger sense of efficacy and tended to feel more responsible for student outcomes than did those in less effective schools;
- Teachers interact differently with high-ability versus low-ability students. High-ability students are more personally responsible for success while low-ability students are more personally responsible for failure; and
- Teachers reflect upon a scope of influence (individual students vs. groups).

Bandura's (1977) social cognitive theory addressed self-efficacy in terms of both efficacy expectations and outcome expectations. While efficacy expectations are about one's self-belief in the capability to execute the actions necessary to perform a task, outcome expectations are about the consequences of performing the task. Woolfolk and Hoy (1990) conducted an analysis of how the concepts of teacher efficacy from the Ashton and Webb (1986) and Gibson and Dembo (1984) studies compared with Bandura's (1977) social cognitive theory. They found that the two constructs of general teaching efficacy (GTE) and personal teaching efficacy (PTE) were not congruent with Bandura's constructs of outcome expectations and efficacy expectations. PTE is defined as effort to overcome environmental factors which speaks to consequences of an action and is therefore an outcome, not an efficacy expectation which is a judgment about ability to perform an action (Woolfolk & Hoy, 1990). This finding took efficacy, beliefs in one's ability, and linked it to the consequences of those beliefs.

Bandura (1997) makes the distinction between self-efficacy and Rotter's (1966) internal-external locus of control. Beliefs about one's ability to perform an action are distinct from whether or not the actions affect outcomes, and outcome expectancies are distinct from external focus of control. Teachers with a high sense of efficacy take more accountability for outcomes (Bandura, 1997) and do not blame outside forces.

Teacher efficacy and mathematics reform. The Common Core State Standards in Mathematics (CCSSM) calls for teachers to have the knowledge to engage students in mathematical investigation, facilitate classroom discourse, and create an environment based on the eight Standards of Practice (CCSSM, 2010). In typical U.S. classrooms, mathematics problems are selected by the teacher and solvable in a matter of minutes, while the reform movement expects students to struggle with problems and persevere for extended periods in solving them (Beswick, 2009). Knoll, Ernest and Morgan (2004) discussed creativity and the use of strategies such as the search for examples, patterns and rules, and the use of explanation, justification and proof when solving problems in reform mathematics.

Many elementary teachers do not have the necessary conceptual understanding of mathematics nor the pedagogical skills necessary to teach according to the demands of the reform (Ball, Hill, & Bass; 2005; Ma, 1999). These limitations impede the implementation of the CCSSM. Elementary generalists tend to lack the necessary disciplinary knowledge in mathematics (Spillane, 2000). Vinson (2001) reported that many in-service teachers, those working in the field, have a moderate or low-level of procedural and conceptual knowledge. Stigler and Hiebert (1999) also described the limitations of U.S. teachers as typically relying on procedural instruction. The authors believed the procedural method of teaching is cultural, learned over a school career of being taught traditionally. After an in depth study of U.S. teachers' knowledge of mathematics, Ma (1999) concluded that "to improve mathematics education for students, an important action that should be taken is improving the quality of their teachers' knowledge of school mathematics" (p. 144).

Ma (1999) explained that the learning gap seen in U.S. students can also be seen in U.S. teachers claiming that U.S. teachers lack a deep understanding of mathematical content and

pedagogy. Hill, Rowan, and Ball (2005) believed that teaching for understanding went beyond content knowledge and a traditional approach to pedagogy, and described the knowledge to teach mathematics in three parts: content knowledge, pedagogical knowledge, and mathematical knowledge. They differentiated between understanding mathematical content, teaching pedagogy and the specialized knowledge of mathematics to teach for understanding. Some teachers may feel highly efficacious in their knowledge of content, but less efficacious in their ability to teach those concepts to students (McGee, 2012). Self-efficacy beliefs about mathematical content and pedagogy affect mathematical knowledge for teaching (Ball, Thames, & Phelps, 2008).

Alberti (2012) drew upon conversations with thousands of educators about the CCSSM over a two-year period (2011- 2012) and warned of full speed implementation without truly understanding the shifts to be made. Teachers with a low sense of efficacy in mathematics often default to a teacher-centered approach around the memorization of facts and learning procedures without understanding (Boaler, 2008). Mathematics reform left teachers feeling less efficacious because it not only called for a change in instruction (Bitter & Hatfield, 1994), but a change in beliefs about the teaching and learning of mathematics (Grant, Peterson, & Shojgreen-Downer, 1996). For the current reform to be successful, teachers will need to increase their efficacy in teaching mathematics (Smith, 1996).

Professional development and teacher efficacy. Professional development has the potential to positively impact efficacy (Zambo & Zambo, 2008), especially when the use of professional development to improve teacher practice allows for the learning to be used in practice (Ball & Cohen, 1999). Using learning in practice increased the likelihood that new practices continued to support any reform (Franke & Kazemi, 2001). Professional development considered to combine content knowledge within the context of the work was more likely to

engage teachers in professional growth (Little, 1993). When focused on specific practices professional development increased the likelihood of teacher implementation of that strategy (Desimone, Porter, Garet, Yoon, & Birman, 2002). Professional development provided for changes in practice (Bittler & Hatfield, 1994). Professional development was effective when provided within a content domain (Cohen & Hill, 2001; DeSimone et al., 2002). The most successful professional development occurs when learning:

- is job-embedded, occurring in the workplace rather than in workshops;
- engages people in the work rather than listening to presentations about the work; and
- is collective rather than individual (DuFour & Fullan, 2013, p.54).

Sustained, job-embedded professional development is likely to improve teacher knowledge and pedagogy (Guskey, 2003; Darling-Hammond & Ball, 2004) thus increasing efficacy beliefs. According to Ross, Hogabaum-Gray, & McDougall (2002) embedded professional development is an essential strategy to raise efficacy, and embedded professional development that focuses on both teacher practice and pedagogy is the most promising strategy to increase teacher efficacy to support the implementation of reform. Delivery of professional development through embedded coaching in the work supported reform agendas (Showers & Joyce, 1996). Two of Bandura's four sources of efficacy, mastery experiences and social persuasion, were shown to have the greatest impact on raising levels of personal efficacy and support the concept of embedded professional development (Mulholland & Wallace, 2001). The job-embedded nature of these professional learning experiences increased the likelihood that teachers could transfer what they learned into their own classroom practices (Showers & Joyce, 1996; Cochran-Smith & Lytle, 1999).

Teacher collective efficacy. Collective efficacy refers to a group's shared belief in its capabilities to perform an action to produce results (Bandura, 1997). Efficacy research has been guided by expanding thought on Bandura's social cognitive theory. Perceptions are formed through the cognitive development of the four sources of personal efficacy (Bandura, 1993), but go beyond the four sources to the influences of context and environment (Adams & Forsyth, 2006; Goddard et al., 2000; Tschannen-Moran et al., 1998). Teaching occurs in a social context and "schools where teachers work together to find ways to address the learning, motivation, and behavior problems of their students are likely to enhance teachers' feelings of efficacy" (Tschannen-Moran et al., 1998, p.221). In a recent review of twelve years of research (1998-2009), Klassen, Tze, Betts, and Gordon (2011) reported the growth of research on collective efficacy, but little is known about the context of school variables in which collective efficacy develops (Adams & Forsyth, 2006).

Tschannen-Moran et al. (1998) incorporated Bandura's (1997) social cognitive theory, and included the external conditions of Rotter's (1966) locus of control theory to create a model that integrated verbal persuasion, vicarious experience, psychological arousal and mastery experience with the context of any situation, because teachers are not equally efficacious in all contexts. Goddard, Hoy, and Woolfolk Hoy (2000) built on this integrated model of the cognitive process of the four sources of efficacy, along with an analysis of the teaching task and assessments of teaching competencies, and applied the model to collective efficacy. The work of Adams and Forsyth (2006) defined Bandura's four sources of efficacy as remote sources, and called the context of the everyday school environment as a proximate source. Remote sources represented cognitive processes in the near or distant past, and influenced teaching behaviors based on proximate sources or the present context. Unlike Goddard et al. (2000), Adams and

Forsyth (2006) felt that remote and proximate sources of efficacy information happened simultaneously to create the cognitive process. Their research concluded that "contextual variables influence teacher perceptions of the faculty's collective ability to produce expected outcomes given environmental constraints" (p. 639). Creating structures to build upon the sources of collective efficacy means that teachers and building leaders can maximize efforts toward improved instruction and student achievement (Martin-Kniep, 2008).

The success of reform movements must include ongoing learning through collective capacity building (DuFour & Fullan, 2013). Building leaders should create the opportunities for teachers to learn collectively to build capacity (Fullan, 2008; Printy, 2008). Structures that allow for continuous improvement create the opportunity for educators to find solutions collectively (DuFour & Marzano, 2011). In order for principals to provide the instructional leadership necessary for teachers to be successful, central office leadership must provide them with the supports they need to be instructional leaders (Honig et al., 2010).

Central Office Support

Changes call for a shift away from central office working for compliance to working in the service of improved teaching and increased student achievement (Honig, 2012). Augustine et al. (2009) noted the importance of central office administration for delivery of embedded professional development for principal efficacy. Honig (2012) identified specific practices of central office administration in supporting principal work as instructional leaders, but without a shift in structure and roles to provide job-embedded supports, there is a tendency to fall back to central office working for management and compliance. Central office staff must "take a joint work approach alongside principals" (Honig, 2012, p.7) and accept the responsibility of

improvement as their own. School systems must share the responsibility of instructional leadership with their principals by supporting the development of principals (Jerald, 2012).

According to Wahlstrom and Louis (2008) leaders must be seen as partners in the work to impact student learning. Principals must be instructional leaders to successfully guide school reform (Camburn, Rowan, & Taylor, 2003). Fullan (2000) maintained that school districts must provide the structure to promote meaningful collaboration not only among teachers, but among principals and district-level administrators. Guskey (2003) noted the need for collaboration between central office leaders (district-level) and building leaders to guide differentiated and effective professional development. "Many districts consider development of their principals' capacity for instructional leadership to be a cornerstone of their improvement efforts" (Louis et al., 2010, p.140) and school systems have begun to take more responsibility for developing instructional leaders (Jerald, 2012).

Principal efficacy. The increase in expectations for students has amplified the need for principals to focus on instructional leadership (Hallinger, 2003). To improve upon instructional leadership, there must be clarity around effective leadership practices (Jerald, 2012). Instructional leadership refers to the support and development of teachers to grow in effectiveness (Davis et al., 2005).

Supovitz and Poglinco (2001) found that instructional leaders organized their schools around an emphasis on instructional improvement. Supovitz, Sirinides, and May (2010) reported that principal leadership was a positive and significant predictor of a teachers' change in instruction, but in a study by Supovitz and May (2011), principals only devoted up to five hours per week on improving instruction in the classrooms. This raises the question as to whether or

not the expectations for principals have surpassed the capacity of a single person (Copland, 2003).

Instructional leadership includes work with teachers to examine evidence around teaching and learning to improve instruction (Honig, 2012; Supovitz et al., 2010; Leithwood, Louis, Anderson, & Wahlstrom, 2004; Waters, Marzano, & McNulty, 2003). Bambrick-Santoyo (2012) identified four high-priority levers for instructional leadership: (a) data-driven instruction, (b) observation and feedback, (c) instructional planning, and (d) professional development. Effective instructional leadership has significant consequences for student learning (Hallinger & Heck, 1996; Marks & Printy, 2003).

The Council of Chief State School Officers (CCSSO) published *Educational Leadership Policy Standards: ISLLC 2008*. Standard 2 addressed the importance of instructional leadership and the school leader's role in student learning and staff professional growth (CCSSO, 2008). Louis, Leithwood, Wahlstrom, and Anderson (2010) claimed that principals were a crucial link between district initiatives, school conditions, and student learning, and a principal's sense of efficacy contributes to teaching and learning.

- Districts that help their principals feel more efficacious about their school improvement work have positive effects on school conditions and student learning; and
- Principals who believe they are working collaboratively toward clear and common goals-with district personnel, other principals, and teachers in their schools-are more confident in their leadership. (Louis et al., 2010, p. 127)

Leithwood and Jantzi (2008) identified eight district conditions that affect leader efficacy: (a) focus on quality, (b) use of data, (c) targeted improvement, (d) investment in

instructional leadership, (e) job-embedded professional development, (f) emphasis on teamwork; g) relations with schools and stakeholders, and (h) district culture (p. 134).

Their study measured both leader self-efficacy and leader collective efficacy. Significant results were found for all eight conditions with stronger correlations for collective efficacy. Investment in instructional leadership and job-embedded professional development were the two conditions with the weakest relationship for collective efficacy. Under all eight district conditions, school leaders' collective efficacy had more influence on leadership than personal efficacy (Leithwood & Jantzi, 2008).

Professional development and principal efficacy. Principals, like teachers, need ongoing, job-embedded professional development to support efficacy (Leithwood, Louis, Anderson, & Wahlstrom, 2004). "Districts contribute to principals' efficacy through worthwhile programs of professional development, aimed at strengthening their capacities to achieve shared purposes" (Leithwood et al., 2012, p. 119).

Other research regarding instructional leadership and job-embedded professional development pointed to gains in student achievement when these two conditions were emphasized (Honig, 2012). Embedded professional development opportunities and professional learning address personal and collective efficacy by building upon Bandura's four sources of efficacy within contexts (Adams & Forsyth, 2006).

Embedded professional development supports principals in the context of their work (City et al., 2009; Darling-Hammond et al., 2007). A model proposed in a Honig et al. (2010) study had central office staff called Instructional Leadership Directors (ILD) dedicated to the work of embedded professional development with principals. The role of the ILD is not to monitor compliance, but is responsible to help develop principals as instructional leaders (Jerald,

2012). The study by Honig (2012) supports a framework that identified five practices that supported principals' instructional leadership: (a) joint work focused on authentic problems of practice, (b) differentiating support based on need and context, (c) modeling, (d) develop and use of tools for reflection and data collection, and (e) brokering for resources and buffering from distractors. The framework centered on a deep inquiry process using data on a problem of practice on student learning, and then moved to contributing factors on teacher practice. Reflection by the principal on his/her own needs to support the teacher was followed by action steps by the ILD and principal together to support the principal, teacher, and ultimately the student (Honig et al., 2010).

Principal professional learning communities. Principal professional learning communities (PPLC) or principal networks are important for building principals' leadership practice (Barnes, Camburn, Sanders, & Sebastian, 2010). Principal meetings must be reshaped to focus more on effective instruction and less on operational and managerial duties (Jerald, 2012). A sixth practice to support instructional leadership was creating opportunities for principals to learn from one another (Honig, 2012). The importance of professional learning communities in building collective capacity and efficacy has been cited often in literature (Martin-Kniep, 2008; DuFour & Marzano, 2011; DuFour & Fullan, 2013).

Fielding et al. (2005) defined four characteristics for any effective networks: (a) trust, (b) focus on learner engagement, (c) relationships to transfer effective practices, and (d) joint work. Mishook, McAlister, and Edge (2011) addressed the need for collaboration across schools, and point out that many professional networks are external. School leaders are typically isolated and efforts are underway to look internally at leadership networks across schools and districts (Hemphill & Nauer, 2010). Hargreaves and Shirley (2009) also believe that strong inter-school

principal networks are a strategy to address achievement gaps. Effective networks can lead to sharing best practices in the classroom that ultimately support student learning (Katz & Earl, 2010).

Summary

The latest reform in mathematics comes from the Common Core State Standards Initiative. This reform requires a shift from procedural to conceptual instruction. Research has shown that efficacy plays an important role in both teacher and principal effectiveness. Professional development for teachers and principals can support raising levels of efficacy. Central office administrators are typically in a support track that is removed from teaching and learning (Fink & Resnick, 2001) and may not be skilled in facilitating professional development for instructional leadership (Honig et al., 2010; Hubbard et al., 2006), but must be partners in the support of instructional leadership, teaching and learning (Honig & Rainey, 2012).

Chapter Three: Methodology

This chapter describes the methodology that was used to examine teacher and principal efficacy as it relates to the mathematics reform of the Common Core State Standards. The sections include the purpose statement, research design, population, sampling, instrumentation, validity and reliability, data collection and data analysis.

Purpose

The purpose of this mixed method study was to examine the effect of the implementation of the Common Core State Standards in Mathematics (CCSSM) on elementary teachers' mathematics efficacy. In addition, the study examined teachers' perception of principals' readiness to lead the implementation of the CCSSM, and teachers' and principals' perceptions of changes in instruction in mathematics as a result of the implementation. The study also examined principals' perception of mathematics efficacy, and principals' perception of central office support for the implementation.

Four research questions frame this study:

1. Has there been a change in teachers' sense of efficacy in teaching mathematics as a result of the implementation of the Common Core State Standards in Mathematics (CCSSM)?
2. What are teachers' perceptions of their own knowledge of the CCSSM and changes in instructional practices in teaching mathematics due to the adoption of the CCSSM, and principals' perceptions of teachers' readiness for implementation?
3. Is there a relationship between teachers' perceptions of the efficacy of their principals' mathematics leadership for the implementation of the CCSSM and teachers' sense of self-efficacy in teaching Common Core mathematics?

4. Do building leaders' perception of the role of central office support influence their sense of self-efficacy for instructional leadership in the implementation of the Common Core State Standards in Mathematics?

Research Design

A concurrent, embedded mixed method design was chosen to conduct this study. In a concurrent, embedded design, quantitative and qualitative data are collected in one phase. The approach allows for data collection in a shorter period of time, and allows a secondary form of data to support the primary form (Cresswell, 2009). The quantitative data collected through the teacher survey were the primary form of data. The qualitative data collected through the principal interviews were the secondary source of data.

Figure 2. Concurrent, Embedded Design

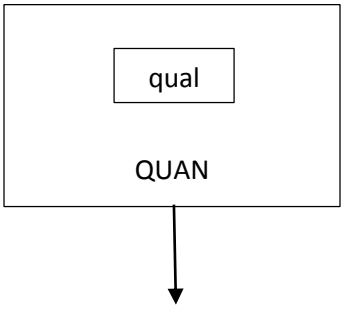

Figure 2. The visual model represents the qualitative design embedded within the quantitative design. The capitalization of QUAN represents the priority placed on the quantitative analysis. By J.W. Cresswell, 2009, *Research design: Qualitative, quantitative, and mixed methods approaches*, p. 210.

quantitative data broadening the results of the quantitative study. The combined approach can yield an expanded understanding of the research (Cresswell, 2009).

Population and Sampling

The population considered in this study was all urban and suburban teachers of mathematics from kindergarten through sixth grade from public schools in New York State. Participants in the study were a sample chosen from the population of urban and suburban elementary public schools in the mid-Hudson to Capital District in New York. The sample used for quantitative data came from the 11 participating schools and consisted of one hundred sixty-two kindergarten through sixth grade teachers with responsibility for teaching mathematics. The qualitative sample consisted of the six suburban principals and the five urban principals from the 11 participating schools. Three urban and three suburban districts were represented in this study. The participants in the study were from 11 schools. One urban school opted to not participate. Two schools from each of the remaining five districts participated.

The sampling of three urban and three suburban school districts was a convenience sampling. They were chosen for their proximity to the researcher that allowed easier access for school visits. The sample was also purposive. The criterion used to select the sample was urban or suburban. All teachers of mathematics from the 11 schools were invited to participate in the survey. Purposive sampling is a way of adding an element of representativeness to the sample (Vogt, Gardner, & Haeffele, 2012).

Six districts with a student population greater than 4,000 were invited to participate. Two urban districts declined participation. Those districts were replaced with districts with between 1,000 and 2,000 students. Similarities within district type were apparent in terms of free and reduced lunch rates. Participating suburban districts all had less than 20% free and reduced lunch rates. Participating urban districts all had free and reduced lunch rates above 50%. All public

schools within the geographical region described were expected to adopt the Common Core State Standards beginning in the 2010-11 school year.

Instrumentation

Quantitative and qualitative instruments were used in this study. The quantitative instrument was a modification of the Mathematics Teaching Efficacy Beliefs Instrument (MTEBI), and the qualitative instrument was three principal interview questions developed by the researcher. This section describes the modifications, and the principal interview questions. Permission to use and modify the MTEBI (Appendix A) was received via email from Dr. Larry Enochs, the developer of the MTEBI. The instruments can be found in Appendix B and Appendix C, respectively.

The survey instrument used to collect quantitative data was a modification of the Mathematics Teaching Efficacy Belief Instrument (MTEBI). Enochs et al. (2000) described mathematics teaching efficacy in two dimensions: personal mathematics teaching efficacy (PMTE) and mathematics teaching outcome expectancy (MTOE). The original 21 items include 13 items that look at PMTE and eight questions regarding MTOE for students. The researcher modified the instrument for this study by including an additional 13 items. The researcher used language consistent with the MTEBI. Eight of the 13 additional items were specific to the Common Core State Standards in Mathematics (CCSSM) and were used to measure PMTE for the CCSSM. Four of the additional items measured teachers' perception of the principals' mathematics efficacy and role in supporting the CCSSM. The final additional item measured MTOE for the CCSSM.

The respondents self-reported using a five-point Likert scale (5=Strongly Agree, 4=Agree, 3= Undecided, 2=Disagree, and 1=Strongly Disagree). Items numbered 3, 8, 15, 17,

18, 19, 23, 29 and 32 were worded negatively and scoring was reversed (5=1, 4=2, 2=4, and 1=5) using the Statistical Package for the Social Sciences version 22 (SPSS v.22). SPSS v.22 was used to analyze data from the modified MTEBI. Quantitative data was used in the analysis of research questions one, two and three.

Interview questions were semi-structured, open-ended, and exploratory focusing on teacher knowledge of the CCSSM, principals' self-efficacy in mathematics and the CCSSM, and perception of district-level support. Open-ended interview questions allow the participants to "voice their experiences unconstrained by any perspectives of the researcher or past research findings" (Cresswell, 2012, p. 218). The questions were developed to help the researcher gain a deeper understanding of change in teacher practice and of the effect of principal efficacy for instructional leadership in CCSSM. The researcher indicates the relationship between principal interview questions and research questions in Appendix F.

Data Collection

Letters were sent to six superintendents to ask permission to contact two of their elementary principals to participate in the study. Permission was granted by two of the urban districts and two of the suburban districts. Electronic contacts were made to eight principals to make appointments while the researcher continued to seek permission from two additional districts. Two additional attempts at each district type were unsuccessful until permission was granted. The request to principals asked for approximately twenty minutes at a faculty meeting to deliver and collect the survey. Interviews with principals were planned for immediately following the faculty meetings.

A letter of consent was signed by each participant. The consent letter was explicit that participation was voluntary and that anyone could withdraw at any time. One hundred sixty-two

teachers and 11 principals participated in the study. Participants were numbered one through 162, and were connected to a district and school identifier. UD1S1 represented urban district one and school one. Although the superintendent of UD2 gave permission to contact the building principals, the principal of UD2S2 opted not to participate in the interview, nor did he grant access to the teachers of UD2S2 for participation in the survey. Five urban schools from three urban districts and six suburban schools from three suburban districts joined in the study.

The researcher was present at eight of the 11 faculty meetings due to conflicting faculty meeting times and other time constraints based on frequency of faculty meetings. In those eight schools, the researcher physically distributed and collected the surveys, demographic questionnaires, and consent for participation during the last fifteen to twenty minutes of faculty meetings. Upon completion, all paperwork was sealed in a large envelope that was labeled with the district and school identifier. In the remaining three schools, principals took over the role of distribution and collection. In the final suburban district, a majority of teachers at both schools opted to not participate.

The researcher interviewed the eight principals immediately following the faculty meetings. He interviewed the remaining three principals when he went to collect the surveys and questionnaires. The researcher used a semi-structured, one-on-one interview to collect qualitative data from 11 building principals. The interviews were audiotaped, and an audio file was created for each and sent electronically to a transcriptionist. Time for interviews ranged from 23 to 40 minutes. Follow up questions were asked for clarity. The transcriptionist returned each transcript within a week, and member checking was used with each principal to check on the accuracy of the transcription.

All data were kept confidential and attempts were made to assure anonymity. Demographic information asked for a grade band, not a particular grade level. No information was shared outside the realm of the study. Data were reported in the aggregate. All data were kept on a password protected computer and/or locked in the researcher's home file. All paper data were destroyed at the conclusion of the study. Data in SPSS will be deleted upon acceptance of the final dissertation. Data were entered from the middle of March, 2014 to the end of June, 2014. The quantitative data were entered on an Excel spread sheet before being imported to SPSS v.22. The researcher cleaned the data by performing a visual inspection looking for codes outside ranges or data that were missing completely.

Demographic data were collected from all participants. Teacher demographic information included gender, district type, current grade level (grades kindergarten through two, or three through six), years at this level, total years teaching, college mathematics and certifications (Appendix D). The principal demographic information (Appendix E) did not address grade level, but asked for both total years teaching and total years as a principal. Descriptive statistics for demographic data are presented in Chapter Four.

Data Analysis

The data collected through the survey were entered into a database in the Statistical Package for the Social Sciences (SPSS, version 22) and used for the quantitative analysis. Descriptive analysis was applied with demographic data using central tendencies and variability. Inferential analysis used Pearson correlations and ANOVAs to compare groups or relate two or more variables. Both categorical and continuous variables were used in this study. Categorical variables such as male or female are discrete, and continuous variables are such that an infinite number of data points could be found within a range, such as height (Vogt & Johnson, 2011).

Pearson correlations were applied to examine relationship between variables in cases where there was a single independent and dependent variable that were both continuous. An analysis of variance (ANOVA) was used when the independent variables were categorical as in the case of suburban versus urban. Throughout the study, responses at four and above will be considered as high efficacy, and responses below three will be considered as low efficacy.

Researchers can allow codes to develop with emerging data or use predetermined codes into which data are fit (Cresswell, 2009). In vivo coding uses participants' actual responses in words and phrases (Miles, Huberman, & Saldana, 2014). The researcher developed the principals' interview questions to gather information to triangulate with the quantitative data. The questions addressed four categories: (a) teacher preparation, (b) changes in teacher practice, (c) principal instructional leadership, and (d) central office support. In vivo coding was used to collect and sort topics into the four major categories. A matrix was developed to gather information in each of the four areas. An example of information collected for teacher preparation revealed a range in types of professional development that included self-study, professional learning communities, internal coaches, principal-led, and outside consultants. The data were triangulated with survey data to deepen the interpretation and analysis of the quantitative data.

Quantitative data were used in the analysis of the first three research questions. The dependent variable for research question one was teachers' mathematics efficacy and the independent variable was teachers' knowledge of the CCSSM. For research question two, the dependent variable was changes in instruction, while the independent variable was knowledge of the CCSSM. The third research question had a dependent variable of teacher efficacy for

CCSSM and an independent variable of teacher perception of principal instructional leadership for CCSSM.

Demographic information was collected to examine relationships between those factors and teacher and principal efficacy. These data included gender, total years teaching, years teaching at the current grade level, college mathematics courses taken, and whether or not a participant held a certification in mathematics. School type (urban/suburban) and free and reduced lunch rates were also collected.

Validity and Reliability

An instrument that measures what it sets out to measure, and whether inferences and interpret tations made are accurate, is said to be valid (Vogt & Johnson, 2011). Reliability describes the consistency of a measurement (Vogt, Gardner, & Haeffele, 2012).

Validity of the MTEBI was established by Enochs et al. (2000) using item analysis and factor analysis. The MTEBI has 21 items, 13 items on the Personal Mathematics Teaching Efficacy (PMTE) subscale and eight items on the Mathematics Teaching Outcome Expectancy (MTOE) subscale. Two items showed item-total item correlations below .30 and were removed from the instrument by the instrument's author. The remaining questions produced correlations that ranged from .36 to .65 and represented the final MTEBI. A confirmatory factor analysis indicated that PTME and MTOE were independent supporting construct validity (Enochs et al., 2000).

Enochs et al. (2000) also ran a reliability analysis using a Cronbach's Alpha test. Reliability measures of the MTEBI produced the Cronbach's alpha coefficient of 0.88 for the PMTE scale and 0.77 for the MTOE scale. A coefficient above .70 suggests that the items in the instrument are measuring the same construct (Vogt & Johnson, 2011).

An expert panel was used prior to the study for both the qualitative and quantitative instruments to determine face validity. Face validity is often determined by asking "expert judges whether the measure seems to be valid" (Vogt & Johnson, 2011, p. 137). A panel of twelve teachers from an urban school not participating in the study reviewed the survey and specific feedback was given regarding the additional items. The researcher asked the three interview questions to the urban principal from this school. Feedback allowed the interviewer to make adjustments to address the clarity of the questions.

Member checking and triangulation are two ways to validate findings (Cresswell, 2012). Member checking is the practice where researchers allow participants in a study to review data, in this case transcripts from principal interviews, prior to analysis to check for the accuracy of the data (Vogt, Gardner, & Haeffele, 2012). Triangulation involves using different sources of data to improve the accuracy of findings (Cresswell, 2012). Data from the teacher survey was compared to responses regarding perceptions that were collected from the principal interviews.

Each principal had his/her transcribed interview sent electronically via email for review. The researcher asked for a return email for feedback on accuracy of transcription and representation of the data collected. Data were triangulated to analyze research question two and three. A combination of quantitative data collected from the teacher survey and qualitative data collected from the principal interviews were used in the analysis and interpretation of these data.

Researcher Bias

The researcher is certified in Mathematics 7 – 12 and has twelve years' experience as an elementary mathematics teacher in suburban schools, and twelve years' experience as an elementary principal in both suburban and urban schools. While his experience and beliefs can be an asset, it also has the potential to be a source of bias regarding preconceived notions. The

three principal interview questions were vetted with an expert panel to check for bias in the questions. The researcher used member checking to be sure the emerging themes were those of the participants.

This study used a mixed method approach collecting quantitative data from a survey of 162 elementary mathematics teachers in New York State, and qualitative data from interviews with the 11 principals from the schools that participated in the survey. Chapter Four is an analysis of the data organized by each of the four research questions.

Chapter Four: Analysis of Data

This chapter begins with the purpose statement and a summary of data collection followed by an overview of the characteristics of the participants. The chapter then presents the analyses of data organized according to the research questions.

The purpose of this mixed method study was to examine the effect of the implementation of the Common Core State Standards in Mathematics (CCSSM) on elementary teachers' mathematics efficacy. In addition, the study examined teachers' perceptions of principals' readiness to lead the implementation of the CCSSM, and teachers' and principals' perceptions of instructional change in mathematics as a result of the implementation. Finally, the study examined principals' perception of their own mathematics efficacy and their perceptions of Central Office support for the implementation.

Quantitative data were collected through a survey and analyzed using SPSS version 22. The data are presented using descriptive statistics, analyses of variances (ANOVA), and Pearson product-moment correlations. The qualitative data were collected through principal interviews and presented using three main themes: (a) resources, (b) instructional changes, and (c) professional development.

Participant Characteristics

One hundred sixty-two teachers completed a demographic questionnaire and took part in the survey. The researcher interviewed the principals from each of the 11 participating schools. Table 2 describes each school in terms of district size, type, and free and reduced lunch rate.

Table 2

School and District Characteristics Based by Size and Free and Reduced Lunch Rates

School Identifier	District Size	District Type	School Size	District F&R	School F&R
UD1S1	1 – 2,000	Urban	350-399	50-59%	50-59%
UD1S2	1 – 2,000	Urban	350-399	50-59%	70-79%
UD2S1	1 – 2,000	Urban	550-599	60-69%	60-69%
UD3S1	5 – 6,000	Urban	400-449	60-69%	70-79%
UD3S2	5 - 6,000	Urban	350-399	60-69%	90-100%
SD1S1	5 – 6,000	Suburban	450-499	10-19%	10-19%
SD1S2	5 – 6,000	Suburban	450-499	10-19%	10-19%
SD2S1	4 – 5,000	Suburban	400-449	0-9%	0-9%
SD2S2	4 – 5,000	Suburban	400-449	0-9%	0-9%
SD3S1	4 – 5,000	Suburban	350-399	0-9%	0-9%
SD3S2	4 – 5,000	Suburban	250-299	0-9%	0-9%

Note. Compiled from NYS Report Card, 2011-12 school year. NYSED (2012) https://reportcards.nysed.gov.
*UD2S2 opted not to participate

Schools ranged in size from 250 to 600 students. UD3 was the closest urban district in size to the suburban districts. The Free and Reduced (F & R) lunch rates were below 20% for the suburban districts, and between 50% and 70% for the urban school districts. UD3S2 had an F & R rate over 90%.

Table 3 represents the participants by gender and district type. Percentages were similar within district type. Seventy-seven or 47.5% of the 162 participants were urban teachers. Ten of 162 teachers were male representing 6.2% of teachers.

Table 3

Percentage of Teachers by Gender and District Type

	Urban		Suburban	
Gender	n	%	n	%
Male	5	6.4	5	6.0
Female	73	93.6	79	94.0
Totals	78	100.0	84	100.0

Table 4 shows the classification of teachers as primary (K-2), intermediate (3-6), or both (K-6). Those spanning across primary and intermediate grades were special education teachers. The majority of participants, 87 of 162 or 53.7% were female intermediate teachers. There was one male primary teacher in the study.

Table 4

Percentage of Teachers by Level

	Urban			Suburban		
Level	Male	Female	%	Male	Female	%
Primary	1	27	35.9	0	30	35.7
Intermediate	4	44	61.5	5	43	57.1
Both	0	2	2.6	0	6	7.1
Totals	5	73	100	5	79	100

Participants in the study represented a teaching force with over 75% of participants in both urban and suburban districts having over 11 years of teaching experience, and over one quarter of the participants having more than 21 years of experience (Table 5).

Table 5

Teaching Experience by District Type

	Urban			Suburban		
Experience	Male	Female	%	Male	Female	%
0-5 years	2	7	11.5	0	6	7.1
6-10 years	1	7	10.3	0	14	16.7
11-15 years	1	14	19.2	1	24	29.8
16-20 years	0	24	30.7	2	14	19.0
21 or more years	1	21	28.2	2	21	27.4
Totals	5	73	100	5	79	100

Note: Percentages include both male and female in each experience block.

Research Question One

Has there been a change in teachers' sense of efficacy in teaching mathematics as a result of the implementation of the Common Core State Standards in Mathematics (CCSSM)?

Quantitative data are used in the analysis of this research question.

This research question sought to quantify the effect of the implementation of the CCSSM on teachers' mathematics self-efficacy. The Mathematics Teaching Efficacy Beliefs Instrument (Enochs et al., 2000) used a Likert scale to measure efficacy in terms of Personal Mathematics Teaching Efficacy (PMTE) and Mathematics Teaching Outcome Expectancy (MTOE). The scale rated responses used 1= Strongly Disagree, 2 = Disagree, 3 = Undecided, 4 = Agree, and 5 = Strongly Agree. Throughout this study, responses at four and above will be considered a high sense of efficacy. Responses below a three are considered as low efficacy. A modification of this instrument was used in this study. Eight of the additional items addressed PMTE for the

Common Core State Standards in Mathematics. SPSS version 22 was used to analyze the quantitative data.

Personal Mathematics Teaching Efficacy. Personal mathematics teaching efficacy (PMTE) is a teacher's belief in his or her teaching effectiveness (Enochs et al., 2000). The MTEBI contained 21 items. Items 2, 3, 5, 6, 8, 11, 15, 16, 17, 18, 19, 20, and 21 measured PMTE (Table 6). Descriptive statistics and ANOVA were used to analyze changes in the measures of PMTE and PMTE for the CCSSM.

Table 6

Survey Items Measuring Personal Teaching Mathematics Efficacy (PMTE) from the MTEBI

Item	Statement
2	I continually find better ways to teach mathematics
3*	Even if I try really hard, I do not teach mathematics as well as I do most subjects.
5	I know how to teach mathematics concepts effectively.
6	I am very effective in monitoring mathematics activities.
8*	I generally teach mathematics ineffectively.
11	I understand mathematics concepts well enough to be effective in teaching elementary mathematics.
15*	I find it difficult to use manipulatives to explain to students why mathematics works.
16	I am typically able to answer student questions about mathematics.
17 *	I wonder if I have the necessary skills to teach mathematics.
18 *	Given the choice, I do not invite the principal in to evaluate my mathematics teaching.
19 *	When a student has difficulty understanding a mathematics concept, I am usually at a loss as to how to help the student understand it better.
20	When teaching mathematics, I usually welcome student questions.
21 *	I do not know how to turn students on to mathematics.

Note: From Mathematics Teaching Efficacy Beliefs Instrument (Enochs et al., 2000). Items with an * are negatively worded and were reversed scored in the analysis.

The modification of the Mathematics Teacher Efficacy Belief Instrument (MTEBI) added items 22, 23, 25, 27, 28, 30, 31, and 32 (Table 7) to measure PMTE specific to the Common Core State Standards in Mathematics (CCSSM).

Table 7

Additional Survey Items Measuring Personal Teaching Mathematics Efficacy for the CCSSM

Item	Statement
22	I have read the complete CCSS in mathematics for my grade level.
23*	I have not changed my approach to teaching mathematics due to the CCSS.
25	I understand the progressions in the CCSS in mathematics from the grade below me to the grade level above me.
27	I use the mathematical standards of practice from the CCSS to guide my instruction.
28	I understand the shifts in CCSS instruction well enough to teach mathematics effectively.
30	I have the necessary skills to teach mathematics using CCSS.
31	The CCSS in mathematics allow me to teach less topics to a deeper, more rigorous level.
32 *	I do not know how to use the CCSS in mathematics to teach for deeper understanding

Note: Modification of the Mathematics Teaching Efficacy Beliefs Instrument (Enochs et al., 2000). Items with a * are negatively worded and reversed scored.

Table 8 represents the means and standard deviations PMTE and PMTE for the CCSSM by school and includes urban, suburban, and overall totals. Changes in means and standard deviations are presented. The overall mean of PMTE based on items 2, 3, 5, 6, 8, 11, and 15 through 21, the original MTEBI items, was 4.0048, or slightly above Agree representing a high sense of self-efficacy. The overall mean based on items specific to self-efficacy for the CCSSM, items 22, 23, 25, 27, 28, 30, 31, and 32, decreased to 3.6840. This represents a difference of .3208. PMTE in urban schools decreased .3267 from 3.9241 to 3.5974, and the suburban schools showed an average decrease of .3135, from 4.0769 to 3.7634.

Table 8

Personal Mathematics Teaching Efficacy (PMTE) and PMTE for the CCSSM by School

School	PMTE Mean	PMTE SD	PMTE for CCSSM Mean	PMTE for CCSSM SD	Mean Change	SD Change
UD1S1	4.0879	.42223	3.7159	.58114	-.3720	+.15891
UD1S2	3.8182	.28425	3.4886	.73836	-.3296	+.45411
UD2S1	3.9519	.22449	3.3672	.45750	-.5847	+.23301
UD3S1	3.8583	.37181	3.6184	.45161	-.2399	+.79800
UD3S2	3.7607	.31351	3.8056	.33137	+.0449	-.01786
SD1S1	4.0271	.37874	3.8676	.39397	-.1595	+.01523
SD1S2	4.2179	.27992	3.9688	.33763	-.2491	+.05771
SD2S1	3.9555	.53743	3.4737	.53938	-.4818	+.00195
SD2S2	4.0067	.33281	3.7065	.51347	-.3002	+.18066
SD3S1	4.2981	.19037	3.9531	.26674	-.3450	+.76370
SD3S2	4.2949	.25005	3.9750	.65192	-.3199	+.40187
Urban	3.9241	.35451	3.5974	.53712	-.3267	+.18261
Suburban	4.0769	.38899	3.7634	.48897	-.3135	+.09998
Total	4.0048	.37975	3.6840	.51767	-.3208	+.13792

A comparison of PMTE and PMTE for the CCSSM shows a decrease in the mean level of teachers' mathematics efficacy in all but one case. UD2S1 and SD2S1 demonstrated the largest decrease. UD2S1 showed a decrease of .5847, and SD2S1 showed a decrease of .4818. Schools UD3S1, SD1S1, and SD1S2 all showed decreases of less than a quarter of a point. UD3S2S showed an increase in PMTE of .0449. Changes in standard deviations show a wider variation of scores in all cases, except UD3S2.

One-way ANOVA was used to study the variance in means of PMTE and PMTE for the CCSSM between a number of independent variables: (a) school, (b) district type, (c) grade level, (d) teaching experience, (e) gender, and (f) mathematics certification. The analyses for school and district type were significant. The results for teaching experience, gender, grade level, and mathematics certification were not significant. Table 9 describes the analyses of variance between schools, and Table 10 describes the analysis of variance between districts for PMTE and PMTE for the CCSSM.

Table 9

Results of One-Way ANOVA Tests: Personal Mathematics Teaching Efficacy between Schools

		SS	df	MS	F	*p*
PMTE	Between Groups	3.310	10	.331	2.512	.008**
	Within Groups	19.763	150	.132		
	Total	23.073	160			
PMTE for	Between Groups	5.664	10	.566	2.283	.016*
the CCSSM	Within Groups	37.213	150	.248		
	Total	42.877	160			

Note: $p < .05$*; $p < .01$**

Table 10

Results of One-Way ANOVA Tests: Personal Mathematics Teaching Efficacy between District-Type

		SS	df	MS	F	*p*
PMTE	Between Groups	.9373	1	.937	6.732	.010*
	Within Groups	22.136	159	.139		
	Total	23.073	160			
PMTE for the CCSSM	Between Groups	1.107	1	1.107	4.213	.042*
	Within Groups	41.770	159	.263		
	Total	42.877	160			

Note: $p < .05$*

Table 11 represents response frequencies and means for PMTE and PMTE for the CCSSM. The percentage of urban teachers who rated themselves a four or above on PMTE was 35.5%. The percentage of the urban teachers who rated themselves a four or above for on PMTE for the CCSSM decreased to 20.8%. This represents a negative change of 14.7%. For the suburban teachers, 54.1% rated themselves a four or above on PMTE, and 21.4% for PMTE for the CCSSM. This represents a decrease of 32.7%.

No urban teachers rated themselves below a three on PMTE. Nearly 16% percent of the urban teachers rated themselves below this level on PMTE for the CCSSM. For the suburban teachers, 1.2% rated themselves below a three on PMTE, and 8.4% below this level for PMTE for the CCSSM.

Table 11

Mean Values: PMTE and PMTE for the CCSSM by District Type

	PMTE				PMTE for the CCSSM			
	Urban		Suburban		Urban		Suburban	
Mean Ranges	*n*	%	*n*	%	*n*	%	*n*	%
2.00 - 2.24	0	0%	0	0%	1	1.3%	0	0%
2.25 - 2.49	0	0%	0	0%	0	0%	2	2.4%
2.50 - 2.74	0	0%	0	0%	5	6.5%	2	2.4%
2.75 – 2.99	0	0%	1	1.2%	6	7.8%	3	3.6%
3.00 – 3.24	2	2.6%	3	3.5%	10	13.0%	4	4.8%
3.25 – 3.49	8	10.5%	2	2.4%	15	19.5%	15	17.9%
3.50 – 3.74	10	13.2%	7	8.2%	12	15.6%	22	26.2%
3.75 – 3.99	29	38.2%	26	30.6%	12	15.6%	18	21.4%
4.00 - 4.24	18	23.7%	14	16.5%	11	14.3%	6	7.1%
4.25 – 4.49	5	6.6%	21	24.7%	3	3.9%	8	9.5%
4.50 – 4.74	3	3.9%	11	12.9%	1	1.3%	4	4.8%
4.75 – 5.00	1	1.3%	0	0%	1	1.3%	0	0%

Table 12 shows the percentages of teachers who rated themselves at high and low levels of self-efficacy for PMTE and PMTE for the CCSSM, and changes in those percentages from PMTE to PMTE for the CCSSM.

Table 12

Changes in Personal Mathematics Teaching Efficacy (PMTE) at the School Level

	PMTE		PMTE for the CCSSM		% Change	
School	low	high	low	high	low	high
UD1S1	0%	71.4%	9%	40.9%	+9%	- 30.5%
UD1S2	0%	45.5%	18.2%	27.3%	+18.2%	- 18.2%
UD2S1	0%	37.5%	18.8%	12.5%	+18.8%	- 25.0%
UD3S1	0%	36.8%	10.5%	31.6%	+10.5%	- 5.2%
UD3S2	0%	22.2%	0%	33.3%	No Change	+ 11.1%
SD1S1	0%	58.8%	0%	41.2%	No Change	- 16.6%
SD1S2	0%	83.3%	0%	50.0%	No Change	- 33.3%
SD2S1	5.2%	47.4%	21.1%	21.1%	+15.9%	- 26.3%
SD2S2	0%	43.5%	4.3%	30.4%	+4.3 %	- 13.1%
SD3S1	0%	100%	0%	50.0%	No Change	- 50.0%
SD3S2	0%	100%	0%	60.0%	No Change	- 40.0%

All but one school showed a decrease in self-efficacy from PMTE to PMTE for the CCSSM. Fewer teachers rated themselves at four or five on the PMTE measure for the CCSSM, and more rated themselves less than a three on the PMTE for the CCSSM. The exception was UD3S2.

Mathematics Teaching Outcome Expectancy (MTOE). Mathematics teaching outcome expectations (MTOE) is a teacher's belief that effective teaching can result in positive student learning outcomes regardless of external factors (Enochs et al., 2000). Items 1, 4, 7, 9, 10, 12, 13, and 14 are from the original MTEBI and are used to measure MTOE (Table 13).

Item 34, using the CCSSM will allow students to reach deeper understanding of mathematics, was added to the survey as a modification to measure MTOE for the CCSSM.

Table 13

Survey Items Measuring Mathematics Teaching Outcome Expectations from the MTEBI

Item	Statement
1	When a student does better than usual in mathematics, it is often because the teacher exerted a little extra effort.
4	When the mathematics grades of students improve, it is often due to the teacher having found a more effective teaching approach.
7	If students are under achieving in mathematics, it is more likely due to ineffective mathematics teaching.
9	The inadequacy of a student's mathematics background can be overcome by good teaching.
10	When a low-achieving student progresses in mathematics, it is usually due to extra attention given by the teacher.
12	The teacher is generally responsible for the achievement of students in mathematics.
13	Students' achievement in mathematics is directly related to their teacher's effectiveness in mathematics teaching.
14	If parents comment that students are showing more interest in mathematics at school, it is probably due to the performance of the child's teacher.

Table 14 uses the means at each school to compare MTOE and MTOE for the CCSSM. Seven of the 11 schools showed a decrease in efficacy as measured by mean scores of MTOE. Overall, suburban schools showed a mean increase of .11, while urban schools showed a mean decrease of .10. Gains in some schools were offset by losses in others resulting in little overall change. The results are less consistent between MTOE and MTOE for the CCSSM than the comparisons between PMTE and PMTE for the CCSSM.

Table 14

Mathematics Teaching Outcome Expectancy (MTOE)

School	MTOE pre-CCSSM Mean	MTOE for the CCSSM Mean	Change
UD1S1	3.36	3.36	0
UD1S2	3.31	3.09	-.22
UD2S1	3.27	3.25	-.02
UD3S1	3.45	3.00	-.45
UD3S2	3.65	4.00	+.35
SD1S1	3.32	3.18	-.14
SD1S2	3.21	4.08	+.87
SD2S1	3.22	3.32	+.10
SD2S2	3.28	3.35	+.07
SD3S1	3.55	3.50	-.05
SD3S2	3.79	3.50	-.29
Urban	3.39	3.29	-.10
Suburban	3.33	3.44	+.11
Total	3.36	3.36	0

The two schools from UD3 showed two of the larger changes. UD3S1 had a negative change in outcome expectancy while UD3S2 had a positive change. The principal from UD3S1 indicated that mathematics was not a strength of his, and the principal of UD3S2 indicated that mathematics was a strength of hers (see Table 23). The largest increase in MTOE was at SD1S2 whose principal also indicated mathematic as a strength of hers.

Analyses using one-way ANOVAs were performed between several independent variables: (a) school, (b) district type, (c) teaching level, (d) teaching experience, (e) gender, and (f) mathematics certification, and the measure of MTOE from the original survey. The analyses were repeated using the same variables and MTOE for the CCSSM. There was no significance when compared to school or district type, teaching level, certification or gender. Table 15 shows significance at $p < .01$ for teaching experience when compared against MTOE, but not compared against MTOE for the CCSSM.

Table 15

Results of One-Way ANOVA: Mathematics Teaching Outcome Expectations (MTOE) and Teaching Experience

		SS	df	MS	F	*p*
MTOE	Between Groups	3.265	4	.816	3.607	.008**
	Within Groups	34.625	153	.226		
	Total	23.073	157			

Note: $p < .01$**

A descriptive analysis reveals that 8.2% of the teachers rated themselves at or above a four on MTOE. Fifty percent of the teachers rated themselves at level four and above for MTOE for the CCSSM . Table 16 presents the percentages of teachers in each experience range who rated themselves at a four or above.

Table 16

Teaching Experience and Outcome Expectancy for Agree and Strongly Agree

	MTOE		MTOE for the CCSSM	
Years	%	n	%	n
0 – 5	9.1%	11	53.8%	13
6 – 10	4.3%	23	52.2%	23
11 – 15	0%	40	46.3%	41
16 – 20	20.0%	40	60.0%	40
21 +	6.8%	44	42.2%	45
Total	8.2%	158	50.0%	162

Listed below are the findings from question one.

- Teacher efficacy decreased significantly as a result of CCSSM implementation. Suburban districts showed a larger decrease in high efficacy ratings than urban districts.
- There was an increase of teachers with a low sense of efficacy as a result of the implementation of the CCSSM.
- No teachers of schools in the study reported a high sense of MTOE.
- The implementation of the CCSSM related to an increase in MTOE.

Research Question Two

What are teachers' perceptions of their own knowledge of the CCSSM and changes in instructional practices in teaching mathematics due to the adoption of the CCSSM, and principals' perceptions of teachers' readiness for implementation?

Analysis of research question two includes both quantitative and qualitative data. Table 17 lists the items used to measure teachers' self-perception of knowledge of the CCSSM.

Table 17

Survey Items Measuring Mathematics Knowledge of the Common Core State Standards in Mathematics

Item	Statement
22	I have read the complete CCSS in mathematics for my grade level.
25	I understand the progressions in the CCSS in mathematics from the grade below me to the grade level above me.
27	I use the mathematical standards of practice from the CCSS to guide my instruction.
28	I understand the shifts in CCSS instruction well enough to teach mathematics effectively.
30	I have the necessary skills to teach mathematics using CCSS.

A one-way ANOVA analyzed a number of independent variables: (a) school, (b) district type, (c) teaching level, (d) teaching experience, (e) gender, and (f) mathematics certification with self-reported knowledge of the CCSSM (Table 18). Significance was indicated between schools at $p < .01$.

Table 18

School Level Results of One-Way ANOVA: Knowledge of Common Core State Standards in Mathematics

Knowledge		SS	df	MS	F	*p*
CCSSM	Between Groups	9.282	10	.928	2.758	.004
	Within Groups	50.487	150	.337		
	Total	59.769	160			

Note: $p < .01$

Table M1 shows a comparison by school of teachers' self-report of knowledge of the CCSSM. The comparison reports the mean and standard deviation from each of the schools. The data are listed in rank order by means. On average, teachers from four suburban schools, SD3S2,

SD1S1, SD1S2, and SD3S1 rated themselves to be knowledgeable regarding the CCSSM. Five of the remaining seven schools average closer to agree than undecided about their level of knowledge. Two are closer to undecided, but all schools indicate an increase of knowledge of the CCSSM. UD3S2 was the top rated urban school.

Table M2 shows self-reported knowledge of the CCSSM broken down by item. Schools are listed in the same order as they were in Table M1. The table reports percentages of teachers at each school that reported at a high level of self-efficacy. The data show that in seven of 11 schools, over three quarters of the teachers felt that they had the necessary skills to teach mathematics using the Common Core, although in eight of 11 schools teachers reported that less than 75% have read the complete standards at their grade level. In UD2S1, only 25% agree that they have read the complete standards at their grade.

Survey item 23 measured teachers' perception of a change in their own instructional practices as a result of the adoption of the CCSSM. Item 23 was negatively worded. Table N1 represents the results for teacher perception of change in practice. The top four schools in terms of knowledge of the CCSSM were ranked between first and seventh in terms of change in practice. Three of the four schools with the lowest means in terms of knowledge of the CCSSM fell within the five lowest means in terms of reported change in instructional practice. A Pearson product correlation between teacher knowledge of the CCSSM and one's change in practice revealed a relationship with significance at $p < .01$ level (Table 19). A correlation of .257 represents a small correlation.

Table 19

Pearson Correlation between Self-Reported Knowledge of CCSSM and Teacher Perception of Instructional Change

		Instructional Change
Knowledge	Pearson Correlation	.257**
	Sig. (2-tailed)	.001
	N	161

**Correlation is significant at the 0.01 level (2-tailed).

Interviews with principals about their perception of their teachers' readiness for implementation of the CCSSM revealed resources and a conceptual approach as two themes.

The resources discussed by nine of 11 principals suggested the importance of manipulatives for conceptual work and a new text series aligned to the CCSSM to anchor the implementation of the Common Core. Both principals from UD1 discussed the new text series. PUD1S1 stated that:

> The district bought a new text series. This was a significant shift in how they taught math. With a text aligned with the Common Core, we used this as a spring board. Without the text, we would have been hurting. (PUD1S1, personal communication, March 14, 2014)

He noted that changes in instruction were slow with a long way to go. He felt that his teachers wanted to hold onto their old ways of teaching, but he has seen more common language and mathematics vocabulary being used (PUD1S1, personal communication, March 14, 2014). PUD1S2 said:

> Thank God for the text. It has been a scaffold to hang the rest on. We really have tried to be careful to make sure the text does fit the shifts and that we are comfortable that this

> text is taking us along the Common Core. (PUD1S2, personal communication, April 1, 2014)

He noted that the Common Core has required them to think other ways:

> To me the biggest change with Common Core is that my classroom teachers have always been able to say 'this is the way I do 4th grade fractions. I've been doing it this way for the past 20 years. I'll just keep teaching that until the kids get it'. But now they have to offer the kids other menu items to get to the same direction and they are not comfortable with the other menu items. (PUD1S2, personal communication, April 1, 2014)

On the other hand though:

> Some of my teachers have been reinvigorated by this, because it's been a challenge. So the teachers that are willing to accept the challenge have moved along. (PUD1S2, personal communication, April 1, 2014)

PUD2S1 discussed the alignment to the common core of the new text series. He felt that children were working more in teams and being more collaborative (PUD2S1, personal communication, March 19, 2014). He thought the changes he observed were often conceptual in nature:

> You no longer teach FOIL at the beginning [an algebraic procedure to multiply two binomials: first terms, outside terms, inside terms, last terms]. You teach it at the end. We teach conceptually how to do the processes and then teach the procedure. We want to teach kids to really conceptually understand. (PUD2S1, personal communication, March 19, 2014)

PUD2S1 described the current preparation to teach using the CCSSM as a process of learning the new text and living with the math modules developed by the state (PUD2S1, personal communication, March 19, 2014).

Urban District Three was the only district in the study that no longer used a text despite an adoption of a new one just two years earlier. UD3 began using the NYS modules as the main resource to drive instruction. According to the PUD3S1:

> I think using the modules has been the biggest shift that I have seen moving to Common Core from just a packaged curriculum. You can't blame the packaged curriculum anymore. You have to really be able to understand mathematics. They kind of struggled a little bit without having a prescribed program. (PUD3S1, personal communication, July 17, 2014)

The other principal whose staff was not using a text book to drive instruction, PUD3S2, pointed to changes in teacher practice regarding a shift to a more student-centered approach. She has seen an emphasis on the process of how students get to the answer. Teachers have allowed them to engage more and explain how they got to their answers. (PUD3S2, personal communication, June 19, 2014)

PSD1S1 believed that since she arrived in her district, the text book has been the curriculum. She had seen a change in philosophy and practice (PSD1S1, personal communication, March 26, 2014). And while there was a new series, she sees the difficulty as:

> There was not a true knowledge of the teaching of mathematics to make the jump from the curriculum we were teaching to the core, and it was a really big shift for people. While teachers are successfully implementing the new text book series, which is Common Core aligned, I would not say that it is synonymous with implementing the

> Core. So how well prepared are we to implement the Core? Only as well prepared as the math textbook.

PSD1S2 stated:

> Math not being the strength of many elementary teachers, they tend to rely on the text book and go page by page. This is changing and that is a good thing. I see a lot less text book being used and more let's teach the concept first, let's practice in a variety of ways, and now let's see what the book can do to help us understand. (PSD1S2, personal communication, April 14, 2014)

She went on to say that she sees her staff using both the new text and the NYS math modules as a resource to teach to the standards, and in terms of instructional changes:

> You can hold a ten frame up and children will just say 'seven'. No more needing to touch to count. It's been great to see a lot more hands on work and a lot more pictorial representations of things. (PSD1S2, personal communication, April 14, 2014)

PSD1S2 felt that:

> Last year, we had a few curriculum days, but it was nowhere near what teachers thought they needed. It was to unbundle language and look at the continuum. (PSD1S2, personal conversation, April 14, 2014)

Suburban District Two also adopted a new text series. According to PSD2S1, he saw the most obvious changes as an increase in use and number of manipulatives that are being used, and an emphasis on fluency through computer based programs (PSD2S1, personal communication, April 2, 2014). PSD2S2 believed the new text starts with the visual and moves from the concrete to the abstract (PSD2S2, personal communication, May 7, 2014). She saw the following changes in classroom mathematics instruction:

> One big change is a language based shift, getting the students to be more verbal with their mathematical reasoning and understanding. There has also been an emphasis on base ten. I've noticed kindergarteners and first graders composing and decomposing numbers to 20. (PSD2S2, personal communication, May 7, 2014)

PSD2S1 said that because he has a veteran staff, their preparation for the Common Core had been more of a re-alignment with the current curriculum (PSD2S1, personal communication, April 2, 2014).

The final district, SD3, also adopted a new text series. PSD3S1 did not speak about the text. She addressed a number of changes in practice since the adoption of the CCSSM:

> Teachers are seeing children digging a little deeper into the concepts of mathematics. I'm seeing more focus on understanding base ten, and why our place value system works the way it does, and more manipulatives where kids are actually composing and decomposing numbers, building to a ten in the more primary grades, and having that ten be that magic kind of number in their minds. Kids are actually able to explain that. I've seen pretty regular use of the tape modeling that the state calls it or bar modeling. We are problem solving where the kids are actually breaking the problem apart into a visual component and then visually representing the problem. I've seen our teachers start to replace the question mark in a bar model problem with an X or a Y and use the term variable. This is what's variable, this is what we are solving, this is what the unknown is. (PSD3S1, personal communication, June 18, 2013)

According to PSD3S1:

> We've put a lot of time into it as a collective staff the last couple of years, looking at the standards, reading the standards and pulling the standards apart, and looking at who does

what before, what does the grade level do before me and after me, and so on and so forth. (personal communication, June 18, 2014)

PSD3S2 saw the strengths in the new series in the online programming and in the communication with parents, and believes his teachers are using it more as a resource, and less as curriculum. He likes the tiered work books so that there is differentiation that teachers can do readily, and he likes the fact that it is based on Singapore math which is the model for the Common Core (PSD3S2, personal communication, June 3, 2014).

Listed below are the findings from question two.

- Many teachers have a low perception of their knowledge of the CCSSM.
- Teachers in all schools reported that they had changed their practice due to the CCSSM.
- Principals perceived that teacher readiness for the implementation of the CCSSM depended on Common Core-aligned text books.

Research Question Three

Is there a relationship between teachers' perceptions of the efficacy of their principals' mathematics leadership for the implementation of the CCSSM and teachers' sense of self-efficacy?

Analysis of research question three includes both quantitative and qualitative data. Table 20 shows the items that were used to measure teachers' perceptions of principals' instructional leadership in terms of CCSSM.

Table 20

Survey Items Measuring Teachers' Perception of Principals' Leadership for CCSSM

Item	Statement
24	My principal is knowledgeable in mathematics.
26	My principal understands the shifts in the CCSS in mathematics to effectively support my needs.
29	My principal has not provided me with the necessary supports to teach the CCSS effectively.
33	The principal has led professional development to prepare me to teach the CCSS effectively.

Table 21 shows the mean value and standard deviation for the items listed in Table 20 which measure teachers' perception principals' leadership for the shift to the CCSSM.

Table 21

Teacher Perception of Principal Leadership for CCSSM

School	*Mean*	*N*	*SD*
UD1S1	3.5795	22	.70028
UD1S2	3.5000	11	.66144
UD2S1	3.8000	15	.59161
UD3S1	3.4474	19	.63234
UD3S2	4.1667	9	.45069
SD1S1	3.8529	17	.70743
SD1S2	4.4773	11	.42507
SD2S1	3.9079	19	.41842
SD2S2	3.3913	23	.61157
SD3S1	4.2500	8	.40089
SD3S2	3.7917	6	1.01755

Table O1 provides a breakdown of the means for each of the four items. PSD2S2 and PSD3S1 were the top two in terms of Item 26. These two principals both reported mathematics as a strength as described by their knowledge of the mathematics and comfort level leading professional development in mathematics.

A Pearson correlation between teachers' perception of principal efficacy to lead the shift to the CCSSM and their own perception of self-efficacy as measured by PMTE for the CCSSM is significant at $p < .01$and demonstrated a moderate correlation (Table 22).

Table 22

Pearson Correlation between Teacher Perception of Principal Efficacy and Teacher PMTE for the CCSSM

		PMTE for the CCSSM
Teacher Perception	Pearson Correlation	.367**
	Sig. (2-tailed)	.000
	N	159

**Correlation is significant at the 0.01 level (2-tailed).

Table 23 describes each principal's teaching certification area, years as a principal, and whether they self-report mathematics as a personal strength based on knowledge, experience and comfort level in providing professional development.

Table 23

Principal Demographics

School	Years as Elementary Principal	Math as a Strength	Teaching Certification
UD1S1	6 -10	No	Elementary Education
UD1S2	21+	No	Elementary Education, English 7-12
UD2S1	6 – 10	No	Special Education
UD3S1	6 – 10	No	Special Education
UD3S2	0 – 5	Yes	Elementary and Special Education
SD1S1	11 – 15	No	Elementary Education, Reading
SD1S2	6 – 10	Yes	Elementary Education, Math 7 - 12
SD2S1	6 – 10	Yes	Special Education, Math 7 - 12
SD2S2	6 – 10	Yes	Elementary, Reading, Math 7 - 12
SD3S1	11 – 15	Yes	Elementary Education, Reading
SD3S2	6 – 10	No	Elementary Education

Five of 11 principals reported that mathematics was a personal strength for them. Teachers from three of these five schools, UD3S2, SD1S2, and SD3S1, found their principals' leadership in mathematics to be highly efficacious. Teachers from SD2S1 rated their principal at the high end of efficacious at 3.9079, but PSD2S2 received the lowest rating of the 11 principals at 3.3913.

PUD3S2 stated that math was a personal strength for her and one of the reasons the school is probably more math centered. She felt she understood the changes pretty well (PUD3S2, personal communication, June 19, 2014). PSD1S2 also felt mathematics was a personal strength for her. She minored in it in college and is assigned to lead math curriculum work in the district (PSD1S2, personal communication, April 14, 2014).

PSD3S1 responded:

> I feel very confident in our math program, my knowledge of it, my knowledge of each of the grade levels, expectations in mathematics, my knowledge of the program that we've implemented through [a CCSSM aligned text] and my knowledge of the standards. (PSD3S1, personal communication, June 18, 2014)

Two principals felt that mathematics was a strength of theirs, but teachers' perceptions did not necessarily agree. PSD2S1 reported that he was certified to teach mathematics from grades seven through 12, but admitted that although he was an elementary principal, he had no elementary certification (PSD2S1, personal communication, April 2, 2014).

PSD2S2 also felt math was a strength. She reported:

> I understand the standards to a degree. Because of our structure in the district, I am fortunate to have a math specialist in the building. I do not have time to be the curriculum leader that I want to be. (PSD2S2, personal communications, May 7, 2014)

Six principals did not see mathematics as a strength and their staff agreed. PUD1S1 felt his math was traditional and wishes he was a little better trained for the Common Core (PUD1S1, personal communication, March 14, 2014). PUD1S2 reported that his flaw was that he could not help his teachers articulate their needs and was not strong enough to help (PUD1S2, personal communication, April 1, 2014). PUD2S1 thought that he was strong conceptually in mathematics, but not instructionally (PUD2S1, personal communication, March 19, 2014).

PUD3S1 would:

> Not consider math to be a personal strength and even going back to when I was teaching in special education, I felt like I kind of steered away from it in that sense, so I guess my skill set would be evolving as well with the standards (PUD3S1, personal communication, July 17, 2014).

PSD1S1 thought mathematics was a strength until the Core and now realizes she can provide support, but not direct instruction (PSD1S1, personal communication, March 26, 2014). PSD3S2 does not consider mathematics to be a strength, but feels he knows the standards pretty well (PSD3S2, personal communication, June 3, 2014).

Listed below are the findings from question three.

- Most principals were perceived as efficacious for instructional leadership in mathematics, but few as highly efficacious.
- Less than half of the principals felt confident in leading professional development in mathematics.
- There is a moderate relationship between teacher perception of principal leadership and PMTE for the CCSSM.
- The relationship between high perception of principal leadership for CCSSM and high teacher efficacy was not consistent.

Research Question Four

Does a building leader's perception of the role of central office support influence their sense of self-efficacy for instructional leadership in the implementation of the Common Core State Standards in Mathematics?

Analysis of research question four includes qualitative data gathered from principal's interview questions two and three. All principals reported support from central office. Principals spoke about central office support in terms of resources such as manipulatives and a new text series. All districts but UD3 purchased a Common Core aligned text series to support the implementation. UD3 used modules designed by the New York state Education Department as their guiding resource. Central office support of extra time for teacher work to map and align the

text to the Common Core was another resource mentioned by eight of 11principals. Central office also provided support through additional personnel such as coaches. Professional development was also noted as a central office support.

PUD1S1 said that central office support for the shift to the Common Core came through the purchase of the text and by providing money for summer curriculum work to align and map the text to match the Common Core standards (PUD1S1, personal conversation, March 14, 2014). He also stated he could lead small pockets or conversations at a grade level, but was not ready to lead a large professional development session (PUD1S1, personal communication, March 14, 2014).

PUD1S2 also spoke of the text, and that the mapping work to pace lessons was supported by central office (PUD1S2, personal conversation, April 1, 2014). Neither of these principals reported that they were confident in leading professional development. UD1 uses math coaches from outside of the district to support the implementation of the Common Core. PUD1S2 said That the money for coaches came from Race to the Top funds (PUD1S2, personal communication, April 1, 2014).

In terms of professional development, PUD1S1 explained that some teachers went to training, but his budget did not allow for much. He said they discussed the shifts of the CCSSM during professional learning communities (PUD1S1, personal communication, March14, 2014). PUD1S2 did not believe that any of the professional development had been targeted enough yet (PUD1S2, personal communication, April 1, 214).

In addition to the new text, PUD2S1 reported other support from central office in terms of payment for substitutes so his teachers could work on the curriculum (PUD2S1, personal communication, March 19, 2014). Central office has also provided mathematics consultants at

UD2. PUD2S1 did not see mathematics as a strength for him, but in terms of professional development he stated:

> I am confident to lead the professional development. Am I 100% prepared to walk in tomorrow and lead them through it? No, but if I had four hours to sit down, I could prepare and lead a two hour professional development. It's just not something that I regularly do. We use consultant math specialists. I rely on them to do the functions of what someone might do as a principal if they had some more support. (PUD2S1, personal communication, March 19, 2014)

PUD2S1 acknowledged the support that central office has provided, but he also believes that:

> Central office had lacked the intestinal fortitude to force change whereas I have been the driver of change. They have provided support, but it has been a very slow shift. They have committed to a math specialist to work with all teachers. In the past it was always voluntary. Now it is mandated. As a district though, we are not moving in sync. We are struggling with cohesiveness at the K – 2 levels. (PUD2S1, personal communication, March 19, 2014)

Urban District Three was the only district to stop using a text book to guide their instruction and began to use the New York State modules as their main resource to guide instruction. PUD3S1 spoke of support in terms of time:

> I think a great strength of our district was that we really focused our new rollout grade level specific, and I think that was a home run to do it that way. Teachers just could relate and have deeper conversations, deeper interactions around what's going on with that particular grade level. Outside consultants were used to work with teachers to dig into the standards. Our math coaches participated in the training and in turn led after

hours and weekend curriculum writing sessions. (PUD3S1, personal communication, July 17, 2014)

PUD3S1 did not see math as a strength, but believes that it is not necessarily a weakness in delivering professional development.

> As far as my confidence in leading professional development in it, believe it or not, I actually think that it is a strength that I do not feel comfortable in the math because I think, hopefully I can emote or convey that with my faculty around the growth mindset of, okay, so let's figure this out together and how we approach it, because ultimately it's that resilience and grit that we want the kids to learn. I have to work really hard at it. So maybe people that don't necessarily feel that math is a personal strength, I think sometimes they can be really strong math teachers. (PUD3S1, personal communication, July 17, 2014)

PUD3S1 stated that:

> There is just not an awful lot of time embedded into the contractual day for the teachers to be getting the PDs. So what happens is, we have some Wednesday PD mornings, and sometimes someone would come in and does some math PD for them. (PUD3S1, personal conversation, July 17, 2014)

PUD3S2 felt that mathematics was a strength for her. In the past she had led book studies and did turnkey training for her staff on the math standards (PUD3S2, personal communication, June 19, 2014). She described the latest professional development effort at her school:

> Embedded professional development had been the missing piece. Initially it was about drive-by PDs. Here are the shifts. Here's the common core. Here you go! Then we

> expected teachers to be able to implement it. The most important support we've had would be the studio classroom. It is an effort to make sure it hits everyone. A strength is that we have these studio classrooms where teachers have time to really dig into the standards and understand and develop lessons and think about different ways to implement those lessons within the classroom, outside of the traditional way. It gives them a place to try on new things that we know are in the best interest of students. (PUD3S2, personal communication, June 19, 2014)

She also reported that:

> Besides a book study in our PLC, we have moved from drive-by professional developments to embedded professional development. We have had a math consultant for five two-day visits called studio classroom. The third through fifth grade teachers have really dug into the standards, both content and practices, and studied the progressions. We have her [the consultant] back again next year. (PUD3S2, personal conversation, June 19, 2014)

In Suburban District One, the principals lead in specific content areas. PSD1S1 explained:

> My focus has been literacy, so I would consider that my strength. I would not feel comfortable in leading professional development in mathematics. The text was a good stop gap and it was supportive of teachers, but it's got to be a stepping stone. Central office put strong teachers in coach positions for professional development to support the teachers. That made a big difference toward buy-in. It made it easier for teachers to admit when they were not comfortable. Halfway through this year we moved away from professional development relating to the math series and doing professional development

more specifically common core mathematics. I admire that the district put the core at the top. (PSD1S1, personal communications, March 26, 2014)

Until recently, PSD1S1 believed the professional development had been reactionary as opposed to proactive, but moved away from professional development relating to the math series and more specifically targeting the CCSSM (PSD1S1, personal conversation, March 26, 2014). PSD1S2 reported mathematics as a strength for her and is certified to teach mathematics at the secondary level. She added to PSD1S1's comments:

> Each of the principals in our district are leads in a curriculum area and math just happens to be the one assigned to me, so I lead out in professional development. It doesn't mean I have to do it. It means I have to get it done. I work regularly with the math coaches leading much of the professional development, both on superintendent conference day formats and after school workshops. (PSD1S2, personal communication, April 14, 2014)

She continued:

> There has been a financial and philosophical commitment. We had multi-year purchasing of texts. We have the necessary manipulatives. We have the use math and data consultants. We have the support of coaches, support of teacher professional development areas – has been a huge change for math. Math always felt like the stepchild. The new assistant superintendent has heard the cry of the teachers and my pounding on the soapbox about how we needed the help in math. (PSD1S2, personal communication, April 14, 2014)

Both principals from Suburban District Two reported that mathematics is a strength and both are certified to teach secondary mathematics. PSD2S1 stated:

> I am confident to a certain degree. I would need to know the purpose of the professional development, and what the expected outcomes are supposed to be. I want to be sure it would meet the needs of the teachers and students. Once I know that, my confidence automatically increases. Currently we do both internal and external training for teachers on the standards and how they fit into the lessons of the text. (PSD2S1, personal communication, April 2, 2014)

His colleague, PSD2S2 believed her teachers were well prepared:

> We started early. Professional development opportunities for teachers have been incredibly welcomed, initiated and successful for students. We had several grade level representatives work with an expert on fluency and not just fact fluency, but fluency with topics like decimals and place value. (PSD2S2, personal communication, May 7, 2014)

PSD2S2 stated clearly that while she sees mathematics as a strength:

> I have an incredibly talented, knowledgeable, organized and well-respected colleague who loves mathematics even more than I do. She is my go-to person. She is the leader of professional development. (PSD2S2, personal communication, May 7, 2014)

PSD2S2 discussed the role of central office from the beginning:

> We started by providing a foundational understanding of the change, where the change came from, the reason for the change, and then using resources within the district to help provide that change over time. A process was created to be sure everything trickled down to every individual teacher. It has been a three year process. (PSD2S2, personal communication, May 7, 2014)

PSD3S1 reported math as a strength for her. She was not certified in mathematics, but had a leadership role in math in the district:

> I guess I do feel pretty confident leading professional development around the Common Core. We have our own network team. Because of that, our own leadership has turnkey training. The other members of leadership, myself being one, come back and train the building. We have had a couple of times to interact with the professional development material, both for our personal learning at leadership meetings and then rolling it out to our teachers as a second or third time with the material. (PSD3S1, personal communication, June 18, 2014)

PSD3S1 reported that the network team had given guidance to the district office that was respected:

> It is important to move quickly enough where you get the teachers the information they need to impact student learning, but to move slowly enough where you are respecting the fact that these are all people we are dealing with, both adults and children and we need to be thoughtful about how much we are putting on them and in what timeframe. (PSD3S1, personal communication, June 18, 2014)

PSD3S1 also emphasized the work at the building:

> As a collective group, we've put a lot of time into it the last couple of years, looking at the standards, reading the standards and pulling the standards apart, and looking at who does what before, what does the grade level do before me and after me, and so on and so forth. I think that give and take of the responsibility around how do we get over this hump or how do we figure this out, or how do we truly understand what the standards are saying. I think it's been a shared goal for the building, which I think has helped everybody. (PSD3S1, personal communication, June 18, 2014)

PSD3S1 believed that she understood the difficulties teachers had because:

> I always teach some math classes and I've taught every math class from 2nd through 5th grade in this building, some grade levels multiple times. I think this has given me the ability to stay even that much more connected to the grade level expectations and to the struggles that the teachers and the kids are having because we've been right there with them. (PSD3S1, personal communication, June 18, 2014)

PSD3S2 stated that his strength was in literacy, not mathematics (PSD3S2, personal communication, June 3, 2014). He continued that:

> We used a consultant from the text book company to get the teachers at least a foundation. I think our approach has been to incorporate the teachers along the way so as much as not doing to the teacher but doing with the teacher. Secondly, we called in an expert to work alongside teachers to do some mapping. (PSD3S2, personal communication, June 3, 2014)

The professional development at SD3S2 has been mainly delivered by representatives from the text book company (personal communication, June 3, 2014).

Interviews revealed that professional development was delivered a number of different ways. The semi-structured interview allowed the researcher to follow up on questions about professional development and central office support to gather a full picture of the different forms of professional development that was employed. Table 24 summarizes the delivery used in each school.

Table 24

Delivery of Professional Development

School	Principal	District Coaches	District Math Specialist	Outside Consultant	Internal Network
UD1S1				X	
UD1S2				X	
UD2S1				X	
UD3S1		X	X	X	
UD3S2	X	X	X	X	
SD1S1		X		X	
SD1S2	X	X		X	
SD2S1			X	X	
SD2S2			X	X	
SD3S1	X			X	X
SD3S2				X	X

Listed below are the findings from question four.

- All principals in the study reported that central office offered the necessary resources to support the implementation of the CCSSM.
- Despite support offered by central office, few principals saw themselves as the instructional leader for CCSSM.

Findings

Listed below is a summary of findings from this study by research question.

Research question one.

- Teacher efficacy decreased significantly as a result of CCSSM implementation. Suburban districts showed a larger decrease in high efficacy ratings than urban districts.
- There was an increase of teachers with a low sense of efficacy as a result of the implementation of the CCSSM.
- No teachers of schools in the study reported a high sense of MTOE.
- The implementation of the CCSSM related to an increase in MTOE.

Research question two.

- Many teachers have a low perception of their knowledge of the CCSSM.
- Teachers in all schools reported that they had changed their practice due to the CCSSM.
- Principals perceived that teacher readiness for the implementation of the CCSSM depended on Common Core-aligned text books.

Research question three.

- Most principals were perceived as efficacious for instructional leadership in mathematics, but few as highly efficacious.
- Less than half of the principals felt confident in leading professional development in mathematics.
- There is a moderate relationship between teacher perception of principal leadership and PMTE for the CCSSM.

- The relationship between high perception of principal leadership for CCSSM and high teacher efficacy was not consistent.

Research question four.

- All principals in the study reported that central office offered the necessary resources to support the implementation of the CCSSM.
- Despite support offered by central office, few principals saw themselves as the instructional leader for CCSSM.

Chapter five presents a summary of the analyses and discusses conclusions and recommendations based upon the findings.

Chapter Five: Summary of Findings, Conclusions, and Recommendations

This mixed method study was designed to examine the effect of the implementation of the Common Core State Standards in Mathematics on the mathematics efficacy of elementary teachers and principals. Perceptions of instructional change, leadership for implementation, and central office support were also explored.

This chapter presents a summary of findings, conclusions, and recommendations about the data that were collected in this research project. The chapter begins with a description of the purpose statement, research questions, and background information about the participants in the study. The chapter is organized in the order of the research questions. Conclusions will follow the summary of findings. Recommendations are presented last and are divided into three sections: (a) recommendations for policy makers, (b) recommendations for practitioners and systems leaders, (c) and recommendations for future research.

Summary of Findings

Several findings emerged from this study regarding the effect of the implementation of the CCSSM on elementary mathematics teachers' sense of efficacy. Other findings address teachers' perception of their knowledge of the CCSSM and of instructional changes as a result of its implementation. Principals' perceptions of teacher preparedness, efficacy for instructional leadership, and central office support will also be presented. A summary of findings is presented with each research question.

Research Question One

Has there been a change in teachers' sense of efficacy in teaching mathematics as a result of the implementation of the Common Core State Standards in Mathematics (CCSSM)?

Finding one. Teacher efficacy decreased significantly as a result of CCSSM implementation. Suburban districts showed a much larger decrease in high efficacy ratings than urban districts.

An analysis of variance showed significance at $p < .05$ when comparing PMTE and PMTE for the CCSSM and district type (Table 10).

A cross-tabulation was run to help analyze the finding of significance. Efficacy was defined as high with mean values at four (agree) or above, and was defined as low when less than three (undecided). On the PMTE measure, 35.5% of teachers in urban districts rated themselves as highly efficacious. Efficacy decreased to 20.8% on the PMTE measure for the CCSSM. No urban teachers rated themselves with low efficacy on PMTE. Post measures indicated an increase of 15.6% in teachers with a low sense of efficacy supporting the negative effect of the CCSSM on efficacy.

Suburban teachers reported that 54.1% felt highly efficacious on the PMTE measure. The measure of high efficacy of PMTE for the CCSSM decreased to 21.4%. This represented a decrease of 32.7% as compared to the urban decrease of 14.7%. One suburban teacher which represents 1.2% indicated a low level of efficacy for PMTE. Low efficacy increased to 8.4% for PMTE for the CCSSM.

An analysis of variance showed significance when comparing schools and PMTE at $p < .01$, and significance when comparing schools and PMTE for the CCSSM at $p < .05$ (Table 9). Ten of 11schools showed a decrease in efficacy on the measure of PMTE for the CCSSM. The range for PMTE was a low of 3.7607 to a high of 4.2981. The range for PMTE for the CCSSM was a low of 3.3672 to a high of 3.9750 (.6388).

The two schools from SD3 showed 100% of teachers surveyed at a high level of PMTE. Three other schools reported teachers with high PMTE rates above 50%: (a) SD1S2 at 83.3%, (b) UD1S1 at 71.4%, and (c) SD1S1at 58.8%. The remaining six schools had less than 50% of the participating teachers report a high sense of mathematics efficacy with UD3S2 reporting 22.2% of the teachers with high PMTE. Rates of PMTE for the CCSSM dropped to a low of 12.5% of teachers to a high of 60% of teachers reporting high efficacy among schools in the study.

Finding two. There was an increase of teachers with a low sense of efficacy as a result of the implementation of the CCSSM.

Ten of 11 schools showed no teachers below a rating of three on PMTE. The remaining school reported 5.2% of teachers at low efficacy. In measures of PMTE for the CCSSM, five of the 11 schools remained at zero percent for measures of low efficacy. The range for low efficacy increased at the remaining six schools from a low of 4.3% to a high of 18.8%. UD3S2 reported high efficacy on PMTE measures, and was the only school that showed an increase in PMTE for the CCSSM. Decreases in PMTE ranged from 5.2% to 50%.

Finding three. No teachers of schools in the study reported a high sense of MTOE.

A comparison of means for MTOE revealed that suburban teachers had slightly lower MTOE than urban teachers. UD3S2 and SD1S2 had outcome expectations at a high level as a result of the implementation of CCSSM. UD3S3 increased from 3.65 to a high rating of 4.00, but UD3S1 had the lowest rating, decreasing from 3.45 to a 3.00. Two other pairs of school from SD1 and SD2 showed an increase and a decrease for MTOE for the CCSSM within the same district. SD1S1 had a slight decrease and SD1S2 had the largest increase in the study of

.87 to the highest efficacy rating of 4.08. SD2S1 had a slight increase while SD2S2 had a slight decrease. No consistent trend was found.

Finding four. The implementation of the CCSSM reflected an increase in MTOE.

Only eight percent of teachers had a high sense of MTOE. This number increased to 50% with the implementation of the CCSSM. An analysis of variance showed significance when comparing teaching experience and MTOE at $p < .01$ (Table 15). Teachers with 16 to 20 years of teaching experience have the highest MTOE and MTOE for the CCSSM (Table 16).

Research Question Two

What are teachers' perceptions of their own knowledge of the CCSSM and changes in instructional practices in teaching mathematics due to the adoption of the CCSSM, and principals' perceptions of teachers' readiness for implementation?

Finding one. Many teachers have a low perception of their knowledge of the CCSSM.

An ANOVA showed significance at $p < .01$ when comparing teachers' perceived knowledge of the CCSSM and schools (Table 18). A comparison of means indicated that the mean rating for SD3S2, SD1S1, SD1S2, and SD3S1 was at four or above. These four schools represented two suburban districts.

There were five survey items that measured teacher perception of knowledge of the CCSSM. Seventy percent or more of the teachers in just three of 11 schools agreed that they had read the entire standards for their grade level, and in one case it was as low as 25% of the teachers. Seventy percent or more of the teachers in just three of 11 schools agreed that they understood the progression of content in the grade before them to the grade after them. In eight of 11 schools, 80% or more of the teachers agreed that they understood the mathematical practices as described in the CCSSM.

In five of 11 schools, 70% or more of teachers agreed that they understood the shifts of the CCSSM. Finally, in all schools, five-eighths or more of the teachers agreed that they had the necessary skills to teach mathematics using the CCSSM.

Finding two. Teachers in all schools reported that they had changed their practice due to the CCSSM.

In eight of 11 schools, the mean response to item 23 was at four or above. The means at the remaining three schools were close to four, ranging from 3.83 to 3.91. SD1S2 rated the change the highest at 4.50. UD3S2 was second at 4.33. As noted earlier, UD3S2 was the only school that reported an increase in efficacy. A Pearson correlation test showed significance at $p < .01$ indicating a low relationship between teacher knowledge of CCSSM and teacher perception of change in practice (Table 19).

Finding three. Principals perceived that teacher readiness for the implementation of the CCSSM depended on Common Core-aligned text books.

The overarching theme of principal perception of teacher readiness was that while there seemed to be pockets of preparedness in each building, there was a long way to go for consistency in implementation of the CCSSM. Most principals indicated that the change in practice had been slow. Five of the six districts adopted a new math series to guide the instruction. Professional development at the onset of the adoption of the CCSSM was typically delivered by outside consultants and focused on the text book. Some principals have indicated that professional development no longer focused on the text, but on an understanding of the standards and the shifts in practice.

UD3 was the only district that no longer used a text book. PUD3S1 indicated that his staff struggled without a text (PUD3S1, personal communication, July 17, 2014), and PUD3S2

discussed the embedded professional development in her building that focused on understanding the standards and preparing lessons that aligned to those standards. Her concern was that only a few teachers from grades three through five were getting that training (PUD3S2, personal communication, June 19, 2014). PSD3S1 was the only principal that felt her staff was well prepared (PSD3S1, personal communication, June 18, 2014).

Research Question Three

Is there a relationship between teachers' perceptions of the efficacy of their principals' mathematics leadership for the implementation of the CCSSM and teachers' sense of self-efficacy in teaching Common Core mathematics?

Finding one. Most principals were perceived as efficacious for instructional leadership in mathematics, but few as highly efficacious.

Teachers in three schools agreed that their principal was highly efficacious and had the necessary skills to lead the CCSSM. SD1S2 rated their principal the highest at 4.4773. The other two schools that had ratings above four were SD3S1 at 4.2500 and UD3S2 at 4.1667. The range of scores from the remaining eight schools was from 3.3913 to 3.9079. Generally, teachers felt principals were reasonably prepared to lead the implementation of the CCSSM.

Finding two. Less than half of the principals felt confident in leading professional development in mathematics.

Five of 11 principals reported that mathematics was a personal strength. PSD1S2, PSD3S1 and PUD3S2 all reported that mathematics was a strength and they were rated the highest in terms of teacher perception. Each was also confident in their ability to lead professional development. Both principals from SD2 were certified to teach secondary mathematics and both reported that mathematics was a strength. PSD2S1 had the fourth highest

perception rating at 3.9079, but the staff had the second lowest post-CCSSM PMTE. The perception of PSD2S2 to lead the CCSSM was last of 11 at 3.3913. SD2S2 had a post-CCSSM PMTE ranking that was seventh of 11.

Neither PSD2S1 nor PSD2S2 led professional development in the building. Both rely on a building level mathematics specialist to lead professional development. PSD2S1 believed that he could lead professional development if he knew the purpose and intended outcomes (PSD2S1, personal communication, April 2, 2014), PSD2S2 reported that while mathematics is a strength, time did not allow her to be an instructional leader in all subjects, and the structure in the district enabled her to rely on the building mathematics specialist (PSD2S2, personal communication, May 7, 2014).

Finding three. There is a moderate relationship between teacher perception of principal leadership and PMTE for the CCSSM.

A Pearson correlation test found significance at $p < .01$ indicating a moderate relationship between teacher perception of principal efficacy and teacher perception on PMTE for the CCSSM (Table 22). The three schools that rated their principals above a four also had PMTE for the CCSSM ratings in the top five of school mean values. Teacher perception of principal efficacy for PSD1S2 was the highest at 4.4773 while SD1S2 had the second highest rating in PMTE for the CCSSM at 3.9688. PSD3S1 had the second highest rating in terms of perception of principal efficacy at 4.2500, and her school had the third highest rating in PMTE for the CCSSM at 3.9531. Teacher perception of principal efficacy of PUD3S2 was the third highest with a rating of 4.1667, and her school had a PMTE for the CCSSM that ranked fifth at 3.8056. UD3S2 was the only school whose PMTE increased from CCSSM to PMTE for the CCSSM.

Finding four. The relationship between high perception of principal leadership for CCSSM and high teacher efficacy was not consistent.

Schools that ranked high in terms of perception of principal efficacy did not necessarily rank high in terms of PMTE for the CCSSM. The perception of PSD2S1 was fourth at 3.9079, but ranked tenth of 11 in terms of PMTE for the CCSSM. The perception of PUD2S1 was sixth at 3.8000, but ranked eleventh of 11 in terms of PMTE for the CCSSM. The perception of PSD2S2 was the lowest at 3.3913, but ranked seventh of 11 in terms PMTE for the CCSSM. Finally, the top ranked school in terms of PMTE for the CCSSM was SD3S2, but was ranked seventh in terms of teacher perception of principal leadership.

Research Question Four

Do building leaders' perception of the role of central office support influence his/her sense of self-efficacy for instructional leadership in the implementation of the Common Core State Standards in Mathematics?

Finding one. All principals in the study reported that central office offered a range of resources to support the implementation of the CCSSM.

The support was typically in terms of material resources such as texts and manipulatives. Besides materials, support also consisted of extra time and pay for teacher collaboration, consultants, and coaches. All districts provided support through outside consultancy. Some districts used teachers who were considered highly effective as coaches for their colleagues. Summer work to align CCSSM with texts was also noted.

Only UD3 did not use a new common core aligned text. They used the modules developed by the State Education Department. In this case, there was an inconsistent approach between the schools from the same district. One had an outside consultant providing teachers

with embedded professional development and internal coach support. The other had after school opportunities with support from the coaches, but not the same opportunity to study and understand the standards.

Finding two. Despite support offered by central office, few principals saw themselves as the instructional leader for CCSSM. While all principals reported that central office provided the necessary support for the implementation of the CCSSM, six of 11 principals reported that mathematics was not a strength for them, and that they were not confident in leading professional development.

In some cases, central office offered support that replaced principals as instructional leaders. Support through coaches and specialists often allowed principals to relinquish their role as instructional leader. This was not always the case. PSD1S2 was a lead for professional development in mathematics in her district. PSD3S1 was part of a network team in the district that received direct instruction in CCSSM in order to turnkey the training to staff. PUD3S2 often led professional development and she worked alongside her teachers when they were involved in the embedded professional development.

Conclusions

One conclusion that can be drawn from this study is that the implementation of the CCSSM has increased the need for high efficacy for teachers in the instruction of mathematics. The data indicates that its implementation has resulted in a decrease in teacher confidence in their ability to teach mathematics as measured by PMTE. The data showed a decrease for both urban and suburban teachers, but a larger decrease for suburban teachers. There was also an increase in teachers with a low sense of self-efficacy.

Another conclusion from this study is that teachers do not necessarily equate confidence in their ability to teach mathematics with expectations that their students will be successful in mathematics. The data show urban teachers at a mean PMTE of 3.92 and suburban teachers at a mean PMTE of 4.08 with a 4.0 defining highly efficacious. Beliefs that their abilities to affect student outcome as measured by MTOE was a 3.39 for urban teachers and a 3.33 for suburban teachers. Not only did suburban teachers experience a greater decrease in PMTE with the implementation of the CCSSM, they also have lower sense of being able to impact student learning.

This study supports the conclusion that the CCSSM has increased outcome expectancy for students. Data shows that while only 8.2% of all teachers in the study had a high level of MTOE, 50% felt that the CCSSM would enable students to reach a deeper level of understanding in mathematics.

This study concludes that while most teachers report changing their practice as a result of the implementation of the CCSSM, there are large gaps in teachers' knowledge of the CCSSM for effective implementation. The quantitative data shows that most teachers have had to change their practice in mathematics instruction as a result of the implementation of the CCSSM. Data also shows that in eight of 11 schools, less than 75% of the teachers have read the complete standards for their grade levels.

This study also concludes that teachers rely on a text book rather than mathematical knowledge to teach mathematics. Qualitative data from principals' interviews support the quantitative data regarding teacher reported knowledge of the CCSSM and change. Principals agree with teachers' perceptions that changes in instruction are occurring, but see the changes as

happening more slowly and in isolated pockets. There continues to be a reliance on a text series to drive instruction.

According to this study, the type of professional development that teachers receive, and who delivers the professional development plays a role in teacher self-efficacy. Three principals felt mathematics was a personal strength and led professional development. Teachers from these three schools perceived their principals as highly efficacious. Two additional principals reported mathematics as a strength. Both were certified as mathematics teachers, but neither led professional development. One was perceived as highly efficacious and the other was not. Teachers from schools that do not perceive leadership as highly efficacious do not necessarily report lower levels of self-efficacy. Two of the three schools that had outside consultants lead all of their professional development rated themselves in the bottom three in PMTE for the CCSSM.

Another conclusion that can be drawn from this study is that central office does offer support for the implementation of the CCSSM. Qualitative data found that the support was typically in terms of text books and professional development, but seldom in terms of increasing principal efficacy for leadership in the CCSSM.

Recommendations for Policy Makers

The data from this study reveals a continued reliance on text books instead of teacher efficacy in the teaching of mathematics. State Education Departments (SED) must partner with leaders from higher education, business and school districts to create programs that equip teachers and principals with a high sense of efficacy. In nine of 12 schools in this study, 38 to 75 percent of teachers had not read the complete set of mathematics standards for their grade level. Only three of 12 principals felt confident in leading professional development in mathematics.

An important focus of Race to the Top has been on the evaluation systems of teachers and principals. While these systems may prove effective in identifying strengths and areas of growth, they may not necessarily support the needed capacity building for improvement. This study has shown that the implementation of the CCSSM has led to a lower sense of teachers' self-efficacy for teaching mathematics and a gap in self-reported knowledge of the CCSSM. Funding must be made available to increase efficacy and capacity through increased knowledge of the CCSSM. While this study reported the shortfalls of current teachers using the CCSSM, there must also be a focus on pre-service teachers training.

Higher education must design undergraduate and graduate programs for pre-service teachers that require coursework specific to the content and pedagogical demands of the CCSSM. The data from the study show the continued reliance on a text book instead of personal mastery in mathematics to drive instruction. To end the reliance on text books as the mathematical authority, a mastery of mathematical practices and a thorough understanding of the mathematics continuum through algebra should be a requirement for all elementary teachers.

The study examined the importance of principal knowledge and the leadership role in professional development. Leadership programs for principals must focus on instructional leadership and address adult learning theory, collective efficacy, and change theory. Based on data from this study, programs should not assume content and pedagogical mastery.

The current elementary system is built for generalists, teachers who are expected to teach all of the core subjects. Consideration should be given to a complete overhaul of certification requirements with a minimum of a minor in one of the core areas with specific expectations in learning the CCSSM, and a redesign to have specialists delivering instruction at all levels of

schooling. The demands of the CCSSM will continue to affect teacher self-efficacy, and in turn the implementation of the initiative.

Recommendations for Systems Leaders

Raising teacher efficacy requires attention to the four major sources that support personal efficacy (Bandura, 1997). These sources include: (a) performance accomplishments, (b) vicarious experiences, (c) verbal persuasion, and (d) emotional arousal**.** Several recommendations can be made to raise mathematics efficacy for teachers and principals.

System leadership should provide for professional development to increase teacher efficacy by focusing on mastery of content knowledge and pedagogical changes in the instructional practices necessary to implement the CCSSM. Performance accomplishments are most dramatically strengthened through personal mastery. Teacher knowledge and understanding of mathematics should drive instruction, but text books will continue to drive instruction until teachers become highly efficacious.

Outcome expectations are an important piece of efficacy. System leadership should also provide professional development on connecting one's ability to student outcomes. The work of Dweck (2006) can be the starting point for that work. Teachers must believe that their instruction can affect student achievement regardless of external influences.

The range in reported efficacy indicates the widely varying needs of teachers. Delivery of professional development through embedded coaching is necessary to sustain the work (Showers & Joyce, 1996). Efforts must be made to improve the reported levels of teacher self-efficacy. System leadership should consider differentiated support for teachers that includes embedded professional development that allows practitioners to work alongside experts to combine content

knowledge and pedagogy within the context of the work. Work in a social context supports the value of collective efficacy as well as personal efficacy.

System leadership should provide professional development to raise principals' efficacy to lead professional development in CCSSM, and create structures to provide that leadership. Data from this study showed that the three principals who felt mathematics was a strength and led professional development for their staff were perceived as highly efficacious and also had teachers who rated themselves as highly efficacious.

It is unrealistic to expect principals to be experts in each of the core subjects (mathematics, English language arts, science and social studies), but having expertise in one of them may prove valuable in leading professional development. Structures that promote teacher leadership in these areas, including using teachers as coaches, should be supported. Central office support in building principals' efficacy, and support of collective efficacy through teacher leadership, should be a goal.

Recommendations for Future Studies

Studies that add to the body of qualitative and mixed method studies should be added to the body of research on teacher and principal efficacy (Klassen, Tze, Betts, & Gordon (2011). While the nature of this mixed method study added to the findings and conclusions, little was learned about the details of instructional changes and increased demands of the CCSSM from teachers' perspectives. Studies that broaden the scope to include interviews with teachers should be considered.

A mixed method or qualitative study that focuses on increasing efficacy by examining the connection between high principal efficacy and principals' delivery of professional development could reshape the types of support principals receive to become instructional leaders. A

qualitative study that examines the effect of low outcome expectations on student achievement and teachers' overall efficacy would inform the field on the importance of teachers with a growth mindset. An examination of the greater decline in efficacy for suburban teachers versus urban teachers is warranted.

Only UD3S2 showed an increased in efficacy with the implementation of the CCSSM. Current research supports embedded professional development. A closer examination of embedded professional development combined with principal leadership of professional development is warranted. Results from these studies could guide the future direction of professional development for both teachers and principals.

References

Achieve [PARCC Consortium]. (2010). Retrieved from http://www.achieve.org/

Adams, C.M. & Forsyth, P.B. (2006). Proximate sources of collective teacher efficacy. *Journal of Educational Administration, 44*, 625-642.

Alberti, S. (2012). Making the shifts. *Educational Leadership, 70*(4), 24 – 27.

Armor, D., Conroy-Oseguera, P., Cox, M., King, N., McDonell, L., Pascal, A., Dauly, E., & Zellman, G. (1976). *Analysis of the preferred reading programs in selected Los Angelos minority schools* (Report No. R-2007-LAUSD). Santa Monica, CA: Rand Corporation.

Ashton, P.T., & Webb, R.B. (1986). *Making a difference: Teachers' sense of efficacy and student achievement*. New York, NY: Longman.

Augustine, C.H., Gonzales, G., Ikemoto, G.S., Russell, J., Zellman, G.L., Constant, L.,... Dembosky, J.W. (2009). *Improving school leadership: The promise of cohesive leadership systems.* Santa Monica, CA: RAND Education.

Ball, D.L., & Cohen, D.K. (1999). Developing practice, developing practitioners: Toward a practice-based theory of professional education. In L. Darling-Hammond & G. Sykes (Eds.), *Teaching as the learning profession: Handbook of policy and practice* (pp. 3-32). San Francisco, CA: Jossey-Bass.

Ball, D.L., Hill, H.C., & Bass, H. (2005) Knowing mathematics for teaching: Who knows mathematics well enough to teach third grade, and how can we decide? *American Educator, 29*(1), 14-17, 20-22, 43-46.

Ball, D. L., Thames, M. H., & Phelps, G. (2008). Content knowledge for teaching: What makes it so special? *Journal of Teacher Education, 59*(5), 389–407.

Bambrick-Santoyo, P. (2012). *Leverage leadership: A practical guide to building exceptional schools.* San Francisco, CA: Jossey-Bass, An Imprint of John Wiley & Sons.

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review, 84*(2), 191-215.

Bandura, A. (1993). Perceived self-efficacy in cognitive development and functioning. *Educational Psychologist, 28,* 117-148.

Bandura, A. (1997). *Self-efficacy: The exercise of control.* New York: Freeman.

Barker, B. (2006). Rethinking leadership and change: A case study in leadership succession and its impact on school transformation. *Cambridge Journal of Education, 36* (2), 277-293.

Barnes, C.A., Camburn, E., Sanders, B. R., & Sebastian, J. (2010). Developing instructional leaders: Using mixed methods to explore the black box of planned change in principals' professional practice. *Educational Administrative Quarterly, 46(2),* 241-279.

Battista, M. (1999). The mathematical miseducation of America's youth. *Phi Delta Kappan, 80*(6), 424-433.

Berman, P., McLaughlin, M., Bass, G., Pauly, E., & Zellman, G. (1977). *Federal Programs Supporting Educational Change: Vol. 7. Factors Affecting Implementation and Continuation*. Santa Monica, CA: RAND.

Beswick, K. (2009). Teachers' beliefs about school mathematics and mathematicians' mathematics and their relationship to practice. *Educational Studies in Mathematics, 79*, 127–147, DOI 10.1007/s10649-011-9333-2

Bitter, G.G. & Hatfield, M.M. (1994). Training elementary mathematics teachers using interactive multimedia. *Educational Studies in Mathematics, 26*(4), 405-409.

Boaler, J. (1999). Participation, knowledge and beliefs: A community perspective on mathematics learning. *Educational Studies in Mathematics, 40*(3), 259-281. doi: 10.1023/A:1003880012282

Boatright, B. & Gallucci, C. (2008). The "studio residency": A job-embedded coaching model. *Washington State Kappan, 2*(1), 28-36.

Bridges, W. (2009). *Managing transitions: Making the most of change*. Philadelphia: Da Capo Press.

Burns, M. (2012). Go figure: Math and the common core. *Educational Leadership, 70*(4), 42-46.

Camburn, E., Rowan, B. & Taylor, J.E. (2003). Distributed Leadership in schools: The case of elementary schools adopting comprehensive school reform models. *Educational Evaluation and Policy Analysis, 25*, 347-373.

Carpenter, T.P., Hiebert, J., Fennema, E., & Fuson, K. C. (1997). *Making sense: Teaching and learning mathematics with understanding.* Portsmouth, NH: Heinemann.

City, E., Elmore, R., Fiarman, S., & Teitle, L. (2009). *Instructional rounds in education: A network approach to improving teaching and learning.* Cambridge, MA: Harvard Education Press.

Cochran-Smith, M. & Lytle, S.L. (1999). Relationships of knowledge and practice: Teacher learning in community. *Review of Research in Education, 24,* 249-305. Washington, DC: American Educational Research Association.

Cohen, D.K. & Hill, H.C. (2001). *Learning policy: When state education reform works.* New Haven, CT: Yale University Press.

Common Core State Standards Initiative (2010). Retrieved on June 1, 2014 from http://www.corestandards.org/other-resources/key-shifts-in-mathematics/

Common Core State Standards Initiative (2010). Retrieved on July 18, 2014 from http://www.corestandards.org/standards-in-your-state/

Copland, M. (2003). Leadership of inquiry: Building and sustaining capacity for school improvement. *Education Evaluation and Policy Analysis 25*(4), 375-395.

Cresswell, J. (2012). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research*. Boston: Pearson Education, Inc.

Creswell, J. (2009). *Research design: Qualitative, quantitative, and mixed methods approaches*. Thousand Oaks, CA: SAGE Publications, Inc.

Council of Chief State School Officers, (2008). *Educational Leadership Policy Standards: 2008*. Washington, DC: Author.

Darling-Hammond, L., & Ball, D. L. (2004). *Teaching for high standards: What policy makers need to know and be able to do* (CPRE Joint Series Report No. JRE-04). Philadelphia: CPRE Publications, University of Pennsylvania. Retrieved from http://www.nctaf.org/documents/teaching-high-standards.pdf

Davis, S., Darling-Hammond, L., LaPointe, M. & Meyerson, D. (2005). *School leadership study: Developing successful principals (Review of research).* Palo Alto, CA: Stanford University, Stanford Educational Leadership Institute.

Desimone, L.M., Smith, T., Baker, D., & Ueno, K. (2005). Assessing barriers to the reform of US mathematics instruction from an international perspective. *American Educational Research Journal 42*(3), 501-535.

Desimone, L.M., Porter, A.C., Garet, M.S., Yoon, S., & Birman, B.F. (2002). Effects of professional development on teachers' instruction: Results from a three-year longitudinal study, *Educational Evaluation and Policy Analysis 24* (2), 81-112.

Dobbs, R. et al. (2012). The world at work: Jobs, pay, and skills for 3.5 billion people. Retrieved from http://www. mckinsey.com/mgi on March 23, 2014

DuFour, R. & Fullan, M. (2013). *Cultures built to last: Systemic PLCs at work.* Bloomington, IN: Solution Tree Press.

DuFour, R. & Marzano, R.J. (2011). *Leaders of learners: How district, school, and classroom leaders improve student achievement.* Bloomington, IN: Solution Tree Press.

Dweck, C. S. (2006). *Mindset: The new psychology of success*. New York, NY: Random House.

EngageNY (2010). *Pedagogical Shifts demanded by the Common Core State Standards* Retrieved on July 7, 2014 from https://www.engageny.org/resource/ common-core-shifts

Enochs, L. G., Smith, P. L., & Huniker, D. (2000). Establishing factorial validity of the mathematics teaching efficacy beliefs instrument. *School Science and Mathematics, 100,* 194-202.

Fielding, M., Bragg, S., Craig, J., Cunningham, I., Eraut, M., Gillinson, S., Horne, M., Robinson, C., & Thorp, J. (2005). *Factors influencing the transfer of good practice.* London: Department for Education and Skills.

Fink, E. & Resnick, L.B. (2001). Developing principals as instructional leaders. *Phi Delta Kappan, 82*(8), 598–606.

Franke, M.L., & Kazemi, E. (2001). Learning to teach mathematics: Developing a focus on students' mathematical thinking. *Theory into Practice, 40,* 102-109.

Fullan, M. (2008). *The six secrets of change: What the best leaders do to help their organizations survive and thrive.* San Francisco: Jossey-Bass.

Fullan, M. (1991). *The new meaning of educational change.* New York: Teachers College Press.

Gallucci, C., & Swanson, J. (2008). *Aiming high: Leadership for district-wide instructional improvement: A partnership between the Center for Educational Leadership and Norwalk-La Mirada Unified School District, interim research report and case summary.* Seattle, WA: University at Washington, Center for the Study of Teaching and Policy,

Gibson, S. & Dembo, M.H. (1984). Teacher efficacy: A construct validation. *Journal of Educational Psychology, 76*(4), 569- 582.

Goddard, R.D., Hoy, W.K., & Woolfolk Hoy, A. (2000). Collective teacher efficacy: It's meaning, measure, and impact on student achievement. *American Educational Research Journal, 37*, 479-507.

Grant, S.G., Peterson, P.L.,& Shojgreen-Downer, A. (1996). Learning to teach mathematics in the context of systematic reform. *American Educational Research Journal*, 33, 509-541.

Guskey, T. (2003). *What makes professional development effective?* Phi Delta Kappan, 90(7), 495-499.

Guskey, T. (1987). Context variables that affect measures of teacher efficacy. *Journal of Educational Research, 81*(1), 41-47.

Guskey, T. (1981). Measurement of responsibility teachers assume for academic successes and failures in the classroom. *Journal of Teacher Education, 32*, 44-51.

Hallinger, P., & Heck, R. (1996). Reassessing the principal's role in school effectiveness: A review of empirical research, 1980–1995. *Educational Administration Quarterly, 32*(1), 5-44.

Hallinger, P. (2003). Leading educational change: Reflections on the practice of instructional and transformational leadership. *Cambridge Journal of Education, 33*(3), 329-352.

Hargreaves, A. and D. Shirley. 2009. *The Fourth Way: The Inspiring Future of Educational Change.* Thousand Oaks, CA: Corwin Press

Hemphill, C., & Nauer, K. (2010) *Managing by the Numbers: Empowerment and Accountability in New York City's Schools.* New York: Center for New York City Affairs, Milano the New School for Management and Urban Policy.

Herrera, T.A. & Owens, D.T. (2001). The "new new math"?: Two reform movements in mathematics education. *Theory into Practice, 40*(2), 84-92.

Hill, H.C., Rowan, B., & Ball, D.L. (2005). Effects of teachers' mathematical knowledge for teaching on student achievement, *American Educational Research Journal, 42*(2), 371-406.

Honig, M. (2012). District central office leadership as teaching: How central office administrators support principals' development as instructional leaders. *Educational Administrative Quarterly, 48*(4), 733-774.

Honig, M., Copland, M., Rainey, L., Lorton, J., & Newton, M. (2010). *Central office transformation for district-wide teaching and learning improvement.* Seattle: University at Washington, Center for the Study of Teaching and Policy.

Honig, M., & Rainey, L.R. (2012). *Central office leadership in principal professional learning communities: The practice beneath the policy.* Seattle: University at Washington, Center for the Study of Teaching and Policy.

Hubbard, L., Mehan, H., & Stein, M.K. (2006). *Reform as learning: When school reform collides with school culture and community politics.* New York, NY: Routledge.

Institute of Education Sciences National Center for Education Statistics (2013). Program for International Student Assessment (PISA) Results. Retrieved on November 14, 2013 from http://nces.ed.gov/surveys/pisa/pisa2012/pisa2012highlights_1.asp

Jerald, C. (2012). *Leading for effective teaching: Toolkit for supporting principal success*. Seattle: University at Washington, Center for the Study of Teaching and Policy.

Katz, S., & Earl, L. (2010). Learning about networked learning communities. *School Effectiveness and School Improvement 21*(1), 27–51.

Klassen, R.M., Tze, V.M.C., Betts, S.M. & Gordon, K.A. (2011). Teacher efficacy research (1998-2009): Signs of progress or unfulfilled promise? *Educational Psychology Review, 23*, 21-43.

Knoll, E., Ernest, P., & Morgan, S. (2004). Experiencing research practice in pure mathematics in a teacher training context. In M. J. Hoines & A. B. Fuglestad (Eds.), *Proceedings of the 28th annual conference of the International Group for the Psychology of Mathematics Education* (pp. 161–168). Bergen: Bergen University College.

Kotter, J.P. (2002). *The heart of change: Real-life stories of how people change their organizations.* Boston: Harvard Business Review Press.

Leithwood, K., Anderson, S. E., & Louis, K. (2012). Principal efficacy: District-led professional development. In K. Leithwood & K.S. Louis (eds.), *Linking Leadership to Student Learning,* (pp. 119-141). San Francisco, CA: Josey-Bass.

Leithwood, K., & Jantzi, D. (2008). Linking leadership to student learning: The contributions of leader efficacy. *Educational Administration Quarterly, 44*(4), 496-528. doi:10.1177/0013161X08321501

Leithwood, K., Louis, K.S., Anderson, S., & Wahlstrom, K. (2004). *How leadership influences student learning*. Minneapolis, MN: University of Minnesota, Center for Applied Research and Educational Improvement.

Little, J.W. (1993). Teachers' professional development in a climate of educational reform. *Educational Evaluation and Policy Analysis, 15*(2), 129-151.

Louis, K., Leithwood, K., Wahlstrom, K., & Anderson, S. (2010). *Learning from Leadership: Investigating the Links to Improved Student Learning.* New York: The Wallace Foundation. (Available at http://www.wallacefoundation.org/Pages/default.aspx)

Ma, L. (1999). *Knowing and teaching elementary mathematics.* Mahwah, NJ: Lawrence Erlbaum Associates, Publishers.

Marks, H.M., & Printy, S. M. (2003). Principal leadership and school performance: An integration of transformational and instructional leadership. *Educational Administration Quarterly, 39*(3), 370-397.

Marzano (2003). *What works in schools: Translating research into action.* Alexandria, VA: Association for Supervision and Curriculum Development.

Martin-Kniep, G. (2008). *Communities that learn, lead, and last: Building and sustaining educational expertise.* San Francisco, CA: Jossey-Bass.

McGee, J.R. (2012). Developing and validating a new instrument to measure the self-efficacy of elementary mathematics teachers. (Doctoral dissertation). Available from ProQuest LLC. (UMI 3510218)

McKnight, C. (1987). *The underachieving curriculum: Assessing U.S. school mathematics from an international perspective.* Champaign, IL: Stipes Publishing.

Miles, M. B., Huberman, A.M., & Saldana, J. (2014). *Qualitative data analysis: A methods sourcebook.* Thousand Oaks, CA: SAGE Publications, Inc.

Mishook, J., McAlister, S., & Edge, K. (2011). *Peer networks in school reform: Lessons from England and implications for the United States.* Providence, RI: Annenburg Institute for School Reform, Brown University.

Mulholland, J., & Wallace, J. (2001). Teacher induction and elementary science teaching: Enhancing self-efficacy. *Teaching and Teacher Education, 17*, 243–261.

National Center for Educational Statistics (2012). Highlights from TIMMS 2011. Retrieved on February 7, 2014 from nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2013009

National Council of Teachers of Mathematics. (1980). *An agenda for action: Recommendations for school mathematics of the 1980s.* Reston, VA: Author.

National Council of Teachers of Mathematics. (1989). *Curriculum and evaluation standards for school mathematics.* Reston, VA: Author.

National Council of Teachers of Mathematics. (1991). *Professional standards for teaching mathematics*. Reston, VA: Author.

National Council of Teachers of Mathematics. (1995). *Assessment standards for school mathematics.* Reston, VA: Author.

National Council of Teachers of Mathematics. (2000). *Curriculum and evaluation standards for school mathematics.* Reston, VA: Author.

National Research Council (2001). *Adding it up: Helping children learn mathematics.* J. Kilpatrick, J. Swafford, and B. Findell (Eds.) Mathematics Learning Study Committee, Center for Education, Division of Behavioral and Social sciences and Education, Washington, DC: National Academy Press.

National Research Council (1989). *Everybody counts: A report to the nation on the future of mathematics Education.* Washington, DC: Authors.

NYSED (2008). News release on November 1, 2008. Retrieved from http://www.oms.nysed.gov/press/ CommMillsAnnouncesResignation.htm

NYSED (2009). News release on December 14, 2009. Retrieved from http://www.oms.nysed.gov/press/AgendaforEducationReform.html

NYSED (2010). Race to the Top: The Regents Education Reform Plan and New York State's Race to the Top (RTTT) application. Retrieved from http://usny.nysed.gov/rttt/application/summary.html

NYSED (2010). Memo from John King on December 30, 2010. Retrieved from http://www.regents.nysed.gov/meetings/2011Meetings/January2011/111p12swa1.html

NYSED (2012). Definition of proficiency**.** http://www.p12.nysed.gov/irs/ela-math/2012/2012-MathDefinitionsofPerformanceLevels.pdf.

NYSED (2012).https://reportcards.nysed.gov/

NYSED (2013). Diagnostic tool for school and district effectiveness. http://www.p12.nysed.gov/accountability/diagnostic-tool-institute/documents/DTSDEHandbook-SupportDocuments.pdf

NYSED (2013). News release on August 7, 2013. http://www.oms.nysed.gov/press/grades-3-8-assessment-results-2013.html

Peterson, P.E., Woessmann, L., Hanushek, E.A. & Lastra- Anadón, C.X. (2011). *Globally challenged: Are U. S. students ready to compete?* Retrieved from hks.harvard.edu/pepg on March 23, 2014

Printy, S.M. (2008). Leadership for teacher learning: A community of practice perspective. *Educational Administration Quarterly*, *44*(2), 187-226.

Provasnik, S., Kastberg, D., Ferraro, D., Lemanski, N., Roey, S., & Jenkins, F. (2012). Highlights from TIMSS 2011: Mathematics and Science Achievement of U.S. Fourth- and Eighth-Grade Students in an International Context. In *Trends in Math and Science Study (TIMSS)* (NCES No. 2013-009). Retrieved from U.S. Department of Education Institute of Education Sciences website:http://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=20130019

Raptis, H., & Baxter, L. (2006). Analysis of an abandoned reform initiative: The case of mathematics in British Columbia. *Canadian Journal of Educational Administration and Policy, 49*,

Robelen, E. (2012). Global data for reading, STEM to renew debate on U.S. standing. *Retrieved from http://blogs.edweek.org/edweek/curriculum/2012/12 /brace_yourself_for_a_fresh.html*

Rose, J. S., & Medway, F. J. (1981). Measurement of teachers' beliefs in their control over student outcome. *Journal of Educational Research, 74*(3), 185-189.

Ross, J., & Hogaboum-Gray, A., & McDougall, D. (2002). Research in reform in mathematics education, 1993-2000. *Alberta Journal of Educational Research, 48*(2), 122-138.

Rotter, J.B. (1966). Generalized expectancies for internal versus external control of reinforcement. *Psychological Monographs, 80*, 1-28.

Schein, E. H. *Organizational culture and leadership* (4th ed.). San Francisco: Josey Bass, 2010.

Schmidt, W. H. & Houang, R.T. (2012). Curricular coherence and the common core state standards for mathematics. *Educational Researcher, 41,* 294-308. DOI: 10.3102/0013189X12464517

Showers, B. & Joyce, B. (2002). Designing training and peer coaching: Our needs for learning. VA: ASCD.

Smith, J.P. (1996). Efficacy and teaching math by telling: A challenge for reform. *Journal for Research in Mathematics Education, 27*(4), 387-402.

Smith, J. P. (1996). Efficacy and teaching mathematics by telling: A challenge for reform. *Journal for Research in Mathematics Education, 27(4),* 387-402.

Spillane (2000). Cognition and policy implementation: District policymakers and the reform of mathematics education. *Cognition and Instruction, 18*(2), 141-179.

Stigler, J.W. & Hiebert, J. (1999). *The teaching gap: Best ideas from the world's teachers for improving education in the classroom.* New York: Free Press.

Supovitz, J. A., & Poglinco, S. M. (2001). *Instructional leadership in standards based reform.* Philadelphia: Consortium for Policy Research in Education.

Supovitz, J., & May, H. (2011). The scope of principal efforts to improve instruction. *Educational Administrative Quarterly, 47*(2), 332-352.

Supovitz, J., Sirinides, P., & May, H. (2010). How principals and peers influence teaching and learning. *Educational Administration Quarterly 46*(1), 31-56.

Tschannen-Moran, M., Woolfolk Hoy, A., & Hoy, W. K. (1998). Teacher efficacy: Its meaning and measure. *Review of Educational Research, 68,* 202-248.

Trading Economics (2013). http://www.tradingeconomics.com/united-states/gdp. Retrieved on March 23, 2014

United States Department of Education (2012). Statement by U.S. Secretary of Education Arne Duncan on the Release of the 2011 TIMSS and PIRLS Assessments. https://www.ed.gov/news/press-releases/statement-us-secretary-education-arne-duncan-release-2011

Valverde, G., & Schmidt, W. (1997-1998). Refocusing U.S. Math and Science Education, *Issues in Science and Technology,* 1-6.

Vinson, B.M. (2001). A comparison of preservice teachers' mathematics anxiety before and after a methods class emphasizing manipulatives. Early Childhood Education Journal, 29(2), 89-94. Doi: 10.1023/A:1012568711257

Wahlstrom, K., & Louis, K. (2008). How teachers experience principal leadership: The roles of professional community, trust, efficacy, and shared responsibility. *Educational Administration Quarterly 44*(4), 458-495. doi:10.1177/0013161X08321502

Waters, J. T., Marzano, R.J., & McNulty, B.A. (2003). *Balanced leadership: What 30 years of research tells us about the effect of leadership on student achievement*. Aurora, CO: Mid-continent Research for Education in Learning.

Williams, H.S. (2009). Leadership capacity: A key to sustaining lasting improvement. *Education*, *130*(1), 30 – 41.

Woolfolk, A.E., & Hoy, W.K (1990). Prospective teachers' sense of efficacy and beliefs about control. *Journal of Educational Psychology 82*(1), 81-91.

Wu, H. (1996). The mathematician and the mathematics education reform. *Notices from the American Mathematics Society, 43,* 1531-1537.

Zambo, R., & Zambo, D. (2008). The impact of professional development in mathematics on teachers' individual and collective efficacy: The stigma of underperforming. *Teacher Education Quarterly*, 159-168.

Appendix A

October 6, 2013

Dear Dr. Enochs:

I am a doctoral student at Sage College in Albany, NY and the Instructional Leadership Director at the City School District of Albany. I have long been interested in the teaching of elementary mathematics. As a thirteen-year elementary teacher and twelve-year elementary administrator, I have observed a wide range of abilities in delivering instruction for student understanding. I understand that self-efficacy plays an important role and that a number of variables affect this sense of efficacy.

With the recent NYS adoption of the Common Core State Standards, it is timely to investigate teacher readiness for the change. I am beginning work on my dissertation and would like permission to use the MTEBI with modifications. While I believe that many solutions will be found in changes to pre-service training, my questions are specific to in-service elementary teachers' ability to implement the new curriculum. I will look at both teacher and school leader self-efficacy, and teacher perceptions of school leader support.

I thank you in advance for your consideration.

Sincerely,

Kenneth A. Lein

Date : Sun, Oct 06, 2013 08:44 PM EDT
From : **LARRYENOCHS <enochsl@onid.orst.edu>**
To : Kenneth Lein <leink@sage.edu>
Subject : **Re: MTEBI**

Certainly you may use instrument.

Larry G Enochs
Professor Emeritus
Science and Mathematics Education
231 Weniger Hall
Oregon State University
Corvallis, OR 97331
541-829-4777
enochsl@onid.orst.edu

Appendix B

Mathematics Teaching Efficacy Beliefs Instrument (MTEBI) with Modifications

Please indicate the degree to which you agree or disagree with each statement below by circling the appropriate letters to the right of each statement.

SA	A	UN	D	SD
Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree

1. When a student does better than usual in mathematics, it is often because the teacher exerted a little extra effort.	SA	A	UN	D	SD
2. I continually find better ways to teach mathematics.	SA	A	UN	D	SD
3. Even if I try really hard, I do not teach mathematics as well as I do most subjects.	SA	A	UN	D	SD
4. When the mathematics grades of students improve, it is often due to the teacher having found a more effective teaching approach.	SA	A	UN	D	SD
5. I know how to teach mathematics concepts effectively.	SA	A	UN	D	SD
6. I am very effective in monitoring mathematics activities.	SA	A	UN	D	SD
7. If students are underachieving in mathematics, it is most likely due to ineffective mathematics teaching.	SA	A	UN	D	SD
8. I generally teach mathematics ineffectively.	SA	A	UN	D	SD
9. The inadequacy of a student's mathematics background can be overcome by good teaching.	SA	A	UN	D	SD
10. When a low-achieving child progresses in mathematics, it is usually due to extra attention given by the teacher.	SA	A	UN	D	SD
11. I understand mathematics concepts well enough to be effective in teaching elementary mathematics.	SA	A	UN	D	SD
12. The teacher is generally responsible for the achievement of students in mathematics.	SA	A	UN	D	SD
13. Students' achievement in mathematics is directly related to their teacher's effectiveness in mathematics teaching.	SA	A	UN	D	SD
14. If parents comment that students are showing more	SA	A	UN	D	SD

interest in mathematics at school, it is probably due to the performance of the child's teacher.

15. I find it difficult to use manipulatives to explain to students why mathematics works.	SA	A	UN	D	SD
16. I am typically able to answer student questions about mathematics.	SA	A	UN	D	SD
17. I wonder if I have the necessary skills to teach mathematics.	SA	A	UN	D	SD
18. Given the choice, I do not invite the principal in to evaluate my mathematics teaching.	SA	A	UN	D	SD
19. When a student has difficulty understanding a mathematics concept, I am usually at a loss as to how to help the student understand it better.	SA	A	UN	D	SD
20. When teaching mathematics, I usually welcome student questions.	SA	A	UN	D	SD
21. I do not know how to turn students on to mathematics.	SA	A	UN	D	SD
22. I have read the complete CCSS in mathematics for my grade level.	SA	A	UN	D	SD
23. I have not changed my approach to teaching mathematics due to the CCSS.	SA	A	UN	D	SD
24. My principal is knowledgeable in mathematics.	SA	A	UN	D	SD
25. I understand the progressions in the CCSS in mathematics from the grade below me to the grade level above me.	SA	A	UN	D	SD
26. My principal understands the shifts in the CCSS in mathematics to effectively support my needs.	SA	A	UN	D	SD
27. I use the mathematical standards of practice from the CCSS to guide my instruction.	SA	A	UN	D	SD
28. I understand the shifts in CCSS instruction well enough to teach mathematics effectively.	SA	A	UN	D	SD
29. My principal has not provided me with the necessary supports to teach the CCSS effectively.	SA	A	UN	D	SD
30. I have the necessary skills to teach mathematics using CCSS.	SA	A	UN	D	SD

31. The CCSS in mathematics allow me to teach less topics to a deeper, more rigorous level.	SA	A	UN	D	SD
32. I do not know how to use the CCSS in mathematics to teach for deeper understanding	SA	A	UN	D	SD
33. The principal has led professional development to prepare me to teach the CCSS effectively.	SA	A	UN	D	SD
34. Using the CCSS will allow students to reach a deeper understanding of mathematics.	SA	A	UN	D	SD

Appendix C

Principal Interview Questions

1. How well prepared are your teachers to implement the Common Core State Standards in mathematics (CCSSM)? What changes in instructional practice have you observed?
2. Do you consider mathematics to be a personal strength? How well do you understand the changes in the standards? Are you confident in leading professional development in CCSSM?
3. What has central office done to support the shift to CCSSM? Can you describe the change effort to accomplish this shift? What do you believe are the strengths and weaknesses in your district's approach to implementing the CCSSM?

Appendix D

Teacher Demographic Questionnaire

1. What is your gender? Male ___ Female ___
2. Type of district? Suburban ___ Urban ___
3. Your current grade level? K–2 ___ 3–6 ___
4. Total years at this level? 0-5 ___ 6-10 ___ 11-15 ___
   16-20 ___ 21+ ___
5. Total years teaching? 0-5 ___ 6-10 ___ 11-15 ___
   16-20 ___ 21+ ___
6. College mathematics? (Check all that apply)

   Statistics ___ Pre-calculus ___ Calculus I ___

   Calculus II ___ Calculus III ___ Linear Algebra ___

   Differential equations ___ Other _____
7. Teacher certifications? (Check all that apply)

   Elementary N-6 ___ Elementary B-2 ___ Special Education ___

   Reading ___ Mathematics 7-9 (ext) ___ Mathematics 7-12 ___

   Other _____

Identifier _____

Appendix E

Principal Demographic Questionnaire

1. What is your gender? Male ___ Female ___
2. Type of district? Suburban ___ Urban ___
3. Total years teaching? 0-5 ___ 6-10 ___ 11-15 ___
   16-20 ___ 21+ ___
4. Years as elementary principal? 0-5 ___ 6-10 ___ 11-15 ___
   16-20 ___ 21+ ___
5. College mathematics? (Check all that apply)
   Statistics ___ Pre-calculus ___ Calculus I ___
   Calculus II ___ Calculus III ___ Linear Algebra ___
   Differential equations ___ Other _____
6. Teacher certifications? (Check all that apply)
   Elementary N-6 ___ Elementary B-2 ___ Special Education ___
   Reading ___ Mathematics 7-9 (ext) ___ Mathematics 7-12 ___
   Other _____

Identifier _____

Appendix F

Interview/Research Question Matrix

Research Question Two: What are teachers' perceptions of their own knowledge of the CCSSM and changes in instructional practices in teaching mathematics due to the adoption of the CCSSM, and principals' perceptions of teachers' readiness for implementation? **Related Interview Question:** How well prepared are your teachers to implement the Common Core State Standards in mathematics (CCSSM)? What changes in instructional practice have you observed?
Research Question Three: Is there a relationship between teachers' perceptions of the efficacy of their principals' mathematics leadership for the implementation of the CCSSM and teachers' sense of self-efficacy in teaching Common Core mathematics? **Related Interview Question:** Do you consider mathematics to be a personal strength? How well do you understand the changes in the standards? Are you confident in leading professional development in CCSSM?
Research Question Four: Do building leaders' perception of the role of central office support influence his/her sense of self-efficacy for instructional leadership in the implementation of the Common Core State Standards in Mathematics? **Related Interview Question:** What has central office done to support the shift to CCSSM? Can you describe the change effort to accomplish this shift? What do you believe are the strengths and weaknesses in your district's approach to implementing the CCSSM?

Appendix G

February 17, 2014

Dear Superintendent:

My name is Ken Lein and I am a doctoral candidate in the Educational Leadership program at the Sage Colleges in Albany, New York. The purpose of my study is to examine teacher and principal efficacy to implement the Common Core State Standards in Mathematics.

I am asking for permission to arrange faculty participation through two of your principals. I will be requesting approximately fifteen to twenty minutes at a faculty meeting to administer a survey to K-6 faculty who teach mathematics. The thirty-four question survey is a modification of the Mathematics Teacher Efficacy Belief Instrument (MTEBI) that includes questions specific to the Common Core State Standards in Mathematics. Responses to the survey will be important to the research that I will am conducting this spring. Demographic information will be collected for the analysis of the data.

I will also ask the two principals to participate in individual interviews at their convenience. The interviews will each last approximately thirty minutes. I will be clear to all staff that participation in this study is voluntary and will not be shared with anyone in any way that identifies them as individuals, and only aggregate data will be presented in the final report. Any summary findings will be available to any respondent upon request.

If you have any questions regarding the nature or scope of this study, please feel free to contact me at any of the following numbers: (w) 518-475-6062; (h) 518-452-1544 and/or (c) 518-810-2637. This research has received the approval of the Sage Colleges Institutional Review Board,

which functions to ensure the protection of the rights of human participants. If you have any complaints about this study, please feel free to contact Dr. Esther Haskvitz, Dean of Sage Graduate School at 518-244-2264. Thank you in advance for your consideration of this request.

Sincerely,

Kenneth A. Lein

Appendix H

Informed Consent Form Cover Letter

Dear Principal,

I am a doctoral candidate at Sage College of Albany in the Educational Leadership Program. I am conducting research to analyze the effect of mathematics efficacy on the implementation of the Common Core State Standards in mathematics (CCSSM) in selected school districts in the Capital Region of New York State. Your participation involves an interview. The interview will consist of questions regarding your beliefs in your own capability to lead mathematics reform and your experience with your school district's support for the implementation of these new standards.

Participation in the interview will be voluntary and you may withdraw at any time. If you choose not to participate or to withdraw from the study, you may do so without penalty or loss of benefit to yourself. There is minimal risk involved with this study based on the subject matter that is being investigated and your position in the school district. The researcher will take all precautions to maintain the confidentiality of all participants.

The benefit of your participation is the addition to the literature in the areas of both mathematics efficacy and the implementation of the CCSSM.

If you have any questions concerning the research study, please e-mail me at leink@sage.edu. In addition, if you have any concerns about this research, please feel free to contact my doctoral chairperson. Her name is Dr. Janice White, Assistant Professor, Sage Colleges. Her e-mail address is whitej5@sage.edu.

All results of the research will be made available in a summary format to the school leaders involved in the study and will be presented at the Sage College Doctoral Colloquium in the fall of 2014.

Please sign the attached consent form, and return it to me in the self-addressed stamped envelope. Thank you for your time.

Sincerely,

Kenneth A. Lein
Doctoral Student
Sage Graduate School

Appendix I

Informed Consent Form Cover Letter

Dear Educator,

I am a doctoral candidate at Sage College of Albany in the Educational Leadership Program. I am conducting research to analyze the effect of mathematics efficacy on the implementation of the Common Core State Standards in mathematics (CCSSM) in selected school districts in the Capital Region of New York State. Your participation involves completing a survey. The survey will consist of questions regarding your beliefs in your own capability to teach mathematics and your perception of principal leadership and support in the implementation of CCSSM.

Participation in the survey will be voluntary and you may withdraw at any time. If you choose not to participate or to withdraw from the study, you may do so without penalty or loss of benefit to yourself. There is minimal risk involved with this study based on the subject matter that is being investigated and your position in the school district. The researcher will take all precautions to maintain the confidentiality of all participants.

The benefit of your participation is the addition to the literature in the areas of mathematics efficacy and in the implementation of the CCSSM.

If you have any questions concerning the research study, please e-mail me at leink@sage.edu. In addition, if you have any concerns about this research, please feel free to contact my doctoral chairperson. Her name is Dr. Janice White, Assistant Professor, Sage Colleges. Her e-mail address is whitej5@sage.edu.

All results of the research will be made available in a summary format to the school leaders involved in the study and will be presented at the Sage College Doctoral Colloquium in the fall of 2014.

Please sign the attached consent form, and place it in the envelope. Surveys will be placed in a separate envelope. I appreciate your time.

Sincerely,

Kenneth A. Lein
Doctoral Student
Sage Graduate School

Appendix J

Informed Consent Form

To: _____

You are being asked to participate in a research project entitled: **THE INFLUENCE OF THE COMMON CORE STATE STANDARDS IN MATHEMATICS ON MATHEMATICS SELF-EFFICACY: A MIXED METHOD APPROACH**

This research is being conducted by:

- Principal Investigator: Dr. Janice White
- Student Investigator: Kenneth A. Lein

The purpose of this mixed-methods study is to analyze the effect of teacher and principal mathematics efficacy on the implementation of the Common Core State Standards in mathematics (CCSSM) from twelve schools within the Capital Region of New York State. The methods of inquiry include data elicited from twelve personal interviews with principals, and surveys from approximately 250 teachers from those same schools.

Research Questions

1. Has there been a change in teachers' sense of efficacy in mathematics instruction as a result of the adoption of the Common Core State Standards in Mathematics (CCSSM)?
2. What changes have the CCSSM brought to teacher instruction?
3. Is a teacher's sense of efficacy around the adoption of the CCSSM affected by his/her perceived level of building leader efficacy in mathematics?
4. Is a building leader's sense of efficacy around instructional leadership for the shift to the CCSSM affected by his/her perceived level of central office support?

As part of the research, the student investigator has selected you for a 30 minute interview so that he can investigate the impact of the implementation of the CCSSM on you and your district. The interviews will be audio taped using a digital recorder to help the researcher create an accurate account of the conversation. The recordings will not be used in public. The researcher will only share the recordings with an approved transcriber and your identity will be kept confidential. All digital recordings will be erased after the research is completed.

Please place your initials here to indicate your permission.

_____

The benefit of your participation is that your input for this project will add to the literature in the area of the implementation of the CCSS in mathematics.

There is minimal risk involved with this study based upon your position in the district, and the subject matter that is being investigated. Participation in the interview will be voluntary. The researcher will take all precautions to maintain the confidentiality of all participants. The interview, and the information received from your school district, will be confidential. All interviews will be coded using pseudonyms by the researcher. This interview is voluntary and you can opt out at any time without penalty by the researcher or your school district.

I understand that I may at any time during the course of this study revoke my consent and withdraw from the study without any penalty.

I have been given an opportunity to read and keep a copy of this consent form and to ask questions concerning the study. Any such questions have been answered to my full and complete satisfaction.

I, _____, having full capacity to consent, do hereby volunteer to participate in this research study.

Signed: _____

Research participant: This research has received the approval of The Sage Colleges Institutional Review Board, which functions to insure the protection of the rights of human subjects. If you, as a participant, have any complaints about this study, please contact:

Dr. Esther Haskvitz, Dean
Sage Graduate Schools
School of Health Sciences
65 First Street
Troy, New York 12180
518-244-2264
haskve@sage.edu

Appendix K

Informed Consent Form

To: _____

You are being asked to participate in a research project entitled: **THE INFLUENCE OF THE COMMON CORE STATE STANDARDS IN MATHEMATICS ON MATHEMATICS SELF-EFFICACY: A MIXED METHOD APPROACH**

This research is being conducted by:

- Principal Investigator: Dr. Janice White
- Student Investigator: Kenneth A. Lein

The purpose of this mixed-methods study is to analyze the effect of teacher and principal mathematics efficacy on the implementation of the Common Core State Standards in mathematics (CCSSM) from twelve schools within the Capital Region of New York State. The methods of inquiry include data elicited from twelve personal interviews with principals, and surveys from approximately 250 teachers from those same schools.

Research Questions

1. Has there been a change in teachers' sense of efficacy in mathematics instruction as a result of the adoption of the Common Core State Standards in Mathematics (CCSSM)?
2. What changes have the CCSSM brought to teacher instruction?
3. Is a teacher's sense of efficacy around the adoption of the CCSSM affected by his/her perceived level of building leader efficacy in mathematics?
4. Is a building leader's sense of efficacy around instructional leadership for the shift to the CCSSM affected by his/her perceived level of central office support?

As part of the research, the student investigator has selected you to complete a survey so that he can analyze the impact of teacher efficacy in mathematics on the implementation of the CCSSM. There is minimal risk involved with this study based upon your position in the district, and the subject matter that is being investigated. This survey is voluntary and you can opt out at any time. The researcher will take all precautions to maintain the confidentiality of all participants.

The benefit of your participation is that your input for this project will add to the literature in the area of teacher efficacy and on the implementation of the CCSS in mathematics.

I understand that I may at any time during the course of this study revoke my consent and withdraw from the study without any penalty.

I have been given an opportunity to read and keep a copy of this consent form and to ask questions concerning the study. Any such questions have been answered to my full and complete satisfaction.

I, _____, having full capacity to consent, do hereby volunteer to participate in this research study.

Signed: _____

Research participant: This research has received the approval of The Sage Colleges Institutional Review Board, which functions to insure the protection of the rights of human subjects. If you, as a participant, have any complaints about this study, please contact:

Dr. Esther Haskvitz, Dean
Sage Graduate Schools
School of Health Sciences
65 First Street
Troy, New York 12180
518-244-2264
haskve@sage.edu

Appendix L

Confidentiality Agreement

I, Susan Dvorin individually agree to maintain full confidentiality in regards to any and all audiotapes, videotapes, and/or oral or written documentation received from Kenneth A. Lein related to the research project entitled:

THE INFLUENCE OF THE COMMON CORE STATE STANDARDS IN MATHEMATICS ON MATHEMATICS SELF-EFFICACY: A MIXED METHOD APPROACH

The information in these tapes and/or documentation has been revealed by those who participated in this research project with the understanding that their information would remain strictly confidential. I understand I have the responsibility to honor this confidentiality agreement.
Furthermore:

1. I will follow the established protocol for my role in the project.
2. I will not share any information in these tapes and/or documents with anyone except the researchers listed on this form.
3. I will hold in strictest confidence the identification of any individual who may be revealed in these tapes and/or documents.
4. I will not disclose any information received for profit, gain or otherwise.
5. I will not make copies of the audiotapes, videotapes, and/or oral or written documentation, unless specifically requested to do so by Kenneth A. Lein.
6. I will store audiotapes, videotapes, and/or oral or written documentation in a safe, secure location as long as they are in my possession.
7. I will return all materials; including audiotapes, videotapes, and/or oral or written documentation; to Kenneth A. Lein within the mutually agreed upon time frame.
8. I will return all electronic computer devices to the researchers at the end of the project. I will not save any data provided to me in any format, electronic or otherwise.

Any violation of this agreement would constitute a serious breach of ethical standards and I pledge not to do so. I am also aware I am legally liable for any breach of confidentiality agreement, and for any harm incurred by individuals if I disclose identifiable information contained in the audiotapes, videotapes, and/or oral or written documentation to which I have access.

Printed name: Susan Dvorin

Signature _____

Title and/or affiliation with the researchers: Transcriber Date: _____

Appendix M

Knowledge of the CCSSM

Table M1

Knowledge of CCSSM: A Comparison of Means and Standard Deviations in Rank Order by School

School	*n*	Mean	SD
SD3S2	5	4.2800	.67231
SD1S1	17	4.0235	.43521
SD1S2	12	4.0167	.37618
SD3S1	8	4.0000	.50143
UD3S2	9	3.7778	.55176
UD1S1	22	3.7182	.59732
UD3S1	19	3.6316	.53025
SD2S2	23	3.6087	.63383
UD1S2	11	3.5091	.85024
SD2S1	19	3.4105	.63060
UD2S1	16	3.3875	.52393
Total	161	3.6981	.61119

Table M2

Knowledge of CCSSM: Percentages at High Levels of Efficacy in Rank Order

	I22	I25	I27	I28	I30
School	% (*n*)	% (*n*)	% (*n*)	% (*n*)	% (*n*)
SD3S2	100% (5)	66.7% (4)	100% (6)	100% (6)	100% (6)
SD1S1	88.2% (15)	76.5% (13)	94.1% (15)	100% (17)	94.1% (16)
SD1S2	75.0% (9)	63.6% (7)	91.7% (11)	83.3% (10)	91.7% (11)
SD3S1	62.5% (5)	87.5% (7)	100% (8)	87.5% (7)	100% (8)
UD3S2	66.7% (6)	66.7% (6)	88.9% (8)	77.8% (7)	77.8% (7)
UD1S1	63.6% (14)	63.6% (14)	81.8% (18)	72.7% (16)	63.6% (14)
UD3S1	63.2% (12)	63.2% (12)	89.5% (17)	68.4% (13)	63.2% (12)
SD2S2	56.5% (13)	56.5% (13)	73.9% (17)	82.6% (19)	82.6% (19)
UD1S2	54.5% (6)	72.7% (8)	54.5% (6)	63.6% (7)	72.7% (8)
SD2S1	52.6% (10)	47.4% (9)	63.2% (12)	52.6% (10)	68.4% (13)
UD2S1	25.0% (4)	50.0% (8)	81.3% (13)	62.5% (10)	75.0% (12)

Appendix N

Change in Practice

Table N1

Change in Practice Due to the Implementation of the CCSSM in Rank Order by School

School	N	Mean	SD
SD1S2	12	4.50	.522
UD3S2	9	4.33	.500
UD3S1	19	4.16	.834
SD3S2	8	4.13	.354
UD2S1	16	4.06	.772
SD1S1	17	4.06	.748
SD2S2	23	4.00	.953
UD1S2	11	3.91	.944
SD2S1	19	3.84	.898
SD3S1	6	3.83	1.169
UD1S1	22	3.82	.853

Appendix O

Principal Leadership

Table O1

Teacher Perception of Principals' Leadership for the CCSSM

	I24	I26	I29	I33
School	Mean	Mean	Mean	Mean
UD1S1	3.55	3.82	4.00	2.95
UD1S2	3.45	3.55	3.91	3.09
UD2S1	4.00	4.06	3.94	3.20
UD3S1	3.84	3.79	3.53	2.63
UD3S2	4.33	3.67	4.33	4.33
SD1S1	3.76	3.88	4.29	3.47
SD1S2	4.82	4.42	4.42	4.08
SD2S1	4.58	4.11	3.95	3.00
SD2S2	3.52	3.35	3.70	3.00
SD3S1	4.25	4.25	4.38	4.13
SD3S2	3.67	3.83	3.67	4.00
Totals	3.93	3.85	3.97	3.27