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Evaluating the Implementation Process of a New Math Program: Math in Focus

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by

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Dr. Stephen Sherblom, Dissertation Chair — 4-15-16 Date

Dr. Kevin Winslow, Committee Member — 4/15/16 Date

Dr. Nadine Menninga, Committee Member — 4-15-16 Date

Declaration of Originality

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

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Abstract

Mathematics is an indispensable skill. Mathematical reasoning occurs when a person is taught the basic foundations during the elementary school years. With the pressures following implementation of Common Core State Standards and Race to the Top, school districts are tried not only to raise their state test scores, but also to prepare, strengthen, and empower educators to feel confident in their ability to instruct mathematics effectively. The Singapore approach to teaching math was the innovative program that created higher math scores in school districts in the United States. The country of Singapore, after developing this approach became the world's leader in math scores. As more school districts attempt to use a Singapore math-type approach, the secrets of success for its implementation are important. Math in Focus is the authentic Singapore curriculum. This study attempted to document which aspects that encompassed implementing this new program worked most effectively by utilizing a mixed-method approach. This study documented and analyzed professional development training and collaborative teacher planning. The teachers in this study had five professional development workshops and met weekly for collaboration. Additionally, state testing scores were analyzed for the academic school years 2011-2012, 2012-2013, and 2013-2014.

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Chapter One: Introduction

Background of Mathematics

The United States lagged behind other countries in mathematics when tested in compulsory education (Organisation for Economic Co-operation and Development [OECD], 2013a, p. 8). In 2012, the U.S. once again performed below average. The Program for International Student Assessment (PISA) completed an assessment in 2012 with 510,000 students. This assessment was administered to 15-year-old students in 65 countries. One hundred and sixty-one schools in the U.S. participated. Of those 161 schools, 6,000 students were chosen randomly to participate (OECD, p. 8).

> Students in the United States have particular weaknesses in performing mathematics tasks with higher cognitive demands, such as taking real-world situations, translating them into mathematical terms, and interpreting mathematical aspects in real-world problems. An alignment study between the Common Core State Standards for Mathematics and PISA suggests that a successful implementation of the Common Core Standards would yield significant performance gains also in PISA. (OECD, 2013a, p. 3)

With the adoption and successful implementation of Common Core State Standards (CCSS), Missouri would be able to assist in the accession of the mean scores for the U.S. This could allow the U.S. to surpass other countries that outperform the country in mathematics, particularly in higher cognitive demands and real-world problems. This study was conducted during the first year of implementation of CCSS. Common Core was not a mandated curriculum for school districts, but allowed teachers a set of standards regarding concepts to provide and teach at specific grade levels. These

standards assisted in the math curriculum for the implementation of Math in Focus. The standards allowed teachers to deepen the understanding of concepts for all students. The students' thinking and reasoning were emphasized to allow them to see that there were several different ways to conceive, determine, and calculate a mathematical problem. There were different approaches that could be utilized to come up with the same solution.

On February 17, 2009, President Obama signed into law The American Recovery and Reinvestment Act (USDOE, n.d.a). As stated by the U.S. Department of Education (USDOE, n.d.a), this Act was created to help the U.S. with the declining economy. One of the measures of the Act was to expand educational opportunities. The expansion was known as the Race to the Top Assessment Program. As stated by the USDOE (n.d.b), Race to the Top provided funding to consortia of states for the establishment of assessments that were valid and showed evidence of instruction. These assessments must show accurate information on what students know and what they can do. The assessments measured student achievement against standards designed to guarantee that students gained the knowledge and skills needed in order to be successful in college and in the workplace. The data from the assessments helped educators with information to continuously improve teaching and learning. President Obama's goal was for the nation to be the world's leader in college graduates by 2020 (USDOE, n.d.b).

As stated from the USDOE (2011), Race to the Top entailed a total budget of $350 million dollars of federal grant funding for the improvement and alignment of the new assessment systems. The new assessments system was aligned with CCSS and was broken up into two consortia assessments, Smarter Balanced Assessment Consortium (SBAC) and Partnership for Assessment of Readiness for College and Careers (PARCC)

(USDOE, 2011, p. 1). As reported by the USDOE (n.d.b, p. 1), Race to the Top requested participating states to improve reform around four specific areas. The first area was to adopt the new standards and consortia assessment that would develop students who to be successful in college and in the workplace. This would allow them to be globally competitive. The second was to build data systems that analyzed student growth from year-to-year. This data would communicate knowledge to administrators and educators on how they could enhance instruction. The third was to enlist, develop, compensate, and maintain educators and administrators. The final area was to recover low-achieving schools (USDOE, n.d.b.).

Race to the Top required the adoption of one of the two consortia assessments with the adoption of Common Core. The state of Missouri adopted SBAC. The state of Missouri adopted the Common Core Standards on June 10, 2010. Missouri was required to fully implement the standards in the 2014-2015 school year (National Governors Association Center for Best Practices [NGACBP], 2010c). CCSS entailed school districts to reevaluate their current curriculum and adapt or adopt new curriculum to adhere to the new CCSS. Math in Focus, along with the school district's new curriculum, was the first step in aligning with the CCSS.

PISA administered its test haphazardly to schools in different countries. The test was given to students between the ages of 15 years 3 months and 16 years 2 months (OECD, 2013b). This range in age requirement must fall on the testing date. PISA did not test students in a specific year of schooling, but rather a specific age. The school and students chosen for the test came from a broad range of backgrounds and abilities (OECD, 2013b).

The U.S. scored below the mean in the PISA math performance in 2012 (OECD, 2013a, p. 7). PISA showed that Singapore was second in its performance in mathematics in 2012, with a mean score of 573. Shanghai, China, had the highest mean of 613. The U.S. was 36th in performance with a mean score of 481 (OECD, 2013a, p. 7). A total of 65 countries were represented in this performance for mathematics with an Organisation for Economic Co-operation and Development (OECD, 2013a) mean of 494. Math in Focus was an authentic Singapore math curriculum brought to U.S. classrooms. Math in Focus addressed problem solving and the creation of positive attitudes toward mathematics. While doing so, Math in Focus emphasized student development of skills, concepts being taught, processes for math, and metacognition. Students were encouraged to become reflective on their math reasoning and also to internalize their learning, so they could apply these skills to different problem solving activities (Cavendish, 2013, p. 1).

Purpose of the Dissertation

The purposes of this study were: (a) to document the implementation processes of a new math program, Math in Focus, with concentration on the fourth grade at Rams Elementary School (pseudonym) for the 2014-2015 academic school year; (b) to evaluate third grade secondary data from Rams Elementary School for the previous academic school year, 2013-2014; and lastly, to evaluate third, fourth, and fifth grade secondary data from Cardinal Elementary School (pseudonym) from the previous academic school years, 2011-2012; 2012-2013; and 2013-2014. Both elementary schools were in the Blue School District (pseudonym). The purpose was to evaluate whether students receiving the studied math program, Math in Focus, were making improvements relative to district

and state averages. The secondary data examined were the Missouri Assessment Program (MAP) scores from the previous school years.

Rams Elementary School adopted and implemented Math in Focus in the 2013-2014 school year for kindergarten, first, second, and third grades only. Fourth and fifth grades adopted and implemented Math in Focus in the 2014-2015 school year; hence this study documented the first year of implementation of a new program with concentration on fourth grade at Rams Elementary School. The Principal Investigator was a fourth grade math teacher (among other subjects) and the Grade Level Chair. According to Blue School District, the Grade Level Chair qualifications included holding an appropriate Missouri teacher's certificate and having sufficient interpersonal skills to coordinate the professional efforts of co-workers within the department and communicate with administrators at the secondary schools. The Principal Investigator documented the implementation part of this research through her own teaching experiences and the experiences of the other three fourth-grade teachers who agreed to participate as a group. This included documenting professional development training for Math in Focus, interviewing teachers regarding their knowledge of and perspective on this approach to teaching math, taking notes on weekly common planning sessions as they grappled with implementation, and follow-up interviews regarding professional development and teachers' experiences through the first year of implementing Math in Focus. Additional interviews with a teacher from the third and fifth grades at Rams Elementary School were utilized to confirm that the training and implementation were the same at these grade levels. When the implementation data (benefits and challenges) were collected for the fourth grade, input from representatives of third and fifth grade were sought for

comparison. Information about the implementation of Math in Focus at Cardinal Elementary School was reported by the Elementary Math Coordinator of the Blue School District, since she oversaw the original implementation and met regularly with school personnel regarding implementation. Cardinal Elementary School piloted Math in Focus for the 2011-2012, 2012-2013, and 2013-2014 school years.

While the schools may have been different enough from each other that a direct comparison between them was not advisable, the program being implemented was the same, so results from the data analysis were used as a second and more adequate sample of secondary data looking for student improvement following participation in Math in Focus. The two schools compared had different socioeconomic status. According to Missouri Department of Elementary and Secondary Education (MODESE, n.d.c., p. 1) Rams Elementary was 10.9% in 2011-2012, 10.2% in 2012-2013, and 10.4% in 2013-2014 in Title 1 funding, which is the percentage of students on free and reduced lunch. MODESE (n.d.c., p. 1) also reported the percentage of free and reduced lunch for Cardinal Elementary in 2011-2012 was 40.1%, 44.1% in 2012-2013, and 42.9% in 2013-2014. MODESE (n.d.b., p. 1) reported the averages for Blue School District in 2011-2012 was 21.0%, 22.7% in 2012-2013, and 22.7% in 2013-2014.

Analysis focused on evidence of improvement for each implemented academic, year relative to district and state averages. Since both schools were in the same district, the training and implementation at Cardinal Elementary School were the same as Rams Elementary School.

Additionally, MAP data from Rams Elementary School was examined from the third grade mathematics MAP scores for the 2013-2014 academic school year. Analysis

of the Rams Elementary School data looked provided potential evidence of improvement relative to district and state averages, after one year of implementation of Math in Focus.

Rationale

In December 2013, the OECD, creator of the PISA, released its findings for the year 2012. PISA was an international survey that evaluated educational systems around the world. The survey tested the knowledge of 15-year-old students from countries all over the world (OECD, 2013a). This survey was only conducted every three years. The assessments were unique, because they did not follow school curriculums. The assessment questions checked to see if 15-year-olds could apply their learned knowledge to real-life situations (OECD, 2013a).

As reported by OECD (2013a, pp. 1-2), the U.S. overall performance was below average in mathematics in the PISA 2012 results. Weaknesses in math included the category of higher cognitive reasoning, or translating and interpreting complex, real life situations. Twenty-six percent of the students tested scored below the PISA baseline level 2, which was proficient (OECD, 2013a, p. 1). This percentage has remained consistent since 2003. Level 2 is where 15-year-olds were able to reveal mathematical skills that would allow them to be efficient in life. Shanghai, China and Singapore had 10% or less of their students performing below the baseline level 2 (OECD, 2013a, p. 1). Pisa also categorized the top performers in mathematics. The U.S. was below-average for this category. The U.S. only had 2% of its 15-year-olds reach the highest level, which was level 6. Shanghai, China, had 55.4% and Singapore had 40% of their students place at level 6 (OECD, 2013a, p. 7).

Cavanagh (2012) echoed the 2012 results in her article, *U.S. Education Pressured by International Comparisons,* quoting the U.S. President,

> It is an undeniable fact that countries who out educate us today are going to outcompete us tomorrow. If we are serious about building an economy that lasts—an economy in which hard work pays off with the opportunity for solid middle-class jobs—we have got to get serious about education. (Obama, as cited in Cavanagh, 2012, p. 7)

According to PISA 2012, the U.S. was below average in mathematics. Thirty-five countries outscored the U.S. in mathematics (as cited in OECD, 2013a, p. 7). In order to keep the U.S. economy strong and middle-class jobs abundant in the country, the U.S. would need to advance students relative to the 35 leading countries that scored higher.

Research Questions and Hypotheses

The research project was guided by the following research questions:

RQ_1: What can we learn about an American elementary schools making a transition to Singapore math (in the form of Math in Focus) by following a grade-level team for the school year as they implement the program?

RQ_2: Did the professional development on Math in Focus prepare the teachers for implementation of the new program?

RQ_3: What was the teacher attitude and perception of Math in Focus?

The secondary data was analyzed using the following hypotheses:

H_1: The MAP scores at Cardinal Elementary School will improve relative to district and state averages over the time periods research 2011-2012, 2012-2013, and 2013-2014.

H_2: The MAP scores at Rams Elementary School will improve relative to district and state averages over the 2013-2014 academic year.

Limitations

The generalizability of the results of this study could be limited, because a program for change was mandated by Blue School District. Rams Elementary School and Cardinal Elementary School had a new academic improvement program, Collaborative Work, which was part of a grant from MODESE (district superintendent, personal communication, July 2014).

MODESE (n.d.a., p. 1) explained the purpose of the Collaborative Work Grant was to improve learning for all students, especially students with disabilities, and to improve teaching by having productive and efficient collaborative teams. Collaborative Work must be implemented, like most new programs, with fidelity. Collaborative Work should utilize a variety of teaching methods and different ways to assess learning (MODESE, (n.d.a.). These decisions should be based on data collected from the students' assessments. Collaborative Work required common formative assessments originated and administered to all students (MODESE (n.d.a.). These common formative assessments, at the study site, were administered to validate and achieve student mastery of a specific learning objective.

Another school improvement program, the Leader in Me, was in its second year of implementation at Rams Elementary School. "The Leader in Me is an innovative, school-wide model that increases teacher effectiveness, student engagement, and academic achievement, while preparing students to be leaders in the 21st century" (The Leader in Me, n.d.a., p. 1). Teachers at Rams Elementary School were required to learn

how to build Leadership Notebooks for each student in their classrooms. The leadership notebooks were tools students used to take responsibility for their learning (The Leader in Me, n.d.b). Students kept track of their personal and academic goals and also kept data on their grades. This allowed students to establish and achieve their goals. Teachers helped students set and achieve goals by helping students identify and apply their strengths (The Leader in Me, n.d.b). The use of student-led conferences were also encouraged (The Leader in Me, n.d.b). This created a limitation for teachers, as this was a non-mandated district program requiring extra lesson planning and class time to teach how to set up and maintain the Leadership Notebooks, and many other elementary schools in the Blue School District did not have the added program, the Leader in Me, to maintain along with the implementation of Math in Focus.

Another limitation for this study was mortality caused by the mobility of students from different schools, whether in-district or out-of-district transfers. Fowler-Finn (2001) stated,

> Mobile students experience a greater adjustment time to the peer group, the classroom and the school. In fact, stable students suffer some impact as well. Schools and teachers are forced to develop special strategies to help mobile students get up to date with instruction and to keep stable students interested and moving ahead while others require remedial attention. (p. 36)

Friedman-Krauss and Raver (2015) also added that mobility could undermine math achievement. Continuity in math was based on previous instruction on skills and concepts. A student could be performing well in one school and enter a new school struggling with concepts, because he or she could be behind that school's curriculum (p.

1727). When students moved to new schools, different factors could interfere with their learning. Psychological effects of new friends, new environment, and a new curriculum could create barriers for learning.

An additional limitation was the relatively small sample size. This mixed-methods research was conducted with six elementary school teachers. The quantitative data was collected from two elementary schools. One elementary school, Cardinal Elementary School, piloted Math in Focus in grades three, four, and five for three consecutive years. The second elementary school, Rams Elementary School, implemented Math in Focus for one year, in third grade, which was one of their state-tested grade levels, for purposes of assessment. Quantitative results could have varied if data was collected and analyzed in an urban, suburban, or city school district where student demographics could differ. The six elementary educators who were part of the study also had various experiences in teaching mathematics. The quantitative data could change, depending on the experience or inexperience of the educators.

The final limitation was that student and teacher participants in the quantitative research were not aware that their scores would be part of a research study. Math in Focus was piloted in the 2011-2012, 2012-2013, and 2013-2014 school year in one elementary school, Cardinal Elementary, in the study-site school district. The other elementary school, Rams Elementary, implemented Math in Focus for the 2013-2014 school year. MAP scores from Cardinal Elementary were used for third, fourth, and fifth grades. MAP scores from Rams Elementary were used in third grade only, as fourth and fifth grade had not implemented Math and Focus. Blue School District implemented Math in Focus for fourth and fifth grade during the 2014-2015 school year.

Definition of Terms

Advanced. Demonstrated a thorough understanding of the content area at this grade level (Missouri Department of Elementary and Secondary Education [MODESE], 2014a, p. 8).

Basic. Demonstrated a partial understanding of the content area expected at this grade level (MODESE, 2014a, p. 8).

Below Basic. Did not demonstrate an understanding of the content expected a this grade level (MODESE, 2014a, p. 8)

Common Core. Common Core established grade level expectations. They also established academic skills that high school graduates would need in order to be successful in college and in their careers. Common Core described the knowledge and skills students were expected to develop. This was not the curriculum, as the curriculum stated how to teach the skill. (Common Core State Standard Initiatives, n.d.)

Proficient. Demonstrated an understanding of the content expected at this grade level (MODESE, 2014a, p. 8)

SBAC. "Smarter Balanced Assessment Consortia—to develop assessment systems that will embody the CCSS, focus schools on supporting the deeper learning required for college and career readiness, and help U.S. students become more competitive with those in the highest performing countries" (Herman & Linn, 2014, p. 34).

Show-Me-Standards. The success of Missouri's students depended on both a foundation of knowledge and skills, and the ability to apply knowledge and skills to the kinds of problems and decisions they would likely encounter after they graduated from

high school. The Show-Me Standards served as a blueprint from which local school districts could write challenging curriculum to help all students achieve (MODESE, 2014c).

SIS. (Student Information System) ~ The Student Information System intended to assist districts in managing student data, planning for educational programs, and complying with state and federal reporting requirements. This system would support daily functions at the school/district level (MODESE, n.d.e).

Summary

The Math in Focus implementation process study used a mixed-methods approach, collecting both qualitative and quantitative data. The qualitative data included interviews and notes from common meeting and plan time. The quantitative data included MAP data from one elementary school, which piloted the program for three years. This included MAP scores from third, fourth, and fifth grade students. MAP scores were also analyzed from one elementary school, whose third grade students had one year of Math in Focus. Fourth and fifth grade students' MAP scores were not used in the second elementary school, due to the staggered timeline of the adoption of Math in Focus. Only grades kindergarten, first, second, and third were mandated by the district to implement the program during the 2013-2014 school year. Grades four and five implemented the program the following school year, 2014-2015, which was the year of research for this study, at which time the MAP test had not been administered.

Chapter Two will encapsulate the literature regarding American students versus students in other high performing countries in mathematics, professional development for new programs, teacher collaboration, change, and assessments.

Chapter Two: The Literature Review

Introduction

The U.S. had fallen behind other countries when it came to comparing student knowledge and application skills in math assessments. Cavanagh (2012) stated,

> Many U.S. leaders say that the performance of American students on a handful of high-profile international tests and measurements—while mixed—underscores the weaknesses of the American education system, and foreshadows the serious economic challenges the country will face if it does not improve the skills of its future workforce (p. 6).

Scores on international tests suggested the U.S. was lagging behind other countries academically. The U.S. education system had to make some changes. A report from PISA 2012 (OECD, 2013a, p. 4) stated that the U.S. ranked number three when it came to the monetary economic advantage it had over other countries, in regards to how much it could spend on education. The U.S. spent about $115,000 per student from, the age of 6 to 15. Korea, one of the top performing countries in mathematics, spent below the average per student expenditure (OECD, 2013a, p. 1). Clearly, spending more money was not going to solve the problem for the U.S. The country needed to take lessons from the top performing countries and emulate and exceed their education system methods.

The purpose of this literature review is to inform educators regarding background information necessary to understand this study, including Common Core, the Singaporean approach to math, professional development, and collaborative team planning.

Math Background

There were differing opinions as to why math achievement scores were lagging in the U.S. In the researcher's experience, educators have heard it is due to poor curriculum, inept teachers, uninvolved parents, educational bureaucracy, ineffective administrators, overcrowded schools, and lack of funding, just to name a few. Vigdor (2012) believed,

> The new math movement of the twentieth century - successive reforms have focused attention on bringing lower-performing students up to standards. In the process, the standards have been lowered, and the advancement of higher-performing students has been allowed to languish. Designers of the nation's mathematics curriculum, in short, have fallen into an "achievement-gap trap" raising the relative performance of average students in part by permitting the absolute performance of the best students to decline. (p. 5)

Alberti (2013) stated, "In high-performing countries, the design principle for mathematics education is a deep focus on a few topics with coherent progressions between topics" (p. 26). Sometimes teachers were overwhelmed with the amount of content to be covered within an academic school year. And, for some grade levels, the content needed to be covered before state testing, which allowed less than the full academic school year for content coverage. With so many concepts to cover, the concepts seem to be exposed to students, as opposed to teaching for understanding and mastery. Schmidt and Burroughs (2013) explained,

> The world's highest-achieving nations have three key characteristics: rigor, focus, and coherence. A rigorous curriculum covers topics at the appropriate

> grade level; a focused curriculum concentrates on a few key topics at a time; and a coherent curriculum adheres to the underlying logic of mathematics, moving from simple to more complex topics. (p. 55)

In order for the U.S. to keep up globally in mathematics, a new reform initiative was released. The initiative, the Common Core State Standards Initiatives (CCSS, n.d., p. 1), aligned itself with what Schmidt and Burroughs stated were the three characteristics of other leading countries in mathematics. The first characteristic was a greater focus on fewer topics (CCSS, n.d.). Teachers would now be able to spend more time on fewer topics, which would help students deepen their understanding. The second characteristic was coherence (CCSS, n.d.). This allowed topics to have a progression from one grade level to the next. The students could build new knowledge and understanding from their previous foundational understanding of a math concept, an extension of previous learning. The third characteristic was rigor (CCSS, n.d.). This referred to the depth in which mathematical concepts were taught. Rigor could be taught in progression with conceptual understanding, procedural skills and fluency, and application of the concept.

The National Governors Association Center for Best Practices (NGACBP, 2010a) stated, "all students are prepared for success after graduation, the CCSS establishes a set of clear, consistent guidelines for what students should know and be able to do at each grade level in math" (p. 1). They further explained how the CCSS would impact teachers. The standards allowed teachers to have consistent goals and benchmarks to ensure the students' progression. This would provide consistent expectations for students who may move to districts from out-of-state. Teachers were able to collaborate across

the country with common standards. The CCSS explained to teachers what students should learn. It did not mandate how to teach (NGACBP, 2010b).

Reese (2011) explained the criteria used to create the CCSS. The expectations were aligned with college and career success. The standards were made to be clear and easy to understand and were to be consistent throughout the U.S. They were realistic and applicable for effective use in the classroom. The content was made to be rigorous and utilized applying what the student knew through higher-order skills. They were evidence-and-research-based (Reese, 2011, p. 16). The standards were prepared from information gathered from top performing countries, in order for graduating students to be successful in a global economy. The criteria used in creating the CCSS were threefold: (a) they were aligned with expectations for college and career success; (b) they were clear, understandable, and consistent across all states; and (c) they included rigorous content and the application of knowledge through higher-order skills (Reece, 2011, p. 16).

The adoption of CCSS was aligned with a common state assessment for schools to evaluate student progression towards their goals based on their grade-level standards. The state of Missouri adopted the SBAC. Herman and Linn (2014) stated,

> Smarter Balanced Assessment Consortia has developed an assessment system that will embody the Common Core State Standards, focus schools on supporting the deeper learning required for college and career readiness, and help U.S. students become more competitive with those in the highest performing countries. (Herman & Linn, 2014, p. 34)

Singapore Math

With many school districts trying to improve their math scores, many looked to Singapore, one of the leading countries in international mathematical scores. Cavendish (2013, p. 7) reported that Singapore ranked second in mathematical performance in PISA 2009 and ranked second in Trends in International Math and Science Study in 2007. PISA 2012 (as cited in OECD, 2013a, p. 7) also reported that Singapore ranked second in the PISA 2012 mathematics performance. It was no wonder school districts were trying to emulate the Singapore math approach.

Singapore was an island located in the southeastern portion of Asia. According to the Ministry of Education, Singapore (2014), Singapore's schools begin with Primary Education. Primary Education was the first six years of the schooling. Mathematics was an important foundation piece in the primary education. In relation to mathematics, the main goal of primary education was to help students with their numeracy skills, problem solving skills, and to develop good habits (Ministry of Education, Singapore, 2014). After the students finished their six years in Primary Education, they took an exam called the Primary School Leaving Exam that assisted in placing them into the appropriate secondary school that matched their learning style and learning pace (Ministry of Education, Singapore, 2014). Students could also base their placement into secondary education by looking at their range of achievements and talents through the Direct School Admission exercise. At the secondary level, the students were placed into one of three different tracks: Express Course, Normal Academic Course, and Normal Technical Course. Each track was four years that led to their General Certificate of Education (GCE), which was equivalent to a high school diploma in the U.S. The placement was

dependent on their interests of study and their learning abilities. As of 2013, there were 182 primary schools in Singapore (2014, p. 21).

Singaporean Math continued to dominate math achievement scores worldwide. According to Ezarik (2005), Singaporean Math had many strengths. Students who were struggling with concepts in math were given an alternate framework that allowed them to cover a concept at a slower pace. As the pace was slowed down, repetition was emphasized. Also, Singapore's elementary teachers were required to show evidence of math skills that were more advanced than U.S. teachers, before they could even begin to attend college to become a teacher (Ezarik, 2005). Singapore teachers received at least 100 hours of professional development per year. Schools were also monetarily awarded for growth or progress, measured by their rigorous, challenging tests (Ezarik, 2005). Hoven and Garelick (2007) acknowledged the same sentiments as Ezarik, and that Singapore Math was teacher-driven and was taught at a much slower pace than comparable programs. This allowed teachers to go into much more depth with the math concept taught (Hoven & Garelick, 2007, p. 30). When choosing to adopt Singapore Math, it was important for school districts to find a series that tailored for the U.S. Garelick (2006) explained one of the problems with implementing Singapore math was the manuals provided minimal direction on how to teach the concepts. This was because the Singapore manual was created for Singapore teachers, who already had a good foundation and background on teaching students for a deeper understanding (p. 43).

According to Leinwand and Ginsburg (2007), there were five elements that contributed to Singapore Math. The first element was an organizing framework. Singapore's framework presented a balanced, integrated vision that connected skills,

concepts, processes, attitudes, and metacognition around the focus of mathematical problem solving Leinwand & Ginsburg (2007). The second element was alignment. This allowed each element, which included a framework, common set of national standards, texts, tests, and teacher preparation programs, to be aligned with clear and common goals Leinwand & Ginsburg (2007). The third element was focus. The U.S. had more topics per grade level than Singapore. Singapore covered an average of 15 topics per grade level (p. 34). The U.S. can have an upwards of 50 topics per grade level (Leinwand & Ginsburg, 2007, p. 34). By reducing the number of topics each year, the curriculum could progress at a faster pace. The average number of pages in a Singapore textbook was 496 pages (Leinwand & Ginsburg, p. 34) compared to an average of 729 pages per textbook in the U.S. (Leinwand & Ginsburg, p. 34). Singapore Math focused on fewer lessons per grade level with an emphasis on a mathematical focus or specific concept. The fourth element was multiple models. Singapore math consistently used the same bar or strip model to teach concepts for parts and whole in addition, subtraction, multiplication, and division (Leinwand & Ginsburg). The fifth and final element was rich problems. Singapore Math expected students to complete multi-step problems by using a range of skills and concepts Ginsburg). This broadened and deepened their mathematical understanding. The U.S. tended to use one-step problems that only require recall and routine application (Leinwand & Ginsburg, pp. 33-35). As Leinwand and Ginsburg (2007) added, Singapore math utilized a bar or strip model to teach concepts. In Math in Focus, the term used with students was the *bar model*. The bar model method was a way for students to visualize algebraic word problems. These bar graph diagrams helped students represent known and unknown quantities for word problems. Students

were required to solve for the unknown by looking at the relationship of the numbers on the bar model (Looi & Lim, 2009, p. 358). Looi and Lim (2009) stated,

> It is not easy to move from understanding a word problem to formulating an equation. There are cognitive discontinuities when changing from arithmetic to letter-symbolic algebraic thinking. First, students have to operate with unknowns instead of numbers. Second, there is a difference between procedural and structural views of expressions and equations. Third, the process of solving problems is different. In contrast, it is students' second nature to solve problems by forward calculation (p. 359).

Bar modeling must initially be used to scaffold student meaning-making. Once students acquired the habit of formulating and solving equations, scaffolding should have abated. Teachers should introduce gradually more difficult word problems that could only be solved with unknown variables. By doing so, students would gain the appreciation of the bar model and learn to apply the bar model to previous learning (Looi & Lim, 2009, p. 362). Bar modeling was used to help transition students into unknown problems or algebraic problems. Garelick (2006) concurred with Looi and Lim (2009) by stating that Singapore math heavily focused on problem solving strategies, which was the most challenging for students in math. Bar modeling, drawing a diagram to represent a problem, provided an effective strategy for problem, solving because students had to solve for an unknown or some symbol representation. Bar modeling functioned as a component to algebra, which was the next logical step. The U.S. textbooks taught students to use the guess and check method, which was manipulating the numbers in

different combinations until the correct answer was identified. Many professional mathematicians found this ineffective (Garelick, 2006, p. 42).

Hogan (2004) explained Singapore students covered less topics and go into much more depth of a concept. Number sense and higher order thinking were emphasized in the elementary grades, rather than numerous topics in math. This teaching sequence allowed students to become better problem solvers with more complex problems (p. 22). Garelick (2006) also point out what Hogan (2004) stated

> Singapore's texts also present material in a logical sequence throughout the grades and expect mastery of the material before the move to the next level. In contrast, mainstream American math texts and curricula frequently rely on a "spiral" approach, in which topics are revisited and reviewed. The expectation of that approach is that not all students achieve mastery the first time around. (p. 41).

The U.S. math expectations were that some students would not understand or master a concept in a certain grade. By spiraling the concepts, the students will hopefully grasp the material when revisited in the next grade level. Singapore math continued to teach a concept until the student had the knowledge of the topic. By limiting the number of topics that teachers covered in a grade level, more time could be spent on fewer topics. This would eliminate teaching, just to say you have covered a topic, as opposed to teaching for mastery.

The Singapore approach placed emphasis on conceptual understanding before procedural understanding. Rittle-Johnson, Siegler, & Alibali, (2001) explained the conceptual and procedural knowledge in the following fashion,

> Children's conceptual and procedural knowledge develop iteratively. Rather than development of one type of knowledge strictly preceding development of the other, conceptual and procedural knowledge appear to develop in a hand-over-hand process. Gains in one type of knowledge support increases in the other type, which in turn support increases in the first. One key mechanism underlying these relations is change in problem representation. In the present study amount of improvement in problem representation varied as a function of initial individual differences in conceptual knowledge, and amount of improvement in problem representation predicted individual differences in acquiring procedural knowledge. Furthermore, supporting correct problem representation led to greater gains in procedural knowledge. To understand how knowledge change occurs one must consider the interrelations among conceptual understanding, procedural skill, and problem representation. Carefully analyzing these relations, and using the analysis to inform instruction, can help children learn. (p. 360)

Math in Focus emphasized both procedural and conceptual knowledge. Cavendish (2013) explained that students were taught a pedagogy characterized by a movement from concrete to pictorial to abstract. Concrete pedagogy was using manipulatives that allowed students to see, manipulate, and understand the concept. Pictorial gave the students an opportunity to visually represent a concept by expressing thinking visually on paper. After students demonstrated a firm understanding of the concept concretely and pictorially, they proceeded to abstract pedagogy. Abstract allowed students to use symbols to solve math problems (p. 2).

The country of Singapore was proven to be the leading country in math scores. With so many American school districts, at the time, just adopting the Singaporean approach to math, more research would become available in the future about its effects. The Singapore approach to math focused on fewer topics per grade level, allowing teachers to teach with a deeper understanding. It also emphasized teaching conceptually, then procedurally for math skills. Bar modeling was also practiced to assist with a deeper understanding of problem solving that would serve as an extension into algebraic equations.

Change

Teachers' attitudes and approaches to teaching were important factors when implementing change in education. Hinde (2004) agreed,

> Educational change falters or fails because the change is poorly conceptualized or not clearly demonstrated. It is obvious who will benefit and how. What the change will achieve for students is not spelled out. The change is too broad and ambitious so that teachers have to work on too many fronts, or it is too limited and specific so that little change occurs at all. The change is too fast for people to cope with, or too slow so that they become impatient or bored and move on to something else. The change is poorly resourced or resources are withdrawn once the first flush of innovation is over. There is not enough money for materials or time for teachers to plan. There is no long-term commitment to the change to carry people through the anxiety, frustration and despair of early experimentation and unavoidable setbacks. Key staff who contribute to the change, or might be affected by it, are not committed. Conversely, key staff might become

> overinvolved as an administrative or innovative elite, from which other teachers feel, excluded. Parents oppose the change because they are kept at a distance from it. Leaders are too controlling, too ineffectual, or cash in on the early success of the innovation to move on to higher things. The change is pursued in isolation and gets undermined by other unchanged structures. (p. viii)

Professional development offered by a school district could help clear up any misconceptions that Hinde (2004) explained, regarding how a program could benefit students, the materials provided or not provided, teacher planning time, and unavoidable setbacks. Professional development could also clarify changes to instructional practices. Hochberg and Desimone (2010) asserted that the effect of professional development in regards to instructional practice depended on the teachers' will and skill to change. Research on teacher knowledge and the belief in change suggested that teacher philosophy and efficacy beliefs were important components in the change process when joined with knowledge, a system of learning opportunities, and personal relevance (Hochberg and Desimone, 2010, p. 97). Hochberg and Desimone (2010) also stated that student achievement could not take place without changes in the way that students learn. Improved student learning was based on the ability of teachers to present specific content that students must learn and to accommodate instruction to meet individual students' learning needs (Hochberg & Desimone, 2010, p. 91). As Ezarik (2005) stated, a significant difference in professional development was that Singapore teachers were required to receive at least 100 hours of professional development per year. Blue School District offered the fourth grade teachers at Rams Elementary School approximately 22 hours of professional development the first year of implementation. This included two

full days in June, and three hours each for the months of September, November, and February (math coordinator, personal communication, May 2014).

Math in Focus demonstrated different methods and approaches, concrete to pictorial to abstract, for solutions to a mathematical problem, as previously stated by Cavendish (2013, p. 2). This allowed the students to choose which method of learning best serves the outcome or solution to a mathematical problem.

Teachers struggled with implementing new math curriculum for many reasons. Allen (2011) explained that teachers taught the way they were taught. The new strategies used were not the way the teachers learned their math. Teachers also lacked confidence in the new approach to teaching. Teachers did not feel in control of their lessons. They feared questions may arise that they would be unable to answer or justify (p. 4). It was difficult for teachers to transition from their old ways of teaching math to a new approach of teaching math. Teachers were not comfortable or did not understand the new approach of delivering the lesson effectively. Allen (2011) also stated that the Singapore math approach was much like the constructivist approach. Allowing the students to choose their best way of approaching a mathematical problem, democratic mathematics, will be difficult to take place if the teacher only taught one solution and expected all students to learn concurrently. Students needed to be able to understand the reasoning of the means rather than just the end result. The constructivist approach allowed students to explore which mathematical meaning worked best for them and allowed students to explore and discover their approaches to an answer (p. 4). The constructivist approach once again followed what Cavendish (2013) stated regarding concrete to pictorial to abstract (p. 2).

Little (1993) declared that reforms in subject matter such as the new mathematics standards

> Constitutes a departure from canonical views of curriculum and from textbook-centered or recitation-style teaching. They demand a greater facility among teachers for integrating subject content, and for organizing students' opportunities to learn. They represent, on the whole, a substantial departure from teachers' prior experience, established beliefs, and present practice. Indeed, they hold out an image of conditions of learning for children that their teachers have themselves rarely experienced. (p. 2)

Allen (2011) and Little (1993) agreed that teachers' experiences can affect their teaching approach. Teachers needed to allow new reform to change their approach of teaching mathematics, not allowing the way they were taught to dictate their instruction of lessons. Sherin and Drake (2009) discussed how curriculum adoption could be interpreted differently amongst teachers.

> A set of curriculum materials does not determine the nature of instruction in any straightforward manner. A teacher reads and interprets the materials, and this interpretation depends greatly on what the teacher knows, including his or her knowledge of the subject-matter, and of the teacher's and students' beliefs about instruction. Furthermore, the manner in which the materials are enacted in a classroom depends on many additional factors. For example, the enactment of the curriculum will depend on how students react as teaching proceeds (p. 471).

Change within teachers could be very subjective, especially with the way the material and lessons were presented to students by their teachers. Changing curriculum was one thing,

but having to change the way in which a teacher presented mathematics posed challenges. Teachers were inclined to teach in the manner in which they understood or in the manner with which they were taught. Teaching mathematics differently involved the teacher understanding and embracing the new teaching approach.

Professional Development

Clearly, change could be a difficult transition for teachers. Professional development should be offered through school districts to help alleviate any unknown factors and anxiety that can accompany change. According to Jovanova-Mitkovska (2010), professional development was a continuous process that originated from the inception of teaching and continued until retirement. This progression involved training teachers with new knowledge and strategies in the classroom. It also involved integrating technology. Professional development was imperative for teachers, because it could influence the way teachers prepared for and implemented new educational reform. Professional development also connected teachers with their colleagues, which allowed for meaningful collaboration. The combination created a positive environment for student learning (Jovanova-Mitkovska, 2010). Hochberg and Desimone (2010) believed that professional development was necessary because it equipped teachers with knowledge for basic content, and supported higher order thinking and problem-solving skills. Teachers were then able to meet state standards and improve student achievement.

According to Kramarski and Revach, (2009) math professional development with self-regulated learning (SRL) could assist teachers in planning lessons and helping students achieve higher scores in problem solving scenarios. The SRL method was a method that utilized IMPROVE (introduce new concepts, metacognitive questioning,

practice, review and reduce difficulties, obtain mastery, verify, and enrichment) metacognitive self-questioning. IMPROVE allowed the teacher to introduce new concepts, metacognitive questioning, practice, review and reduce difficulties, obtain mastery, verify, and enrichment. The SRL method advised students to understand when, why, and how to solve problems (Kramarski & Revach, 2009, p. 379). Kramarski and Revach (2009) stated that IMPROVE allowed students a much deeper understanding and knowledge of how to eliminate unnecessary information when they needed to know *when, why*, and *how* questions. By questioning the comprehension, connection, strategy, and reflection, students would develop a mental image or representation that would corroborate their findings or their answer (p. 379).

Jovanova-Mitkovska (2010) agreed with Tunks and Weller (2009) regarding new knowledge and strategies,

> Changing teacher practice typically involves staff development training that emphasizes the presentation of new ideas or techniques for using newly adopted materials. Characteristically, staff development training engages teachers for varying lengths of time, either in monthly meetings sponsored by school districts or grant-based workshops that last from 3 to 4 weeks in the summer. (p. 162)

Ezarik (2005) advised school districts that plan to adopt the Singaporean Math method to

> Be prepared to formally train teachers and let them observe and meet with other teachers using the books. Introduce the books to kindergarten and first-grade students and continue instruction from there; use them over a substantial geographic area so mobile students have a better chance of transferring to schools using the books. Offer weaker students extended instruction time and extra help.

> Ensure that any misalignment between the Singapore textbook and state math frameworks and assessments is addressed in advance. Use the current U.S. edition of Singapore books, which incorporate the English measurement system, U.S. currency and American examples and terminology (p 70).

Professional development should not only be looked at as a means to immerse teachers in the map of the manual or how to teach concepts. Students who struggled to grasp the skills or concepts must also be addressed. Hochberg and Desimone (2010) stated,

> The role of professional development in the accountability system is more complex than simply serving as an input that results in the desired outcome. Instead of simply changing classroom practice and impacting achievement through professional development activities directly, we need to consider the intermediate steps of changing teacher content and pedagogical content knowledge, developing the ability to identify and address student learning needs, and fostering appropriate epistemological and efficacy beliefs relevant to the new practice to be implemented. All of this must occur in a manner that is responsive to different teacher and student characteristics. Further, we need to acknowledge that efforts to impact teacher practice may yield different results depending on contextual factors of the school environment, which may influence teachers' motivation to change as well. (p. 94)

Students who struggled with the ability to grasp concepts needed intervention strategies. Different schools or districts varied with students' abilities to grasp concepts. According to Sherman, Richardson, and Yard (2014) students struggled in math for several reasons. One was the type of instruction they received. Instruction must provide meaningful

questions, reasoning, and opportunities to understand the concept. Students who were taught the procedure through rote memorization had difficulty making connections and retaining the concepts taught. Another factor was the type of curriculum that was used in their prior school district (Sherman, Richardson, & Yard, 2014). Most curriculums spiral for students to scaffold information or concepts that were related to previous learning in prior grade levels. Students who did not understand a concept were typically given worksheets for drill and practice or repetition. This was ineffective as it limited the students' ability to reason or problem solve. Achievement gaps can also occur if the students' ability level or immersion into a concept is not being retained. This type of achievement gap typically occurred with students who were truant or were new to a school district. Lack of life experiences such as communicating to people about numbers through real life situations could also create that achievement gap (Sherman et al., 2014). Another reason for students to struggle in math was their ability to develop mental strategies for recalling math concepts. Sometimes students' attention span was limited by distractions or having problems with multistep procedures (Sherman et al., 2014). The final difficulty was the language used in math. Understanding terms and operations are essential to understand algorithms and in order to problem solve. Examples could be multiples, denominators, and volume ((Sherman et al., 2014, p. 1-2).

As the concepts progressed and students digressed, teachers could become discouraged by the new curriculum change or lose the motivation to change the new teaching approach.

Hochberg and Desimone (2010) also stated,

> The impact of professional development on instructional practice depends, in large part, on teachers' will and skill to change. The research on teacher knowledge and belief change suggests that teacher epistemological and efficacy beliefs, combined with knowledge, the systematizing of learning opportunities, and personal and contextual relevance are critical components in the change process. Thus, when considering what effective professional development looks like, especially as part of an accountability context that requires rapid, targeted interventions—we need to include not only effective features but also how aspects of the particular settings in which changes must occur may either foster or impede the critical knowledge, abilities, belief, and instructional practice change processes. (p. 98)

Professional development contributed to the success of new curriculum. Familiarizing teachers with the different components and materials was just the beginning. Teachers must be reassured that the change had purpose and was relevant to the learning of our 21st century students. Professional development should provide teachers with innovative methods or approaches to teach the new concepts. Intervention strategies for struggling students should also be addressed. Lastly, common plan time should be allocated for teacher collaboration.

Types of Assessments

Garrison and Ehringhaus (2014) explained formative assessment as a part of the instructional process. Formative assessments allowed the teacher to adjust teaching and learning while it was happening. Formative assessments informed teachers about the student's comprehension at a point when timely adjustments could be made. These

adjustments will help students achieve targeted standards-based learning goals within a set time frame (Garrison & Ehringhaus, p. 1). Quint, Sepanik, and Smith (2008) stated that formative assessments were administered to see what students did and did not know. With the assessments, educators could modify their instruction accordingly. Formative assessments were usually tests or activities that measured student learning. The educator also provided feedback used to adapt their teaching practices. This teaching practice would help to meet the student needs. Garrison and Ehringhaus (2014) also explained **s**ummative assessments as assessments given periodically to determine a particular point in time where students knew or did not know the information. Administrators and teachers think of summative assessments and associate them with standardized tests. One example of a summative assessment was state assessments, which played a critical role for school districts and classroom programs (Garrison & Ehringhaus, 2014, p. 1).

Interpreting Data

Breiter and Light (2006) explained there are six steps to transform data into knowledge. The six steps were collecting, organizing, summarizing, analyzing, synthesizing, and decision-making. When analyzing the data, the test scores could guide practice which turned into knowledge (p. 210).

According to Olah, Lawrence, and Riggan (2010) teachers' interpretation of student data could be influenced by a student's past performance on assessments, interactions with their peers, type of questions on the assessment that a teacher felt were too challenging for their students, or the district's curriculum or pacing guide. This information was thought to explain why students or a classroom did not perform well. This also was used as a determining factor, as to instructional performance as teachers,

whether their teaching was effective or ineffective, and their overall interpretation of the student or classroom performance (p. 234).

The school in this study, Rams Elementary School, used Collaborative Work time to organize and interpret student performance on math skills. MODESE (n.d.a,) explained the purpose of the Collaborative Work Grant was to improve learning for all students, especially students with disabilities, and improve teaching by having productive and efficient collaborative teams (p. 1). The fourth grade team chose their math skills based on scaffolding skills that were not taught in the previous grade. Other times, it was based on students' needs or skills that were more difficult for students to grasp. Students were placed in ability groups based on their pre-test administered before Essential Time. Essential Time was an opportunity for students to be placed in specific leveled groups with different teachers in fourth grade. Each fourth grade teacher had a leveled group, depending on their pre-test scores. During Essential Time, teachers taught and guided students to the mastery of the specific skill. Based on the groupings of the students, a variety of teaching methods were used to assess learning. Students were then retaught or reviewed on a concept that followed with a post-test. The post-test was entered into an excel spreadsheet provided by Blue School District. This information showed individual student names and the percentage of students who fell into one of the four different categories: proficient, close to proficient, far to go, and intervention.

Organizing Data

Many teachers received results from district or state testing and had no idea what to do with the information. Many times the data was difficult to read and comprehend. Love (2004) stated that many schools lacked the process to connect a meaningful

interpretation of their assessment with instruction. In order to organize the data, team members should predict what they think they will see in the data. By predicting data outcomes, team members will activate prior knowledge and be motivated to learn from the data. The key was to work on one data report at a time, to eliminate confusion or overload. Each report should produce a colorful graph displaying results. These results would be considered a data wall. Mokhtari, Rosemary, and Edwards (2007) reported five steps for organizing data. The first step was organizing the data so more than one set of eyes can come to a consensus on the observation. The second was to select a recorder who will help with step four (Mokhtari, Rosemary, and Edwards, 2007 p. 356). The third step was for partners to analyze the data and take notes on their observations worksheet (Mokhtari et al., 2007, p. 356). The fourth step was for all partners to get together as a team and put their interpretations into a discussion of findings (Mokhtari et al., 2007, p. 356). These findings should devise school improvement goals and action steps. Lastly, the teams should communicate the formative plan to other school personnel and stakeholders and then monitor their plan (Mokhtari et al., 2007, p. 356).

Collaboration

Collaboration was essential for organizing and interpreting data. However, collaboration also went beyond data. Collaboration could also be used with teaching and how students learn. Meirink, Imans, Meijer, and Verloop (2010) found that collaboration allowed teachers to exchange ideas or experiences, develop and discuss new materials, get feedback from colleagues, and give each other moral support.

Berry, Daughtrey, and Wieder (2009) stated that teacher effectiveness had less to do with individual attributes, and more to do with how educators worked with each other

and provided collective leadership for their schools and communities (p. 2). Studies showed that students performed better on math and reading assessments when they attended schools with a higher level of teacher collaboration. This could create a tipping point for sustained school turnaround (pp. 3-4).

Berry et al. (2009) stated that collaboration mattered when it came to teacher effectiveness. Adequate time needed to be scheduled for successful collaboration. Educators should have common plan time during the day. By doing so, the school also conveyed that collaboration and leadership were important. Collaboration should also be set up for vertical and horizontal planning. Horizontal planning took place when educators planned with educators in their same grade level or department. Vertical planning happened when teachers could share information regarding the students and their learning styles with teachers in the next higher level. For example, a third grade teacher could inform the fourth grade teacher of the background skills taught in a specific concept area (Berry et al.). Educators also knew that collaboration included sharing knowledge and ideas. For some educators, this implied risk. Trust was a major element in collaboration. Teachers who worked in an environment with trust had a basis for inquiry and reflection into their own practice, allowed them to take risks, challenge and critique each other, and collectively solve tough problems as a team (Berry et al., 2009, p. 7). Rasberry and Mahajan (2008) conceded with Berry et al. (2009) that when teachers felt comfortable taking risks, were not fearful of repercussions, and were willing to try new things, trust within the collaboration teams would develop (p. 19). Rasberry and Mahajan (2008) stated that educators who worked with their peers and teachers in professional learning communities by collecting and analyzing classroom data, sharing

best practices, and making instructional decisions as a team engaged in deeper learning as teaching professionals, to better meet the needs of their students (p. 1). Collaboration could be very intimidating to teachers, especially those who were not comfortable with a specific subject or skill being taught. They may feel as if they were being judged negatively. Teachers needed to feel free to express themselves without any misunderstandings or misconceptions of a concept, or just to clarify that their approach to teaching was appropriate. Suggestions or improvements from fellow colleagues should be welcomed, appreciated, and nonjudgmental.

There were several practices to create collaboration. Poulos, Culberston, Piazza, and D'Entremont (2014) agreed that the first task was to set a structure and expectations for collaboration. This included giving teachers an opportunity to work together. This did not include in the break room or in the hallways, and included a set time, outside of meetings. Another was to allow for constructive feedback. This included challenges, feedback on teaching, and trying new pedagogical practices. Although teachers were not comfortable with being critical of one another, leaders could use techniques to help teachers. One was to model constructive feedback (Poulos, Culberston, Piazza, & D'Entremont 2014). The other was to introduce challenging questions to teaching in a team setting. In doing so, leaders must be aware of teacher dynamics so that teachers could express themselves freely. Teachers should use this interaction as an opportunity to have in-depth conversations that will evoke feedback and constructive recommendations on their challenges as a teacher. By following these techniques, teachers can improve classroom practices, utilize data use, and increase academic rigor (Poulos et al., 2014, pp. 29-31). Poulos et al. (2014) had parallel thoughts with Jolly

(2013) in regards to collaboration. Teachers needed to see the importance and influence of someone who was skilled at a specific concept. This person should be able to take a leadership role to guide and inspire others, not to intimidate or make someone feel inferior. Jolly (2013) stated,

> For teachers to collaborate, teachers next need to look at what knowledge and experience they bring to the team; they will have opportunities throughout the year to share their skills. They then examine any gaps between their current knowledge and what they need to know to successfully reach the goal (p. 34).

Collaboration was an indispensable tool needed for successful schools. School districts need to accommodate teachers by allotting common plan times in order for teachers to meet with their teams. Common plan times should be taken advantage of by teachers, in order for collaboration to take place. Some teachers may choose not to utilize common plan time to work together due to factors that could include, but are not limited to grading papers, organizing, or parent phone calls/emails. Districts may need to mandate time for teachers to engage. Administrators may also need to monitor or observe meetings for fidelity and/or to make sure that the atmosphere is purposeful and conducive to positive feedback or constructive criticism. Open discussion and suggestions should be embraced without passing judgment or making someone feel inadequate. This could give teachers an opportunity to involve everyone in the decision-making and to support one another with their triumphs and struggles.

Summary

In order for a successful implementation of any new program to take place in a school district, professional development should be mandated and provided. Professional

development must be meaningful and purposeful. It must be able to create a smooth transition and prepare teachers with a new knowledge and the confidence to teach new strategies that are expected. Teachers should also have a contact person who is easily accessible to address any issues or questions that may arise. Teachers must learn to embrace the changes that a new program brings. With the advent of Common Core, this change was in the way teachers traditionally taught math. CCSS Initiatives (n.d.) explained that a key shift in teaching mathematics was application. This required students to correctly apply their gained math knowledge, which was their procedural fluency and their solid comprehension of conceptual understanding to math concepts (p. 1). Data should be utilized to drive instruction. The data should be teacher friendly with terms and graphs that are not difficult to analyze, deduce, and to put to use effectively. Lastly, teachers should be given common plan times to collaborate and have meaningful conversations regarding the new program. Collaboration will cultivate teachers and help them with the shared responsibility of student success.

Chapter Three: Methodology

The purposes of this study were: (a) to document the implementation processes of a new math program, Math in Focus, with concentration on the fourth grade at Rams Elementary School (pseudonym) for the 2014-2015 academic school year; (b) to evaluate third grade secondary data from Rams Elementary School for the previous academic school year, 2013-2014; and lastly, to evaluate third, fourth, and fifth grade secondary data from Cardinal Elementary School (pseudonym) from the previous academic school years, 2011-2012; 2012-2013; and 2013-2014. This chapter will describe the methodology the researcher used to answer the research questions and test the hypotheses. Since this is a mixed-methods study, this chapter is divided into two parts; the first describing the qualitative aspects of the study, and the second detailing the quantitative analysis.

Research Questions and Null Hypotheses

The research project was guided by the following research questions:

RQ_1: What can we learn about an American elementary schools making a transition to Singapore math (in the form of Math in Focus) by following a grade-level team for the school year as they implement the program?

RQ_2: Did the professional development on Math in Focus prepare the teachers for implementation of the new program?

RQ_3: What was the teacher attitude and perception of Math in Focus?

The secondary data was analyzed using the following null hypotheses:

H_1: The MAP scores at Cardinal Elementary School will not improve relative to district and state averages over the time periods researched; 2011-2012, 2012-2013, and 2013-2014.

H_2: The MAP scores at Rams Elementary School will not improve relative to district and state averages over the 2013-2014 academic year.

The Research Site

The research site was Rams Elementary School (pseudonym) in the Blue School District (pseudonym). During the research study, this accredited school district had 15 elementary schools. Two of the elementary schools were grades kindergarten, first, and second only, with four middle schools, and five high schools. The K through 12 student population was 18,381, with 22.7%, or 4,124 students, eligible for free or reduced lunch and 83.5% of the student population classified as White (MODESE, n.d.c, p. 1). Two elementary schools were included in this research. Cardinal Elementary School had a student population of 398 (p. 1). This elementary school only included third, fourth, and fifth grade students. Cardinal Elementary School had 42.9% of students qualified for free or reduced lunch. Rams Elementary School had a student population of 543 (p. 1). This school included kindergarten through fifth grade, and 10.4% (p. 1) of students qualified for free or reduced lunch (MODESE, n.d.c).

The National Center for Educational Statistics (2015) reported approximately 10.9 million school-aged children were living in poverty (p. 1). Research suggested that living in poverty during early childhood was associated with lower than average academic performance that began in kindergarten and extended through elementary and high school (p. 1).

Participants

Participants were educators in an elementary school where the researcher was employed. The identities of the participants remained anonymous by appointment of fictitious names in the research. The participants were given an informed consent for participation in the research, and understood they could withdraw from the research at any time. The researcher was not superior to the participants. All participants, including the researcher, were grade-level teachers. The teachers were verbally recruited and provided an adult consent form provided by Lindenwood University. The four, fourth-grade teacher participants for the qualitative part of the research were included because the researcher was a fourth grade teacher at Rams Elementary School in the Blue School District, where the participants taught as a grade level. One, third grade teacher and one, fifth grade teacher were also participants from Rams Elementary School. Of the six teachers in the qualitative research part of this study, each teacher was a certified teacher with an average of 15 years of teaching experience. The education levels of five of the participants were at the master's degree level of education and one teacher had a bachelor's degree.

The sample for the secondary data collection was selected from students at Cardinal Elementary School. There were approximately 25 students per classroom, with five sections per grade level (third, fourth, and fifth grades only). This gave an estimated total of 375 students. An additional sample for secondary data collection was selected from third grade students at Rams Elementary School. There were approximately 25 students per classroom, with four sections of third grade. This gave an estimated total of 100 students. Convenience sampling was used for collection of data from files on

students who attended Cardinal Elementary School for the 2011-2012, 2012-2013, and 2013-2014 school years and on third grade students who attended Rams Elementary School for the 2013-2014 school year. Rams Elementary and Cardinal Elementary scores were used in order to compare the MAP scores with the district and state averages. All MAP data were collected according to grade level, elementary school, and academic school year. Student names and teacher names were not used for this data. MAP assessments were state-wide and intended to measure the achievement of standards by students.

Sampling Procedure

This research compared the third grade-Mathematics MAP scale score average at Rams Elementary School with the third grade district average (with Rams Elementary data removed) and state average Mathematical MAP scale scores. These MAP scale scores were the results of the first year of implementation for third grade only in the Blue School District. The same process was used for the third grade Mathematics MAP scale score average for Cardinal Elementary School for the academic school years of 2011-2012, 2012-2013, and 2013-2014. The average MAP scale scores for all three academic years were also compared to the third grade district average (with Cardinal Elementary data removed) and the state average. The data were analyzed for both elementary schools to help determine if the scores improved relative to district and state averages over the three year and one-year time periods.

The MAP scale scores were provided by Blue School District's Executive Director of Assessment and Data. The scores were presented to the researcher after identifying all the elementary school buildings and individual student scores by grade

level. All student names were removed from the data, in order to secure anonymity. In order to obtain the state average MAP scale score for each year and grade level, the researcher utilized MODESE; state assessment data was available to the public. The reports were obtained through drop down menus, which allowed individuals to narrow results by state versus district, content area, grade level, and school years.

This research compared the fourth and fifth grade Mathematics MAP Missouri Growth scores at Cardinal Elementary School with the fourth and fifth grade district average (with Cardinal Elementary data removed) and state average Mathematical MAP Missouri Growth scores. These scores were used for the 2011-2012, 2012-2013, and 2013-2014. The MAP Missouri Growth scores were also provided by Blue School District's Executive Director of Assessment and Data. The scores were presented to the researcher after identifying the elementary school buildings and individual teacher growth scores by grade level. All teacher names were removed from the data, in order to secure anonymity. The researcher did not have to obtain the state average MAP Missouri Growth scores, as the state average in growth was set at 50 (MODESE, 2014b, p.12).

The researcher compared the Mathematical MAP Missouri Growth scores at Cardinal Elementary School with the district and state average. The data was analyzed to help determine if the scores improved relative to district and state averages over the three year period.

MODESE (n.d.d) explained the Missouri Growth Model,

> Student growth is the change in academic achievement (as measured by the grade level Missouri Assessment Program exams in English language arts and mathematics) for an individual student between two or more points in time. The

> Missouri Growth Model calculates how much students "grew" relative to predictions. These predictions are based on prior exam score, and student mobility. Average student mobility rates and average prior-year test scores are also used. (p. 1)

This research also conducted a qualitative approach with one, third grade teacher; one, fifth grade teacher; and four, fourth grade teachers at Rams Elementary School. The research generated information on (a) professional development training in preparation to teach Math in Focus; (b) the benefits/ hindrances of team planning during the first year of implementation; and (c) teacher perceptions of the program's strengths and weaknesses and their level of buy-in regarding its use. Interviews were conducted regarding each of the five professional development trainings for the fourth and fifth grade teachers at Rams Elementary School. Third grade interviews were conducted after each of the three professional development trainings. During the research, additional qualitative data was also amassed. The four, fourth grade teachers met weekly for collaborative team-planning for mathematics, and the researcher took notes on the conversations following the meetings.

Coding Procedures

The researcher used a coding procedure for examining the data and scrutinizing for themes. The researcher voice-recorded all interviews and took notes for grade-level meetings. The interviews were transcribed for later review. After reviewing each transcript, colored highlighters were utilized, focusing on word repetitions, common thoughts and ideas, and teacher opinions. The next step was to format the information into categories that would become the theme for the data collection.

Professional Development

The researcher utilized a qualitative approach during the professional development trainings and weekly team meetings. The researcher scribed the professional development training process as it happened and conducted post-training interviews with all participants. The researcher took notes at the team meetings and analyzed the data to establish the common themes. Professional development trainings were in June, September, November, and February of the 2014-2015 school year. The June training was given over the summer and was over a two-day period. Teachers who were unable to attend the June meeting were given another training date in August that was condensed into a one-day training.

The September, November, and February trainings were three hours in length. Elementary buildings were assigned to a designated elementary school in the district for the trainings. These trainings were during the school day, and substitutes were provided for the half day of classroom instruction time that was missed by the teachers. Teachers were placed in trainings dependent on which year of implementation of Math in Focus they were involved in and common grade levels. The four fourth grade teachers and the one fifth grade teacher from Rams Elementary School were in the first year of implementation. The third grade teacher was in her second year of implementation. Third grade professional development consisted of three workshops, each three hours in length. These trainings were also during the school day, and substitutes were provided for the half days of classroom instruction that was missed by the teachers.

Team Meetings

The first weekly team meeting took place on September 10, 2014. Weekly meetings were set for the second and fourth Wednesdays of every month. The remaining two meetings were set on different days during the first and third weeks of the month. The meetings typically consisted of going over current or upcoming chapters in mathematics and which topics were to be discussed or taught. Discussion regarding lessons taught, student learning, and strengths and weaknesses of the Math in Focus curriculum were also noted.

Data Collection and Analysis Procedures

This research required a mixed-method approach utilizing both qualitative and quantitative research. For the qualitative research, interviews and documented collaborative team planning were conducted. This information was in regards to the implementation process of Math in Focus, as it related to the professional development training, hindrances and benefits of collaborative team planning, and the strengths and weaknesses of Math in Focus. For quantitative research, secondary data provided by the MAP scores were used and analyzed. These data provided potential evidence of effectiveness of the program, when compared to district and state means.

Data collection utilized for the study were accessed through the Student Information System (SIS) for the school district by the Executive Director of Assessment and Data. SIS was where student data were managed by the Blue School District. All student and teacher names were de-identified to allow participants to remain anonymous. The Missouri Growth Model was applied to Cardinal Elementary School, the elementary school, which piloted Math in Focus for the three years previous to this study. In order to

examine the growth of the students, only grades four and five were analyzed via Missouri Growth Model at Cardinal Elementary School. All third grade students at Cardinal Elementary School and Rams Elementary School utilized MAP scale scores that were also accessed through SIS. Since the study began in the first year of state testing for the third grade, the researcher was unable to utilize the Missouri Growth Model with this sample of data.

Instruments

For this study, the researcher conducted interviews with all participating teachers from Rams Elementary School and observed and participated in the fourth-grade professional development and grade-level meetings. The district provided secondary data of students' MAP scale scores for mathematics in grades three and MAP Missouri Growth scores for grades four and five from Cardinal Elementary School. The researcher conducted interviews with third, fourth, and fifth grade teachers following the professional development on Math in Focus. Weekly fourth-grade level meetings, in which the researcher participated as a teacher, were also observed and noted. Both the interviews and observations were analyzed qualitatively to document the teachers' knowledge, beliefs, expectations, and questions, as they learned and implemented Math in Focus in their classrooms. The secondary data was analyzed statistically utilizing *z*-tests and *t*-tests for difference in means of the MAP scale scores and the data provided by the Missouri Growth Model.

MODESE (2014a) explained the Map Scale scores, "CTB/McGraw-Hill uses the student's correct responses to derive a MAP scale score. The scale score describes achievement on a continuum that in most cases spans the complete range of Grades 3–8"

(p. 3). MODESE (2014a) also explained the MAP scale scores as a way to measure the progress for students in relation to the Show Me Standards. This information was used to notify the public and state legislatures about student performance. The MAP scale scores were then placed into a level-achievement category. The categories were Below Basic, Basic, Proficient, and Advanced. MODESE (2014a) explained Below Basic, "The student has not met the achievement standard and needs substantial improvement to demonstrate the knowledge and skills in mathematics needed for likely success in future coursework" (p. 5). Another term used in the level-achievement category was Basic. MODESE (2014a) defined Basic, "The student has nearly met the achievement standard and may require further development to demonstrate the knowledge and skills in mathematics needed for likely success in future coursework" (p. 5). An additional level-achievement category was Proficient. MODESE (2014a) explained Proficient, "The student has met the achievement standard and demonstrates progress toward mastery of the knowledge and skills in mathematics needed for likely success in future coursework" (p. 5). The final level achievement MODESE (2014a) explained was Advanced. "The student has exceeded the achievement standard and demonstrates advanced progress toward mastery of the knowledge and skills in mathematics needed for likely success in future coursework" (p. 5).

MODESE (n.d.d.) explained the Missouri Growth Model, "Please note that student growth is defined as the change in achievement (as measured by the MAP English language arts and mathematics assessments) for an individual student between two or more points in time" (p. 1).

In the initial beginning timeline of this study, the researcher interviewed the assistant superintendent of the Blue School District. Interview questions inquired about why the district made the adoption change, why Math in Focus was chosen for adoption, and what the costs for the program were (see Appendix A). The researcher also interviewed the elementary Math Coordinator. The interview question topics included the type of training and on-going training available for teachers, how the piloted elementary school was monitored, and choices for the pacing for instruction (see Appendix B).

Summary

The purpose of this study was to document and evaluate the implementation process of a new math program, Math in Focus, with concentration on the fourth grade and student achievement. This study of implementation was conducted at Rams Elementary. Quantitative data from a second elementary school, Cardinal Elementary, which piloted Math in Focus the three years previous to this study was also used. This research generated information on the (a) professional development training in preparation to teach Math in Focus; (b) the benefits/ hindrances of team planning during the first year of implementation; and (c) teacher perceptions of the program's strengths and weaknesses and their level of buy-in regarding its use. Lastly, an additional topic was included; (d) using secondary data, measured by student scores on MAP, the study looked for evidence of effectiveness of the program when compared to district and state means for Cardinal Elementary, that piloted Math in Focus for the years 2011-2012, 2012-2013, and 2013-2014. Quantitative data also looked for evidence of effectiveness

in comparing district and state means for third graders at Rams Elementary, which implemented Math in Focus for the 2013-2014 academic school year.

Chapter Four: Results

Professional Development

The purpose of this study was to document the implementation processes of a new math program, Math in Focus, with concentration on the fourth grade at Rams Elementary School (pseudonym). The district provided a workshop-based professional development in June for all elementary teachers in the school district, including the fourth grade teachers in the research. The workshop was two full days with the goal of "Defining Singaporean approach of effective math instruction and provide specific info [sic] and strategies for successful implementation of Math in Focus" (Math in Focus workshop Powerpoint, personal communication, June 2015). The teachers were grouped by grade level and the number of years with experience in Math in Focus in the school district. Teachers were able to make up this workshop in a one-day August session if their schedules did not permit them to attend in June.

June Professional Development

The June workshop representative was from Houghton Mifflin, who resided in Lexington, Kentucky. There were 31 fourth-grade teachers in attendance, all from various elementary schools in the district. This group of teachers were all in their first year of Math in Focus. The four fourth grade teachers from the research are addressed in this report as Teacher A, Teacher B, Teacher C, and Teacher D. The presenter began by stating, "Today is an overview on how things are taught in Math in Focus. You must understand it in order to implement it" (workshop presentation, personal communication, June 2014). The agenda for the workshop included an overview of Math in Focus

resources, introduction of chapter components, introduction to lesson structure (why do or do not do certain things), guided lesson planning, and introduction to bar modeling.

The workshop began with a story problem: "Jen has 5 stacks of quarters. Lee has 9 stacks of quarters. Each stack of quarters is worth $10.00. How much more money in dollars does Lee have then Jen?" (workshop presentation, personal communication, June 2014). Teachers were told to solve the problem utilizing the manipulatives at their tables. The manipulatives consisted of unifix cubes, chips (for place value) that had 1, 10, or 100 on them, and base-ten blocks. The presenter asked the teachers to share their answers and thoughts. Some of the answers from the various teachers included, "Use the 10 chips to make stacks"; "I wish chips were different colors so I could represent two different kids"; "I ignored 10 and used two different color chips to represent kids"; "I used base ten rods because they are in stacks of ten." The presenter then proceeded to say that some students would struggle with this because it was multi-stepped. The students would have to have a good foundation of reading comprehension. The presenter proceeded to indicate that visualization was the main component of mathematicians.

The presenter then had each table discuss five things that should be evident in every successful math lesson. Each table listed one or two things that the participants at the table came up with. Answers brought up were: modeling examples, small group teaching, repetition/practice, differentiation, use of manipulatives/hands-on, and independent practice. The presenter then asked the table groups to create a poster that would motivate students to become mathematicians. The poster themes varied from understanding the problem by visualizing, breaking down the steps, solving the problem, checking your answer, and explaining your thinking.

The presenter discussed the non-negotiable items for teaching Math in Focus. They included the process represented by concrete, pictorial and then abstract. The goal was to teach students to develop the ability to think abstractly. The concrete materials allowed students to see the numbers represented. The pictorial allowed students to connect the concrete to pictures, with the final goal of thinking abstractly and on their own, with gradual release.

The presenter asked the teachers to read and then write the main points on chart paper for the following titles from the Math in Focus Implementation Guide: Chapter Overview, Test Prep, Chapter Wrap-Up, and Recall Prior Knowledge/Pre-test. Each table was given a specific title to write about. Each table presented findings to the entire group. The presenter then discussed each topic by pointing out the corresponding pages in The Math in Focus Implementation Guide.

The presenter asked all the teachers to get out their teacher manuals. She pointed out the pre-test and the Test Prep for Chapter One. She then passed out a worksheet for each teacher. She asked all the teachers to take the pre-test while circling problems they felt would be difficult for fourth graders. She pointed out that any common missed concepts or problems could be addressed in Think Central, which was a website for Math in Focus. She then went over the teacher manual by pointing out the bolded and colored titles.

With the teacher manual still out, the presenter went over some of the bolded titles in the manual. Chapter Wrap-Up was good for anchor charts. The chapter review/test was good to use as a grade to see if the students understood the concepts. The Test Prep was a mixture of multiple choice and short answers. The presenter pointed out

that this, too, could be used as a grade. There was an Extended Response portion of the test that should not be used for a grade, rather as a tool to build scaffolding for the language used in math. The presenter went on by pointing out other items in the teacher manual. An example was the Independent Practice workbook. This was designed to be completed in class, and was good for independent work that could be used for a grade. The blue text was geared for the learner, and the orange text was geared for the teacher. The presenter went on to discuss the importance of gradual release, which was to do something to get students involved in the task.

The presenter then went over four different components and how they could be addressed. The first was direct involvement. Direct involvement could be attained through whole group teaching, concrete learning (manipulatives), discussing what students know and coaching them towards the key mathematical idea, and teach/learn/investigate. The second was guided practice. This could be attained through flexible grouping, teacher time with struggling students, supported by teacher rather than led by the teacher, and based on questions and activities from the text. The third was Independent Practice. These could be monitored by using the workbooks provided by Math in Focus. The workbook titles in the math series were Let's Practice, Workbook, Extra Practice, and Enrichment. The final component was differentiation. This included which workbooks to use for specific students. If there was a struggling student, the Reteach workbook was beneficial. Students who were on level would use Extra Practice. Advanced students would benefit from the Enrichment workbook.

The second day of the June workshop followed an agenda goal of understanding types of problems from earlier grades. The presenter questioned the teachers on their

knowledge of bar modeling. Of the five tables, three tables had no knowledge, one table said it was pictorial, and the last table mentioned that it was a visual representation. The presenter then went over a Powerpoint that covered the topic of bar modeling.

The June workshop presented a Powerpoint regarding word problems in Math in Focus (2015)

> Systematic method of representing word problems and number relationships that is explicitly taught in Singapore beginning in second grade and extending all the way to algebra. The Singapore Model Method (bar modeling) uses rectangular blocks to represent known and unknown numbers. Rectangular blocks are used because they can easily be drawn and divided. Begins in second grade and gets progressively complex. (Math in Focus workshop Powerpoint, personal communication, June 2015)

The presenter then began to go through slides with various word problems that required addition and subtraction for solving, and how to use bar modeling. The bar model examples were all second grade basic adding and subtracting problems. For the word problems, the presenter asked teachers to create bar models and also use colored unifix cubes to represent the problems. For example, one of the addition problems was,

> There are 14 breadsticks in a basket. There are also 17 breadsticks in the basket. How many total breadsticks are in the basket? An example of subtraction was: Second grade has a new aquarium. There are 21 fish in it. 15 fish were given by families. The rest were bought by the school. How many fish did the school buy? (workshop presentation, personal communication, June 2014)

The presenter emphasized that bar models were great for conversation. Students who could not explain their bar model needed to solve the problem again. It was not necessarily about the correct answer, but how to solve the problem step-by-step. The presenter also showed more complex word problems. An example was: Computers cost $1950. It costs $250 less than a television. How much did the television cost? How much did both items cost (workshop presentation, personal communication, June 2014)? The presenter also showed word problems with one digit multiplication problems and division with one digit divisors. After the bar modeling Powerpoint, there were many comments from the fourth-grade teachers. During the questioning, the elementary Math Coordinator was present to answer questions. One of the main discussions was on the topic of how to grade bar modeling. The coordinator explained that if a student's bar modeling was incorrect, but the student could have a conversation with the teacher to explain the thinking, teachers should count the answer right. Another teacher mentioned that if the teachers were not grading the bar modeling, but the reasoning in the answer, what was the point in teaching bar modeling? The coordinator mentioned, "This is a conversation that will take place within the year. Strategy is about bar modeling. Turning bar modeling into a procedure for pure purpose of getting a grade is not the intent or expectation" (math coordinator, personal communication, June 6, 2014).

The last part of the professional development was to allow teachers to sign up on Think Central, Math in Focus' online website. The presenter also went over Calendar Math. Calendar Math should be 10 to 15 minutes per day. It assisted in using everyday language. It also was a visual tool for students, parents, and teachers and articulated math

terminology. The remainder of the day was spent cutting out items included in the Calendar Math kit and placing them in Ziploc bags.

Feedback

The researcher conducted post workshop interviews in September 2015 for each attending fourth-grade teacher, with the intent to seek reactions to the workshop, specifically how well-prepared they felt to be implementing Math in Focus. Three of the fourth-grade teachers attended the two day workshop in June. One of the fourth grade teachers attended the one day workshop in August.

None of the three teachers who attended the two day June workshop thought it was effective in preparing them for the first days of school. All three felt the workshop focused too much on the primary (K-2) grades. Teacher A said, "Everything they did was lower level. She kept saying 'I want to show you what they are doing before they get to you,' but then they never really talked about fourth grade. It was all primary grades." The presenter's reasoning was that it was important to know what the students were learning in the previous grades. Teacher A mentioned that she never really understood bar modeling in the end. Another teacher felt that it was more about making sure teachers looked at the teacher manual prior to the beginning of the year. This teacher felt like the presenter just had teachers open the teacher's manual and pointed out bolded titles with only a brief explanation. All four of the fourth-grade teachers agreed that much of the planning would have to be completed during the summer. Teacher D said, "There are a lot of components to this program. It is going to be a lot of reading on our own independent time without proper training prior to the first day of school. There is going to be a lot of catching up to do over the summer on my own." Teacher C said, "I

felt like there were an awful lot of materials to learn, to get through. I feel like I have more work to do than even before I got into this series. I feel overwhelmed and overloaded." Teacher A said, "I felt so unprepared going into the workshop and thought I would leave more prepared. Now I realize how unprepared I really am."

Calendar Math was another common theme from the June workshop. Teacher A said, "Calendar Math would have been more helpful than just saying this is what your calendar will look like. They need to show it, model it. I would rather have them model the different lessons or the steps in the lesson." Teacher B said,

> She just showed us different pieces and we separated the different pieces that were in our kit and she kind of showed us how to find different materials, but did not show us how to use it. They showed us what one would look like on a bulletin board, but not how the individual pieces come into play. It was more of the physical materials and how it was laid out. I would like to have had her actually teach the objectives.

Teacher D said, "Too much time was spent on cutting individual pieces out and not on how to effectively present or teach Calendar Math to the students."

Some positive feedback from the workshop from one of the teachers was on how the presenter gave examples of questioning for students and classroom example math problems with use of the place value chips. The presenter modeled a lesson to the teachers as if the teachers were the students. Teacher D liked how the presenter pointed out the non-negotiable items for teaching Math in Focus. This allowed teachers to plan, with the knowledge that these items should be present in all lessons.

September Professional Development

The district provided another workshop-based professional development in September for all elementary teachers in the school district. The workshop was three hours in length and occurred on a regular school day. A substitute was provided for all teachers in attendance. Once again, the teachers were grouped by grade level and the number of years with experience in Math in Focus in the school district.

The September workshop featured a representative from Houghton Mifflin. This representative was a different person from the June and August make-up professional development sessions. The presenter began by showing a series of circles connected to squares. The series of shapes created a pattern. On the bottom of a pattern was a number. This pattern was then repeated two more times until there were a total of three patterns and numbers below the pattern visible on the overhead board. The presenter wanted to know what the group noticed about the patterns and asked the group to figure out the value of each circle and square. The presenter then discussed how to figure out what the ninth pattern would be. She showed how algebra could be utilized. She then asked what the teachers thought the hundredth pattern would be for the next series. She then proceeded to revisit the three non-negotiables from the June training. She gave each table of teachers a poster and a topic different from each of the other tables. The teachers at each table were to create a poster about their specific assigned topic. There were a total of five non-negotiables represented by the five tables of teachers. The topics were: concrete-pictorial-abstract, visualization, Math is Thinking, gradual release, and assessments. Time was given for the teachers to create the poster. Teachers were able to look through their manuals for information.

The first topic was concrete-pictorial-abstract. The information presented by the group of teachers who received this assigned topic stated that all new concepts started out concrete. Concrete was using pictures or illustrations to show concrete ideas. Concrete meant using a form of manipulatives. Abstract should not be expected until the students had a firm grasp on the concrete and pictorial. All lessons should follow the concrete-pictorial-abstract order. The presenter also added this information to the poster: "Virtual manipulatives are pictorial, not concrete. Abstract would be using an algorithm" (presenter from September workshop, personal communication, September 5, 2014).

The next poster represented visualization. Visualization was making a movie or picture from your mind, using manipulatives, modeling and sketching, seeing patterns in numbers and shapes, place value chart, number lines, hundreds charts, and equations. The presenter added, "Visualization is real life connections. You must give students the tools to visualize" (presenter from September workshop, personal communication, September 5, 2014). The presenter also randomly said numbers out loud, and teachers were to write the first thing that came to minds. The numbers were 7, 21, 2, 13, 12, 4, 186, and 222. The message was that she wanted teachers to know that it was easy to associate small numbers. Larger numbers were harder to associate and must be taught.

The next poster was Math is Thinking. The information presented from teachers were key words, such as classifying, analyzing, identifying, comparing, estimation, data analysis, and numerical calculation. The presenter added,

> Math is Thinking is used in extended response problems. Put on your thinking cap activities should be completed as a class. The workbook should be used for independent work. The enrichment worksheets are more challenging

> assignments. If students are struggling with enrichment, go down to the next grade level and use their enrichment worksheets for the corresponding chapter. (presenter from September workshop, personal communication, September 5, 2014).

The next poster to be presented was on gradual release. The September presenter emphasized, "Direct involvement, not direct instruction. Explaining should be the last resort" (presenter from September workshop, personal communication, September 5, 2014). The first part in direct involvement was teaching while the students were involved in the lesson. Next, guided practice allowed the students to work in a group or with a partner. The last was independent practice. Students should be able to work on the assignment independently.

The final poster on non-negotiables was assessment. The different ways to assess students were through: prior knowledge, pre-test, Let's Practice workbook, and Chapter Review/Test, Test. The September presenter added,

> In previous years, we used the chapter/review/test in the book as a grade. This should be done as a class or as a formative assessment. The Assessment workbook is preparation for state testing. Use this Test Prep as the assessment or a summative assessment. We have changed the structure from what we have learned from three years of piloting. (personal communication, September 5, 2014).

The presenter then asked the teachers to open the teacher's manuals and went over the basics of the book. She advised us to read the Chapter Overview first, then watch the math background video. Next, we looked at the Chapter Wrap-Up, Chapter Review/Test,

and the Test Prep. She also pointed out a parent letter that could be sent home to parents regarding the upcoming chapter. She asked the participants to open the manuals to chapter Two, Skills Trace. The September presenter stated, "In planning, what do we want kids to learn from the lesson? In Chapter Overview, there is a Skills Trace. This will allow you to see where they were last year and where they will be going in fifth grade" (personal communication, September 5, 2014).

The presenter then went over Think Central and showed teachers how to access the videos. The clips were broken down into what students needed to learn, how it would happen, and the final tips on what you might want to know about the chapter. For remediation options, the teacher's manual correlated with the questions on the assessment. The presenter added,

> For chapter 2.1, there are four items that will come from that particular lesson. For lesson 2.2, five questions will come from that lesson. If students do not have mastery of the lessons, the Reteach Workbook will help with struggling students. (presenter from September workshop, personal communication, September 5, 2014).

The last of the professional workshop ended with the presenter showing participants a division lesson. She presented the format as if the participants were the students. The story problem was: Farmer Joe had 525 heads of lettuce. He sold his lettuce to 3 restaurants. How many heads of lettuce did each restaurant receive? The presenter asked participants to show 525 with place charts, using charts and chips. Then, she asked if we could prove that it was 525. She had each person at the table add together out loud, by using the place value chips. Then the presenter asked if participants

could show 525 a different way. Then the presenter asked the participants to show 525 using the least number of chips. Then, she asked how do you know it is the fewest? Next, the presenter asked the teachers to divide their place value charts into thirds horizontally. That allowed the first column to be hundreds, the second column to be tens, and the last column to be ones. The presenter asked the group to take out five hundreds chips and pass one out to each of the three horizontal hundreds place values. This put one hundreds chip in each section with two chips left over. Because one place value chip was placed into each section, the presenter explained that the '1' is the number we put over the '5' when dividing 523 into '3'. She continued this process until each place value chip was passed out evenly into each of the three sections. After the math lesson was shown to the teachers, the presenter added, "Why not just show this? You must give students the manipulatives." She gave the teachers time to do another problem by adding four restaurants to the problem. She had one partner do the chips while the other did the algorithm. She then had the teachers switch roles.

Feedback

The researcher conducted a post-workshop interview for each attending fourth-grade teacher, with the intent to seek their reactions to the workshop. All four teachers were in the same professional development workshop and all agreed that this professional development was effective. All four teachers agreed that the approach to teaching division by the presenter was beneficial. Teacher A stated, "I gained knowledge in the questioning that she was doing when she taught us the mock lesson on division. I like how she had us use manipulatives." Teacher C said, "I am looking forward to doing the division with the chips." Teacher B stated,

> It really helped us when she gave us the example of how she would actually teach a problem. And she modeled it for us. It was nice to hear the questioning that she was using. I like to see how it actually works in the classroom. It seems more realistic to me.

Teacher D said,

> I really enjoyed how she used the place value mats and chips to explain division with three digit dividends. I like how this approach really showed the why of why you put numbers where you do in algorithms. It was very helpful in the reasoning aspect.

All four teachers also agreed that Calendar Math was still a concern. Teacher D stated,

> There were three non-negotiables to be covered in Calendar Math according to the June presenter: number line, calendar, and daily deposit. This workshop we were told that we needed to implement more as the year progresses. Right now it just seems very overwhelming. I wish the presenter would have modeled Calendar Math since that was implemented on day one of school. A still photo on a bulletin board or a video of a teacher teaching Calendar Math would have been beneficial.

Teacher C stated, "I would have liked to see how the pieces in Calendar Math come into play" and followed up with, "We know it is there. We know we are supposed to do it. We had to implement it on day one. Now we will have to read the book about it." Teacher A stated, "For calendar math we were told to do three things. And now they are changing it to do more."

Emerging Theme

An emerging theme was the pacing of the lessons. A pacing guide was emailed to all teachers from the elementary Math Coordinator. This pacing guide allowed each teacher to see how much time should be spent on each chapter. Teacher A stated,

> Each grade level (previous grade level, 3rd grade) is only getting through the first book so they are coming with half the knowledge that they are supposed to have when we start teaching this stuff. But yet they tell us not to go back and spend a lot of time re-teaching, but if they do not have the foundation we are just kind of setting them up for failure for this. They talk about staying on pace, but really did not say how to stay on pace. So they are just kind of telling us to do stuff without truly explaining how we are supposed to do it. What exactly are you supposed to do when they do not have it? They did not tell us that. They just said to stay with the pace in the book.

Teacher C stated,

> There needs to be a review time and there is not. And I do not feel I have the freedom to review because we are on this specific path. The district wants us all to basically teach chapter 2 at this time, chapter 3 at this time. And so there is no leeway. We are going to stop and review a day. I do not feel like I can do that.

Teacher D stated,

> The main issue I am having is the amount of information that the district wants us to teach in a small amount of time. For example, our pacing guide allows 15 days for estimation and number theory. But this consists of multiples, least common multiples, factors, greatest common factors, prime numbers, composite numbers, multiplication with 3 digit by 1 digit, division with 3 digit divisors, and more

> concepts that I cannot remember. This is difficult to get in, especially when most of the students struggle with basic math fact fluency. Students are lacking the prior background knowledge to stay on pace. We are having to teach third grade components just to get them caught up with fourth grade lessons. This will take more time than the pacing guide allows.

After the professional development, the elementary Math Coordinator sent an email with questioning ideas from the farmer division problem used in the workshop. The Math Coordinator wrote the questions down as the presenter was presenting. These were actual questions she asked the teachers during her presentation. This allowed the teachers to see the type of questioning that could take place in the classroom. Participants were all were very thankful for the questions. These questioning techniques were beneficial for all teachers. Teacher D stated,

> I am so glad the Math Coordinator typed all the questions during the lesson. As teachers, we focused on being the student, and did not really have the time to also write down the example questioning she was using. The questioning that she was using were the questions that should be asked of the students. This really helped with higher-order thinking, really delving into students explaining their thinking.

Team Planning

Rams Elementary School arranged for all grade level teachers in the building to meet twice per month, for one hour. While these meetings were not mandated for mathematics planning and discussion, the fourth-grade teachers spent the majority of their meetings focused on mathematics. These meetings allowed grade levels to discuss a variety of professional duties. More meeting opportunities were available through early

release days, which were one-time-per-month for two hours. These meetings varied in options on topics to be discussed. The administrator would set the agenda, which also included grade-level planning. Another opportunity for teachers to meet was during Collaborative Work time. The dates and times for Collaborative Work varied each time. Collaborative Work allowed teachers to utilize Essential Time with students during the school day. The meeting times were set differently, according to each grade level. The times were based on going around special education pull-outs and specials schedules. Specials schedules included physical education, library, art, and music. Essential Time was an opportunity for students to be placed in specific leveled groups with different teachers in fourth grade. Each fourth grade teacher had a leveled group, depending on their pre-test scores. During Essential Time, teachers taught and guided students to the mastery of the specific skill.

The first team planning meet occurred on September 10th. This meeting was during the Collaborative Work time. The purpose of this meeting was to develop a common formative assessment that could be measured for mastery. The results of the formative assessment would guide decisions on classroom teaching and learning practices. The grade level decided on addition with regrouping. As a grade level, the group created the assessment with only four questions. The students not only had to solve the addition algorithm, but also show the pictorial approach to their solutions. The students had not been exposed to the pictorial portion of this skill by any of the fourth-grade teachers. The fourth-grade team came to consensus on how addition should be taught and assessed. This would allow consistency, especially since the students were placed in different groups, with a teacher who may not be their homeroom teacher.

During the coming weeks, students were placed in four different groups, based on their results from the formative assessments. Each teacher was responsible for the mixed group of fourth graders and their approach to guiding students in the mastery of the skill. A post-test was given to students by their homeroom teacher, to measure their progress. At our next meeting, post scores were entered into an excel spreadsheet. The teachers discussed the results, which gave teachers an indication of which students were struggling with addition with regrouping. Teachers had to make time during their school day to work with their students who struggled in addition with regrouping. During the remainder of the meeting, the teachers agreed to start the next cycle with subtraction with pictorials and abstract strategies. As a grade level, once again the group had to come up with a consistent way to grade the pictorials. Since the students were grouped according to their scores, the teachers wanted to make sure that all teachers were teaching and modeling the strategy consistently. During this meeting the pre-test and post-test were created. The tests also included a scoring guide, so the teachers could grade the tests consistently. This helped with the leveling of the students in groups. The pre- and post-tests, templates were created for students to show their work. This included large squares for each numbered problem to help keep the work legible.

The two meetings for the month of September were regarding a chapter with estimation and number theory. The meetings had an emerging theme of students not knowing their basic multiplication math facts. There was a lot of frustration from all four teachers because students struggled with factors and multiples, due to their lack of multiplication math fact fluency. The consensus was that it was difficult for students to list the factors of a number, when they could not recall their basic multiplication facts.

This created additional time on assignments, not because students did not understand what factors and multiples were, but because they did not have the automaticity of their math facts.

The meetings for the month of October were mainly about the teaching of multiplication. An email was sent to all fourth-grade teachers in the district with tips for teaching multiplication in the month of October. The tips for October were an attachment from an email. The email with the attachment from the Math Coordinator stated,

> The standard algorithm for multiplication is not expected for mastery until the end of 5th grade. The standard algorithm for long division is not expected for mastery until the end of 6th grade. The purpose for 4th is to develop the understanding behind the algorithm. This can be done using the strategies introduced in Chapter 3. If students are struggling with the traditional computation after using manipulatives, use other strategies to develop understanding. (math coordinator, personal communication, October 7, 2014)

All the fourth grade teachers were confused on how to assess students on multiplication, when the majority of the assignments from the Math in Focus series were based on algorithm, not the understanding of multiplication. Two teachers felt like the worst teacher for giving bad math instruction for multiplication. Because of the frustration with teaching multiplication, a meeting was arranged to meet with the Math Coordinator. During the meeting, the main point the coordinator wanted to point out was to stay on pace. The Math Coordinator stated,

> I can go slow, but not too slow. Here is an example: The first year of fifth grade was in chapter 2 in February, and I am like, I am sorry, you have to move on. Well, but you cannot stay in chapter 2 the whole time. And it was their first year and they were piloting. It was a very tough time, but we know you have third graders coming in that even though they only had it for a year, but have a little more background than our pilot buildings. And so you know you can be a little behind, you just cannot sit and spin. So we can talk about ways to move forward. (math coordinator, personal communication, October 2014)

During the meetings, teachers also brought up that the students did not know their basic multiplication facts. Therefore, another emerging theme during the meeting was that the students did not know their basic multiplication math facts. The coordinators response was,

> Math facts are not fourth grade objectives. We know that kids do not have them. But we cannot stop your curriculum to teach math facts so you have to embed math facts in it so when you are working on multiplication in Chapter 3 and you are doing 3 digit by 1 digit or two digit by one digit or three digit by two digit, you are using multiplication facts . . . I remember today emphasize doubles and doubling doubles, which is twos and fours. (math coordinator, personal communication, October 2014)

The Math Coordinator continued to explain how Calendar Math would work on different multiples of numbers for each upcoming month, which would help with the students' multiplication math facts. She also emphasized that Calendar Math reinforced skills and also filled in gaps. All fourth-grade teachers reported feeling confused about the process

of multiplication verses the mastery of multiplication. Teachers were confused on how to assess students when the Math in Focus assignments expected the final answer of a multiplication problem, which was mastery. The Math Coordinator explained that the math problems could be worth more than one point. One point could be for the process and another point could be for the answer. The Math Coordinator also stated that point values could be tweaked, but how the points were allocated should be a grade level decision. The Math Coordinator wanted all the fourth-grade teachers to be consistent with their grading. Teacher A asked, "So for the one point, is that they are doing the process, but maybe doing the wrong answer for the multiplication problem?" The coordinator responded with:

> Yes, they might miss the answer, but if they understand what they are doing, but just have poor computation, then they get a point for the process and miss the answer. Math is scored the same way. And MAP is scored the same way. (math coordinator, personal communication, October 2014)

Teacher D clarified,

> So if we are grading them on understanding, let us just say this is the test, and they get the work and not the answer, it would be a 50%? So they could make a 50%? But how would we do that if we are not grading mastery?

The coordinator responded,

> Do you grade on points? Some of these are more than two points. So this one over here is worth three points. This is worth two points. You can, you can make this was worth three or four points. You can say in the first year. You cannot do this 6 years from now. In the first year you can say you know what, this is really

> a tough problem. Did they even have a way to start it? If they had a way to start it, that looked halfway reasonable, give them a point for that. Okay, you guys have to make those decisions, but that is what you do before you teach those chapters theoretically when you look at your test prep. (math coordinator, personal communication, October 2014)

The coordinator then pulled out the Test Prep for Chapter 3 and stated,

> This is a basic question. Because when I went through and looked at the test prep for chapter 3, is it a basic question, an application question, or novel problem? So I looked at this and said this is a basic question. They are just asking them to find the answer. So I am going to expect to see partial product out to the side. A kid might use an area model if they are struggling. Because that would be a good explanation. Number two is application because it is in a story problem. So I am going to look at the language. The language is about which means are talking about estimation. So that is something I want to pay attention to as I go through my chapter and teach my lessons. Occasionally I would be asking my kids, okay before we work this, what do we think about the answer? So that tells you through my lessons I need to be pulling that in. This is basic except it says 8 can be subtracted from 2560 how many times? Seriously do we want them subtracting? Absolutely not! They will be subtracting till the cows came home. One thing we want them to understand is that division is what, repeated subtraction. So it is a strategy. You just want to talk about that language so that does not freak them out and they start trying to subtract that out. You want them to divide, but they have got to understand that. So you teach that. As you go

> through the chapter and when you look at number four, its application, but it talks about has half as many stamps. That language there is important and you can teach that language as you go through the chapter if they are not doing it in the chapter. (math coordinator, personal communication, October 2014)

Teacher D needed clarification and asked,

> I guess what we are asking is, let us go back to chapter 3. How many times can 8 be subtracted from 2560? So they divide, and they get the wrong answer. But division is not supposed to be mastered till the end of sixth-grade? So I am confused at what we are grading then.

The coordinator explained it by using an English example,

> So when you teach main idea in fourth grade, are you not going to assess on that even though they are going to be doing main idea in sixth grade? You are assessing them on where they are right now in that journey. We expect them to have an understanding of the process of division. That an expectation. We do not expect them to be fluent with the algorithm until the end of sixth-grade. So we have to plant that foundation so we are doing whether it is partial quotients, whatever we are doing to help them. We are going to do standard algorithm over here. Okay, because that is with the manipulatives, where the kids are dividing and sharing those out, being able to sketch those out, just like she did the 525 divided by something with you in training. That is the expectation. (math coordinator, personal communication, October 2014)

Teacher A asked, “They are probably going to get a D or an F if they can do every process and if they get the wrong answer?” The coordinator responded saying,

> But if you have been working on this in class, they should understand that the answer and the process are both important. And if they are getting the wrong answer, then they do not really need to have A or B. (math coordinator, personal communication, October 2014)

Another teacher commented that parents were going to get upset about the grading. The coordinator responded,

> So here is the issue, and it is not the answer to say, the district said we had to do that. The answer is it is good math. If you do not understand in place value what you are doing here, it does not matter, you do not even know if your answer is close to right. You have no idea where it came from. You cannot even judge whether your answer is reasonable if you do not understand how you were dividing this out. So then kids who make mistakes in division and never understand why they made a mistake because they have no understanding of the process. (math coordinator, personal communication, October 2014)

After the meeting, Teacher B responded, “It seems like if we did not go digging for information, we would not know if we are doing it right. There should be a workshop or something that explains all this.” Teacher A responded with,

> They are not expected to master it, so if they are not expected to master it, then they should not have a 50%. If they do not know it, but they still get a 50%. You [Mathematics Coordinator] are telling me they have to know it because they are failing it. She [Mathematics Coordinator] was not seeing that because she does not see it as a grade. But as a classroom teacher, we know we have to take grades.

Also, in the latter October meetings, teachers discussed ways in which they decided on which small groups to work with. Ideas shared were: I walked around to see who does not get it. I used post-its, red, yellow, and green. They did one problem and put the post-it where they thought it goes. Green meant they understand it, yellow meant they sort of understand it, and red meant they are struggling. They place their post-it note where they feel they are for a particular problem. Another teacher used exit slips, which consisted of no more than two problems to check for mastery. Another teacher mentioned that she used so much time on instruction that she would just call back five students at a time. If they understood, she would let them go back to their desk.

Another way fourth-grade teachers utilized their weekly meeting time in October was reviewing the Test Prep. Teachers would take the Test Prep for the upcoming chapter, which was suggested by the Math Coordinator. After solving the problems, they would discuss each problem as a grade level. They would go over how many points should be allocated for each problem. As a grade level, it was agreed to add teacher directions next to several problems on the Test Prep. These directions gave students specific directions on what the expectations were. Some problems just had 387 x 6. Teachers would indicate next to the problem that two strategies were needed. Teacher A suggested a template for the students to show their work. By making the template, it would be organized for the student and the teacher. So if a problem asked for two strategies to solve a problem, a template was created with two squares next to number one. The group also decided to write the problem on top of the template, so students were not confused with transferring problems from one piece of paper to another. The process was continued until the entire Test Prep was completed. Once the Test Prep was

completed, as suggested by the Math Coordinator, a scoring guide was made for the teacher, as a reminder of how many points each problem was worth. Teacher D added that by taking the Test Prep in advance and knowing what to expect the students to know, this definitely would be beneficial when the topic was taught. She also stated that it would have been helpful if there was a better explanation and examples of all the different multiplication strategies expected of the students.

Collaborative Work met once during the month of October. During this team planning time, the teachers looked ahead to see what skills were approaching. Fractions were the next unit. All four teachers took the Test Prep for the fractions chapter. They also knew that fractions were not taught to fourth graders last school year, because the third grade teachers did not get to that chapter. Third grade skills for fractions that should have been taught the previous year were comparing and ordering fractions and adding and subtracting fractions with like denominators. The group went through the teacher manual and went to the section of Remedial Options, to see which lessons corresponded with the Test Prep. It was decided that students should be able to demonstrate equivalent fractions in simplest form. As the teachers began to create the formative assessment, they realized simplifying fractions would be too complicated for the introduction of fractions. They did not feel as if any of the students would get any of the problems on the formative assessment correct; therefore, skewing the numbers to place them into leveled groups. All the students would have been placed in the intervention category. It was decided to change the student objectives to demonstrating equivalent fractions using concrete, pictorial, and abstract ways. Teacher B commented,

"Since we are trying to identify higher students, we need questions that students would know basic knowledge of."

After the group came up with the four questions for the pre- and post-tests, they created a scoring guide to keep teachers consistent with grading. Next, they decided on the dates to give the pre-tests and the post-tests. They also decided on the dates and times for Essential Time, which were when the students were sent to different teachers' classroom for the leveled instruction. They borrowed a third grade teacher's manual to see what should have been taught in fractions. The teachers then created a Powerpoint lesson on the basics of fractions. The higher leveled group also had a Powerpoint created by the teachers that would address the fraction concepts they should have acquired in the third grade. Teacher D commented, "This background knowledge will help when we get to fractions. This will be a skill the students will already have when we introduce our fractions chapter."

In the first meeting in the month November, which was prior to the next professional development, one of the items discussed was an email from our Math Coordinator that based on feedback, and Math in Focus and district expectations, grades 2-5 will be focused on bar modeling and analyzing Test Prep for instructional purposes stating (mathematic coordinator, personal communication, November 7, 2014). The email elicited some feedback from the fourth grade teachers. Teacher A commented,

> So apparently a lot of people have had the same questions we had for it to be part of our training. I think it has come back to our Math Coordinator when people have been looking at the Test Prep … this is completely different than what we are teaching.

Teacher D commented,

> Actually, when we requested the meeting, it was not about the Test Prep. It was about her October Tips and the mastery level of multiplication and division at the end of fifth and sixth grade. However, this did prompt her to explain how we were to assess the Test Prep.

Emerging Theme

An emerging theme from the November meetings was the struggles with division and multiplication in chapter three for the students. Teacher B stated, "It seems like my kids, using all these different methods and strategies is confusing to them. They cannot keep all the methods straight." Teacher A commented, "I would like to have a test on just multiplication and then a test just on division." Teacher C added, "That is why I have been reviewing division this week. And I just hit a brick wall." Much of the frustration with chapter three was the wording of the assignments. Teacher C commented, "But they change the wording around so unless you are teaching to that specific assignment and not from the text. Because the text is even different than what some of the assignments are." Teacher D added,

> Like the test question, how many times can eight be subtracted from 2,580 or some four digit number like that. I know it was brought up at our last meeting with the Math Coordinator. You have to put these little note in your manual to help you remember the language.

Teacher B added,

> Yea, I mean obviously there is nothing on any assignment that states that. You know what I mean? Just things like that. You teach it and you think they are

understanding it. Then they get the assignment and it is worded differently, directions are different. Then they do not know what they are doing, you know?

November Professional Development

The next professional development required was the November workshop. The presenter was a representative from Houghton Mifflin who resided in New Orleans. There were 21 fourth grade teachers in attendance, all from various elementary schools in the district. Once again, this group of teachers were all in their first year of Math in Focus. The presenter began by having teachers discuss, as a whole group, some successes they were seeing in their classrooms. Some of the successes from the teachers were: "After our first section on the benchmark, they did much better"; "There were a ton of example problems where they explained their thinking"; "Long division method makes more sense than drawing arrows, the way we use to teach it"; "A good, solid understanding of place value. The value of the digits is there. That has been missing for a while"; "I like the Thinking Cap worksheets. I have them work in groups, then give them butcher block paper to show their thinking. I like that my thinking may be different from theirs" (teachers from workshop, personal communication, November 6, 2014).

The presenter asked the teachers to discuss what their challenges were. Some of the challenges from the teachers were, "Navigating the website and all the workbooks"; "Filling in the gaps"; "We were told that our students did not have to master multiplication and division, but if they do not, they fail" (teachers from workshop, personal communication, November 6, 2014). The presenter addressed the issues by navigating the website to show the teachers how to access all the workbooks. The presenter also addressed how to fill in the gaps. She explained there was a transition

resource map online that could help fill in the gaps. The presenter also explained that the Singaporean philosophy was that students should be able to apply concepts, even if the language changes. In regards to mastering multiplication and division, she mentioned that was something the district had to address.

The next portion of the professional development was about problem solving. She asked what model drawing does for students and provided the following: "Provides an entry point. Communicates what math operation needs to be done. Encourages analysis of givens and restraints. Promotes algebraic reasoning" (PowerPoint from workshop, personal communication, from November 6, 2014). The presenter then went over different bar modeling examples that utilized addition, subtraction, multiplication, and division. The district Math Coordinator went over Calendar Math for the next topic. She discussed how different parts of Calendar Math could be chosen based on student needs. She suggested that if students were struggling with multiples of four and daily deposit, let that be the focus. She also reminded teachers that parts of Calendar Math that were not reviewed should be updated. By updating, she meant that some of the numbers used in Calendar Math are based on the number of the day in the school year. If it is the 40th day of school, many of the components of Calendar Math should represent that number.

The presenter went over an upcoming chapter on fractions. She explained that students would need to compare fractions using number lines, bars, and circles. In order to make it concrete for students, unifix cubes, fraction bars, and blank strips of paper should be used to compare fractions. The Math Coordinator chimed in, "Fraction strips are non-negotiable. Students must use stuff. Students must have a reference of where fractions are coming from. Fractions cannot be taught abstractly." The Math

Coordinator also added that when students were expressing fractions in simplest form, the algorithm that was explained from the Math in Focus textbook should not be taught. The algorithm was not an explanation. She wanted simplest form to be taught concretely or pictorially.

Feedback

The researcher conducted a post workshop interview for each attending fourth-grade teacher within the week of the workshop, with the intent to seek their reactions to the workshop. All four teachers were in the same professional development workshop. All four teachers felt this workshop was beneficial. A common theme was how the district wanted teachers to teach a concept differently than how the textbook indicated. Teacher A stated,

> We are no longer teaching what is in the book, but we do not have a guide to teach. Well, it was the same with multiplication and division. We were told to teach all the multiplication strategies which are not in the book at all. But we are supposed to assume that we knew to teach them. So now I am concerned with what is to be assumed that I am teaching in every chapter. We are not supposed to teach them multiplication or division to find like fractions, but that is what all the worksheets are. They are supposed to draw them and find other ways. And I just do not see how that is necessarily relevant and that we can grade because there are no worksheets. We are supposed to stay true to the book. So it is just confusing how to do it.

Teacher B stated,

> In multiplication, the trainer said we need to follow along with the book and do what the book says. But then they are adding things that the Math Coordinator would like us to do, like area model and partial product (multiplication strategy) in everything, which area model is not mentioned in the book. We looked on the district website for area model for an explanation. And with our next chapter that we were going to be starting with fractions, with the equivalent fractions, we were looking at the test then looking at that chapter before. We were unaware that the Math Coordinator does not want us to teach the multiplication and division signs of finding the equivalent fractions. And that is in the textbook and all of their assessments and workbook pages.

Teacher C stated,

> There is a lot of things we just are supposed to assume or go find for ourselves. The Math Coordinator said that Singapore math is always pictures. That was one of those, we are just to assume that we would do pictures with everything. Okay, well I no longer assume it, I know it. I did not know to assume, and that seems like that is a lot of this in Math in Focus. There is a lot of things we just are supposed to assume or go find for ourselves.

Teacher C also added, “But chapter 3, it seemed like every time we would teach something, oh no you have to go back and do it this way." Teacher D mentioned,

> The district wants you to stick with the book, however every chapter that has been taught so far, chapter 1, 2, and 3, the coordinator has made some sort of exception. The exceptions seems to come after the fact. The only exception would be this workshop where we looked ahead to fractions.

Emerging Theme

A common theme for fractions was about how the prior grade did not get to the chapter about fractions the prior year. So the students current to the study had no background regarding fractions. Teacher D stated,

> Fractions may be a problem. Third grade never taught fractions so we need to teach or touch on third grade fractions. In addition, we have to teach fourth grade fractions. Our pacing guide from the Math Coordinator gave us 21 days. Math in Focus chapter 6 (fractions) gives us 17 days.

Teacher C had concerns with the pacing guide for fractions and said, "Did the Math Coordinator take into consideration some schools have to reteach fractions because third grade never taught it?" Teacher B said,

> We are going to have to parallel teach third grade fractions along with fourth grade fractions because third grade last year did not get to fractions. So we are now required to teach their objectives, as well, but we cannot stop and just teach theirs because we have to move forward, and we do not have enough days built into our schedule for us to take the time to actually go back and teach those foundational skills. So we have to do it alongside ours. So basically reteaching two curriculums of fractions in one year.

However, Teacher A stated positively, "The Math Coordinator talked a lot about fractions within Calendar Math which I thought would kind of help catch them up on what they missed in third grade. I guess that was something else that I looked forward to." Teacher D also added, "Well, at least we have our essential time to teach the foundation of fractions."

Parts of the workshop that teachers felt were beneficial were the bar modeling examples. Teacher C said,

> The workshop did give me a better glimpse of what a bar model was. It did show me how to do it because the book does not really give you a good explanation. The book, they give you all these worksheets, but there is very few with the answers that have bar modeling. So at least I do have some notes that I can refer back to and understand about bar modeling.

Teacher A stated, “I was inspired to try to teach bar modeling, I guess. It was our first time really learning about it." Teacher D stated, “I felt more prepared regarding bar modeling. I like how she started with primary grades and then moved to fourth grade. It is good to see the foundation of bar modeling." Teachers also thought the focus lessons in the back of the teacher manual were beneficial. Teacher A said, "We learned about those extra lessons in the back of the book that nobody told us about."

Three teachers mentioned that it would have been convenient to get notes from the Powerpoint from the presenter. Teacher C said,

> I spent a lot of time writing down the word problem and then to copy down the bar model, and I guess I just do not multi-task very well. And I spent more time concentrating on getting the script written and drawing the bar model that by the time I got all that done, she was moving on to something else. And I had not heard the explanation. They should copy off the Powerpoint for us or give us pre-copied problems with the bar models on there so that we can just kind of look at her modeling, and we do not have to concentrate on writing all the problems down.

Teacher A mentioned, "But I feel like everyone in the room was not paying attention because you were too busy trying to write down the problems. So to have those in front of us would have been extremely helpful." Teacher D also stated, “Sometimes you focus too much on copying the problems that it is difficult to really listen to the conversations that are taking place.”

Team Planning

During some of the November meetings, the teachers created exit slips, assignments, and other forms of formative assessments with strategies for the multiplication and division chapter. These strategies included place value charts for students to show pictorially how to divide utilizing four digit dividends. The district’s expectation of utilizing different strategies for solving multiplication and division problems was different from Math in Focus’ expectations. The district wanted students to continuously show their understanding pictorially. Math in Focus concentrated on the pictorial aspect, but many of the latter assignments focused on the algorithm of a problem. In order to prepare students for the understanding of the algorithm as opposed to the mastery, these assignments seemed essential for students to be successful. Fourth-grade teachers also created a study guide that resembled the Test Prep for chapter three, multiplication and division. The study guide mirrored the Test Prep; however, it utilized different numbers and story problem examples. The study guide included the same template expected of the students in the Test Prep, which was to show their understanding pictorially. This study guide also included an answer key with point allocations to assist the teachers with expectations for Test Prep. The teachers discussed how to effectively and fairly grade the tests that would be given over multiplication and

division. The expectations of student answers and work were hypothesized for universal grade level grading. It was important for the grading to be consistent amongst the grade level team.

Other meetings consisted of utilizing the Think Central website for Calendar Math. Math in Focus offered a kit that could be displayed as a bulletin board for Calendar Math, which every fourth-grade teacher had displayed in the classroom. One teacher found the online version that could be displayed on the projector, updated it, and saved it. This online version was shown as an option for those teachers who wanted to use the online version versus the bulletin board display. The November Calendar Math online version was used as an example in the meeting to show all the different elements available. Each slide was discussed in depth for understanding for each teacher. This teacher also assisted the other fourth-grade teachers with downloading the online version on their desktops. Each month for the entire year was placed in a folder on their desktops. The consensus was to keep the calendar and counting tape displayed on the bulletin board and utilize the remainder of the elements online through the Think Central website. This would allow the students to manipulate components through Smart Board interactions.

An additional meeting allowed the grade level to discuss the background knowledge of the students in regards to fourth-grade expectations for fractions. Before beginning, the group emailed the Math Coordinator to make sure they were teaching fractions as the district expected. The teachers were aware that expressing fractions in simplest form was not to be taught by dividing or multiplying the numerator and

denominator by a common number, but to express it pictorially. They wanted to make sure that the remainder of the chapter was taught the way Math in Focus indicated.

The Math Coordinator responded via email,

"First, here are the most important understandings that students should begin fourth grade with. These understandings should have been developed with paper strips, grid paper, number lines. Need to emphasize what makes a whole, whole must be the same to compare fractions, unit fractions and unit fractions can be added to make the whole, make equivalent fractions, and add and subtract like fractions. Use the Recall Prior Knowledge and Pretest (the one in assessment book) to determine what understanding your students have or need to know about fractions. Use fractions strips or I can send you directions from Marilyn Burns for fractions strips. Number lines and grid paper should also be used. For skills that need to be reinforced, decide if the skills can be taught alongside (parallel) with fourth grade lessons. If the weak skill is not directly related to any fourth grade lessons, it should be frontloaded. Use the transition guide on Think Central to locate materials needed. For fourth grade lessons, use paper strips and number lines throughout the chapter to reinforce equivalent fractions. When you get to multiplying fractions, grid paper will be an excellent model. Students may use the multiplication strategy for finding equivalent fractions as long as it is connected to the paper strip models or the number line model. At all times, students should be able to explain or show with a model how to find equivalency and how to multiply by a whole number. Just using or knowing an algorithm to find equivalency, add and subtract unlike fractions and multiply is not acceptable

> without a model or representation. If you would like more detailed info, I would be happy to come over and talk through the planning with you. (mathematics coordinator, personal communication, November 15, 2015)

After looking at the fraction chapter and the pacing guide, the consensus was the pacing to teach fractions was not realistic. The pacing guide allocated fractions from mid-November to the end of December before winter break, or 21 days. Of the 21 days, the school dedicated two days before Thanksgiving break to Pioneer Days. Two additional days were early release, which meant students were dismissed two hours earlier than their normal dismissal time. There was also the winter party at the end of December.

To plan for fractions, the grade level took the Test Prep for fractions. This gave a good indication of what was expected of the students. The teachers went through each problem looking for mathematical vocabulary that could be unfamiliar to fourth-grade students. Some words that were highlighted were sum, difference, equivalent, and express. The teachers also noted how improper fractions had to be converted to a mixed number and mixed numbers to an improper fraction. Students had to be able to add up to three fractions with unlike denominators. Also, the answers had to be in simplest form. Students had to be able to subtract proper fractions from whole numbers.

Explicit directions had to be followed on the Test Prep as the answers to fractions were asked to be expressed in different forms, mixed number or improper fractions. For example, there were fractions whose sum equaled a mixed number; the directions would want the answer to be expressed as an improper fraction. In order for the Test Prep to follow the school district requirements, the test had to be modified with additional directions indicating students to draw the fractions. The grade level created an extra

sheet for the assessment so students could show their work pictorially. As a grade level, the teachers went through each section throughout the chapter and created assignments for fourth grade fractions because Math in Focus assignments did not focus on the drawing of fractions, as the district mandated.

According to the email from the Math Coordinator, third grade curriculum was not to be taught in isolation, but to parallel teach. Due to this group of students not being exposed to fractions in third grade, the teachers decided to utilize the Essential Time or Collaborative Work for the foundation of fractions. This included vocabulary terms, such as denominator, numerator, equivalent, equivalent fractions, unlike fractions, mixed numbers, simplest form, and improper fractions. Several meetings in November consisted of looking at third grade curriculum of fractions to see what prior skills were needed for success in fourth grade fractions. The grade level put together a Powerpoint with all the prior knowledge needed from third grade fractions. They retrieved a third grade teacher manual in order to remain consistent with how Math in Focus taught fractions. This Powerpoint was created and modeled to mirror Math in Focus third grade fractions.

Another email was sent out by the Math Coordinator. The December meeting discussed the email from the Math Coordinator. The email was regarding multiplication and division with sketching and three models for breaking into equal groups: circles, area model, and place value mat. The grade level had already taught and assessed multiplication and division two weeks prior to this email. After looking at the three types of models mentioned in the email, the grade level had taught two of the three suggested by the Math Coordinator. For the third model, they used place value circles instead of

base ten models. They felt as a grade level that it had the same understanding effect. The consensus was to use this information for next year. As Teacher C stated, “I will just put it in my file for next year.”

Another email was sent to fourth-grade teachers in early December. This was an attachment that had cards to go with the Hands-On Activity for two fraction lessons. This email was appreciated by the grade level, because the activity was time appropriate for the lesson they were teaching. It was in accordance with the pacing guide. An additional email was sent to fourth-grade teachers with directions for a fraction kit. The email also indicated that the fraction kit should be used for days one and two of fractions. The frustration as a grade level was once again the timing of the email. The entire fourth grade team had already started teaching fractions, and this was to be used for Day 1 and Day 2. Teacher D stated,

> According to the pacing guide, fractions were supposed to start in mid-November. She needs to realize that there are some teachers who are on pace with the pacing guide. This fraction kit should have come to us in mid-November, not December.

Teacher B commented, "I am not going back. My kids get it. I have to move on." Teacher A commented, "You are better off if you are behind on the pacing guide because she sends us stuff two to three weeks later. So you are better off if you are behind." Teacher D added, "This is very frustrating because she wants you to keep on pace, but yet we have to backtrack with fraction kits." This meeting was very frustrating for the grade level because everyone was trying to stay on pace with the district's pacing guide. One lesson in Math in Focus that required one day for instruction was very difficult to adhere

to. Even though the Math Coordinator gave additional days on top of the Math in Focus pacing guide, it still did not feel like an adequate length. An example would be a lesson teaching finding equivalent fractions and adding unlike fractions. Math in Focus allotted one day for this lesson. However, these two skills required background knowledge that fourth graders lacked. Equivalent fractions had to be taught strictly through pictures. Adding the fractions with unlike denominators was also taught through pictures. In order to add the fractions with unlike denominators, students had to have a strong grasp on equivalent fractions, as one of the fractions had to be converted to a different fraction that had the same denominator as the one being added. Common mistakes from students included to just add numerators and denominators together to get a new fraction. This was a very difficult topic to teach in a few days, yet alone one day. This was just too confusing for students to grasp in a short amount of time.

For the January meetings, the grade level discussed reviewing fractions that were already taught in December, due to the winter hiatus. The teachers created a study guide and answer key that would emulate the fractions Test Prep. Teachers discussed which lesson they were on in regards to teaching fractions. Two of the four teachers were ready to assess the students on fractions. One teacher was in the middle of fractions. The other fourth grade teacher was just beginning fractions. We sent an email to the Math Coordinator to make sure we were on pace with the math instruction. The Math Coordinator was stringent on keeping up with the pacing guide, reminding everyone that if they get more than two weeks behind, she should be contacted.

The teachers also inquired as to how to sign students up on Think Central for students to access the online textbook. The Math Coordinator responded via email,

Fractions, including the December tips daily breakdown, should take about 25 to 27 days. Concrete models, sketches, and number lines should be incorporated continually during instruction. If a teacher started chapter six before break, she should easily finish by the end of January. If you started after break, she would go into first week of February (mathematics coordinator, personal communication, January 9, 2014). The Math Coordinator also explained how to sign up students for Think Central.

As a grade level, we created a letter to parents regarding Think Central. The letter included the website address, the student's user name and password, how to navigate to access the textbook, workbook pages, and the virtual manipulatives. The grade level also decided to familiarize students with Think Central and how to navigate the website, to avoid any confusion at home. Computer time was reserved for each teacher for this process.

January meetings consisted of creating an exit slip to check for mastery and understanding of Calendar Math skills. The exit slip was created to give to students at the end of January, after continuous repetition of January Calendar Math. The exit slip consisted of the slides from Think Central that were repeatedly reviewed with students. Exit slips were also created as a formative assessment for each lesson taught in fractions. These exit slips were created by a teacher and shared with the grade level for understanding. The grade level also discussed how many points were to be allocated and what the expectations were for student mastery. Once again, the grade level wanted to remain consistent with grading.

Some of the January meetings had discussions on the fraction lessons. One teacher mentioned that if she were to start over on fractions, she would give a rotating

review of previous lessons on fractions. She indicated that after students learned a different lesson in fractions, they forgot what to do. She thought it would be good to have them do a few problems from the previous fractions lessons.

All four teachers agreed that subtracting and adding fractions with unlike denominators was the most difficult for fourth graders to understand. Teacher B mentioned her frustration with fractions by stating, "I keep beating a dead horse. I cannot keep re-teaching and re-teaching small groups. I mean, you know what I mean. I just cannot do it. All I do is teach the same thing over and over." The meetings also discussed which lessons each teacher was on and the pacing of the lessons. The teachers wanted to stay with the pacing guide and also the pace as a grade level. Any teacher who started teaching a new fraction lesson prior to other teachers would also discuss what struggles the students had, what worked teaching-wise, and what did not work teaching-wise. This was beneficial, as it prepared the teachers for obstacles to come. Teacher B also stated in regards to the pacing guide for fractions, “If mine are really struggling, I will push the date back again."

As a chapter was closing, it was important for all of the fourth-grade teachers to preview and discuss the upcoming chapter. They had become proactive with the pre-planning of the upcoming lessons. All the teachers wanted to make sure they were prepared for how and what to teach.

The upcoming chapter was on decimals. The group emailed the Math Coordinator to inquire whether the lessons on decimals for Math in Focus were to be taught like the book modeled, if they were to be taught differently than the book, or if any lessons were to be excluded. The Math Coordinator responded via email:

The emphasis is on understanding the whole (1) in decimals, especially in. In Calendar Math, you use pennies to work on decimals. Students still confuse 10 pennies as whole numbers rather than 10/100 of a dollar or 1/10 of a dollar. It is imperative to visually help them understand the difference. First, emphasize and encourage the connection between fractions and decimals. They should be able to go back and forth from fraction to equivalent decimal and decimal to equivalent fraction easily. Use the ten rod in the horizontal position consistently to help students think about the value represented differently than in base ten whole numbers. Tie the horizontal tenths bar to the number line representation. Students should be sketching or using the model on TR p. 57. Lesson 7.2, again and even more important here, make the connection to the model. Students will confuse the hundredth model as 100 whole numbers rather than 1 whole in 100 little pieces called hundredths. The number line is huge. Continue to connect equivalent fraction to the decimal and vice versa. Lesson 7.3, use models even after the text does not show them. Lesson 7.4, personal opinion, the language of round down is not my favorite. Focus on the closest whole number on either side of the number to be rounded. Hands-on Activity p. 39 and Let's Explore p. 40 are great to do. They can also order the decimals after they measure reviews measuring skills. Lesson 7.5, be careful with finding simplest form. This is a direction in the book. It is not an expectation every time. There will be times when simplifying should not be done. Avoid teaching it as a rule that must always be done. Chapter 8, focus on what they know about adding and subtracting using the relationship to place value. They are practicing basic facts

> and the regrouping process and extending that background to new content. (mathematics coordinator, personal communication, January 24, 2015)

The grade level decided to teach decimals up to spring break, which started the second week in March. Teacher A added, "I would go up to spring break because do you really want to do what we did with fractions, (winter break) start it then stop it." Teacher D added, "Yea, that was a bit chaotic. The students really forgot a lot about fractions in that two week break." They began planning for decimals by having the teachers take the Prep Test. After completing the Test Prep, Teacher A said, "The thing is I can do this and explain it to you, but to explain this to a student. They would be cross-eyed." Teacher B commented, "When I first looked at this, it looked like Chinese. Because last year, we taught a ton of decimals. I mean we taught money." Teacher D positively added,

> A lot of this goes back to fractions. They are going to need to know how to transfer decimals to fractions. Then how to add these fractions with unlike denominators, like denominators, or whole numbers, which we would have already taught. Plus Calendar Math covered a lot of this.

Teacher A added, "Did third grade teach decimals?" As a group, the teachers looked through the Teacher's Guide to Transition and realized that third grade taught lessons by adding and subtracting money. We continued and went through each problem on the Test Prep and noticed that some of the problems were taught through Calendar Math. Teacher D positively said, "So let us look at number one again. They should know this is 95 hundredths because when you do Calendar Math with the pennies in the hundreds chart, they should know this." The group decided to look at the lessons from the Teacher

Manual. Regarding prior knowledge for students, the grade level felt the students were proficient due to the previous teachings in fractions. They looked through the Teacher manual, and Teacher C optimistically said,

> So it says, Recall Prior Knowledge, the shaded part shows 3/10. Read 3/10 as three tenths. They have to write this out which they do in all the worksheets. So the shaded parts 23/10 or 2 3/10 or two and three tenths in words. Expressing fractions as equivalent fractions with a denominator of 10 and simplifying fractions with a denominator of 10. They should know how to do this. Number line, they should know how to do a number line. They should know prior knowledge because it is all fractions.

Copies for the pre-test were prepared. The group discussed the manipulatives that would be required for each lesson. As they did with all chapters, they made copies of all the assignments to be given to the students. Teachers discussed how the assignments from Math in Focus were several pages and/or many problems. Teacher C mentioned, “I am looking at this and this first worksheet packet is 10 pages." This particular packet was for Reteach. Teacher A commented, "The first Extra Practice is 50 problems for 7.1." Teacher A explained, “I do not pass it out and make them do the whole thing. I break it up or have them do even or odd." Another teacher mentioned her students lose everything, and these were very long packets. A teacher added that the packet had 58 problems and another had 38 problems. The group decided as a grade level to copy them as packets and to leave it to the discretion of the teacher concerning which problems were due as an assignment for students.

The teachers went through the teacher manual and tabbed all the resources and black line masters required to teach decimals. The teachers discussed the lessons and made copies. An additional lesson was created to aid students in decimals. It utilized a ten by ten array of pennies. On one array each penny was labeled .01. The teachers then took different arrays and labeled a ten by one array with 0.1; a ten by two array with 0.2; a ten by five array with 0.5; a five by five, split an array into quarters, and labeled with 0.25. They had the students color code each one of the arrays with a different color and cut them out. This allowed the students to decipher hundredths and tenths. A study guide was created for decimals that emulated the Test Prep. This study guide included directions for students to show their work pictorially in a designated area. Notes on decimals were created by the teachers for students to use as a reference. The notes focused on place value from the hundredths and up to the thousands. The notes consisted of number lines with equivalent decimals and fractions, hundreds chart, and money. These notes showed how these items could be represented as a fraction and a decimal. The teachers also created exit slips for formative assessments for each lesson in the chapter.

The pacing guide with respect to decimals was also discussed. The district pacing guide allocated 15 days. Math in Focus also allotted 15 days. Typically the Math Coordinator added on extra days beyond what Math in Focus suggested. The discussion of when everyone would be assessing students on fractions and beginning decimals allowed teachers to see if they were on pace with the district pacing guide. Fourth-grade teachers were given a pacing guide at the beginning of the year. With the Math Coordinator's last email indicating the flexibility of when fractions could be completed,

the initial pacing guide was not accurate. The pacing guide from the beginning of the year indicated that fractions should be finished in December and decimals should be completed by the third week in January. Some issues with completing decimals in 15 days for the month of February were early release days and Martin Luther King holiday. Teacher C said, “I lose one day a week of teaching because some students leave all day for the gifted program." An email was sent to the Math Coordinator requesting an updated pacing guide. The Math Coordinator responded by stating,

> There will not be an updated instructional sequence. It is not likely that anyone is ahead of the sequence. That is reasonable considering this is our first year and there are gaps to fill. Conceptual understanding is the most important thing for fractions and decimals. Mastery of the algorithm of fractions is not the focus, but the understanding and explaining through a sketch or explanation. Understanding of fractions is expected and not specifically instructed again. So this is the job of fourth grade. (mathematics coordinator, personal communication, January 29, 2015)

Another January meeting consisted of discussing the student's assessment on fractions. The consensus was how well the students did. This was quite an elated feeling for the fourth-grade teachers. Teacher A mentioned,

> This is the first chapter that we have been able to teach somewhat like the book. Remember multiplication, there were a bunch of different strategies and they were not in the book. Well somewhere in the back of the book, but nobody told us that they were there.

Teachers also discussed some confusion from previous chapters. One teacher mentioned how she did not like how multiplication and division were taught and assessed together. Another teacher thought multiples and factors were confusing for students and students could not distinguish between them. The students would get confused on the two terms.

Collaborative Work planning focused on reviewing division. A discussion was brought up that when teachers teach a chapter and then move on to another chapter and skill, students forget the process of how these skills were taught. The teachers chose to review division for Essential Time, because some students were struggling with improper fractions. They created a pre- and post-test that assessed them on four different division problems. Each division problem had four digit dividends. They chose division problems where the quotient had a zero in each of the place values. They discussed dates to administer the pre- and post-tests, and also scheduled the essential times where students would be placed in groups based on their pre-test scores.

February Professional Development

The final February workshop for the school year was conducted by the same representative from the September workshop. The Math Coordinator for the middle school and three Instructional Math Coaches from the school district were present during the workshop. The Math Coordinator began the workshop by stating, "The first year purpose is to provide background. This will help us figure out how to move to the end of the year, build content knowledge, and expectations of students." (mathematics coordinator, personal communication, February 20, 2015). The presenter asked each teacher to think of what was going well, any problems or concerns, and one question they still had. Each teacher wrote this on a post-it and put it on the front board. The presenter

then asked where teachers were on pacing. The consensus was somewhere between finishing chapter seven, decimals, and beginning chapter nine, angles. (According to the initial pacing guide, chapter seven was to be taught the first three weeks in January and chapter nine beginning the last week in January, skipping chapter eight until May. Chapter nine should have been covered by mid-February and chapter 10 starting in the second half of February. This meant that teachers who were finishing chapter seven were behind the pacing guide. And those who started chapter nine were already behind, according to the initial pacing guide. However, with the extended dates, Chapter nine, which was the chapter the fourth-grade level was on, put the grade level on pace.) The Math Coordinator added that the speed that was kept up for the chapter that teachers were on (referring to those on chapter nine, which included our grade level) raised concerns about the depth the teachers taught and how much the students understood the algorithm. She continued to add that teachers may have run through and just did the algorithm. She wanted teachers to reflect on how they taught the chapters, because there was probably some depth and concept missing.

The presenter then listened to some of the concerns from the teachers. One topic brought up was what to do with struggling students; at some point you need to move on. The presenter added, “They will get a chance for mastery in other chapters. For example, you will see decimals again in measurement" (presenter at workshop, personal communication, February 20, 2015). Another concern was grades. The presenter added,

> Why grade the worksheets? There are other ways to get grades. You could use exit slips, Problem of the Lessons which is in your Teacher's Manual, and Chapter Review in the student book. By looking at the Remediation Options in your

> Teacher Manual, it can show you what is assessed in Test Prep (presenter at workshop, personal communication, February 20, 2015).

The Math Coordinator then chimed in,

> Math in Focus researched the problems and why they are placed where they are placed. This is my fourth year in this program and I am still learning why they do it. They spent money researching. You should not be using old worksheets from years ago once you understand their progression and deliberateness. But right now you do not have that knowledge, I do not have that knowledge. Second grade has to produce bar modeling on benchmarks. However, they just found out they are not supposed to produce, just recognize. You do not have the research background to make up your own. (mathematics coordinator, personal communication, February 20, 2015)

Another teacher added that she was told not to use the workbook as a grade. The Math Coordinator responded that the workbook was independent work and taking grades on that was up to the teacher.

The presenter then changed gears to find out what was going well with Math in Focus. Some of the comments were, “Kids were doing well with the pictorials”; “The kids really like fractions because they wanted to stay in for recess to finish”; “Enjoy how the students are having deeper conversations about math”; “Teachers are getting together with grade levels and setting deadlines.”

The presenter added that teaching Singapore math meant changing pedagogy by using the non-negotiables. The non-negotiables were: concrete - pictorial - abstract, visualization, math is thinking, and gradual release. She had the teachers talk in groups

about how they incorporated those math non-negotiables in a different subject, reading. The presenter explained that the Chapter Wrap-Ups in the back of the chapter made great anchor charts. She mentioned to make a blank chart based on this and put it on the wall. As the students learned the concepts, students could fill in the anchor chart. She added that anchor charts were good for pictorials for daily lessons. She also mentioned that a teacher could make a copy of the Chapter Wrap-Up and have the students highlight items according to mastery level. They could highlight green if they get it and pink if they need to learn it. For Math is Thinking, she pointed out that the book had pictures of students talking, showing their thinking out loud. She also mentioned that if students were confused, they should ask a classmate near them and then the teacher (presenter at workshop, personal communication, February 20, 2015).

The Chapter Opener in the Teacher Manual also activated prior knowledge and activated schema. It explained to the students why they were learning. Every problem in Math in Focus was made to be realistic. The presenter went over the difference between pictorial and visualization. She mentioned that visualization, which is in a person's head or mental math, was imperative in fractions. She closed by emphasizing these were not just non-negotiables, they were good instruction (presenter at workshop, personal communication, February 20, 2015). The presenter then discussed the items that would be assessed for state testing. The presenter added,

> There are some highly tested items in 4th grade. One is fluency with multiplication and division. Students need to understand of equivalent fractions, subtraction of fractions with like denominators and multiplication of fractions with whole numbers. They also need to understand geometric figures which can

> be analyzed and classified based on properties, like parallel, perpendicular, angles, and symmetry. (presenter at workshop, personal communication, February 20, 2015)

She mentioned that most of this would be covered in Calendar Math. The presenter then went over the difference in state testing with fourth and fifth grade students. She said, "Fifth grade is fractions and decimals. We have a role to prepare them for fifth grade" (presenter at workshop, personal communication, February 20, 2015). She had each teacher get their Teacher's Guide to Transition out. She went over the learning trajectories for Math in Focus. She discussed that there were seven major trajectories, and they were color-coded in the book. This allowed teachers to see how concepts were built. The presenter then went over how to use this book to help teachers. She added,

> Let us look at fractions and mixed numbers. Look at mixed numbers on page 40. Now look at the summary. On the next page there is a chapter write up that tells what happened in previous grades. Look at it in two perspectives. Let us look at second grade with fraction circles and squares. In fourth grade, we move out of circles because it is hard to divide. For pictorial, they draw strips or use pictures, and look at the relationship compared to a whole. They need to know how part relates to whole. Which one is more? So abstract wise 1/5 and 1/4. They will say five is bigger so it must be bigger. Students need to understand the picture. It will be hard for them to understand because they cannot visualize. For third grade, they are adding to make a whole. Students are looking for equivalent fractions through a picture (presenter at workshop, personal communication, February 20, 2015).

The Math Coordinator added, “Paper fraction kits develop that visual model perfectly. But developing that visual model is not what they are coming with from third grade" (mathematics coordinator, personal communication, February 20, 2015). The presenter then gave each table some strips of paper. The number of strips varied for each table. One table received five strips for four people. Each teacher received a strip and the fifth strip was split into fourths. So each teacher received one strip and one quarter of a strip. The presenter stated that this was a great lesson on discovering fractions. The presenter then began talking about fractions that were less than one or a whole then adding them with unlike denominators. She added that in fourth grade, the trajectory was deliberately built. Students will change denominators, but the denominator will be one of the fraction denominators that you are adding. The presenter added,

> Trajectory is deliberately built. It is carefully planned. An order of how it should be unfolded. This is the importance of trajectory. Must know these thing in order to do well in fifth grade. You are setting the concept to learn the algorithm later on (presenter at workshop, personal communication, February 20, 2015).

The presenter then began to show us fractions from Smarter Balanced Assessment (SBA), the Missouri Consortia Assessment, for fourth grade. She added that students must be able to visualize, eliminate answers, and know how to do multi-step problems. She really emphasized eliminating answers by process of elimination. She then showed fifth grade SBA items. The middle school Math Coordinator added, “We really need our students to understand conceptually. There will be a few high flyers that will get it, but still have them draw it. Make sure to have your students show a picture or concrete to make sure the skill is being reinforced." (presenter at workshop, personal communication,

February 20, 2015). The presenter added that sometimes modeling is higher level thinking, not the algorithm. She continued to go over the transition guide and looked at the development of the trajectory for decimals. She wanted teachers to start with second grade and how it was built. She wanted them to look at concrete, pictorial, and abstract, and how those numbers built in decimals.

Feedback

After the professional development in February, fourth-grade teachers were interviewed regarding their thoughts and experience. One of the fourth grade teachers was not present at the workshop. The three fourth-grade teachers thought this professional development was beneficial. The common theme was how successful the fractions chapter was. Teacher C responded,

> My celebration was that it seemed like now that were in this decimal unit, that my kids really had a good understanding of place value and the understanding of decimals. I think because we spent quite a bit of time with fractions. And we have done a lot of bar modeling when I used decimals. We did the bar modeling where we took the bar model and we cut it into fifths, then we cut it into tenths. And they seem to be able to get those equivalent fractions. And maybe it was because we spent a lot of time with the equivalent fractions, in converting fractions that they were just able to see it.

Teacher B commented, "Students did well on the fractions assessment. A large percent of them getting an A or B." Teacher D commented, “My success was how well my class did on the fraction assessment. Overall, our grade level had phenomenal scores."

The pacing guide was still a frustration for the grade level. The teachers were concerned with the comment from the Math Coordinator at the beginning of the workshop. She mentioned that if you were on pace with the pacing guide then you were not going into enough depth. Teacher B said,

> I was a little taken back by it because in the beginning of our training she spoke firmly about staying on pace, and that we should follow the text and be very close. And if we were more than two weeks behind, a week, or two weeks, we had to notify her and she was going to have to come to our building to discuss with us on how to keep on pace. So we stayed on pace and have met all the expectations. And now all of a sudden that we are on pace, now we are not doing it right. So what did she want? Does she want us on pace or not want us on pace? Then why do we have a pacing guide if we should not be on that pace? Then she should just say do whatever you want to do whenever you want to do it.

Teacher C said,

> Well that kind of turned me for the whole meeting because I did not like what she said. I think I know where she is going with that, but she has been on us to stay on pace. She has said that if you fall behind, you need to call me, and I will come in and show you how to get caught up. Now that we, as a fourth grade group, are staying on pace and planning our lessons together. Now all of a sudden we are told if we are staying on pace, apparently we are not going deep enough. Basically it was for me, you are just browsing over. You are just covering it. The kids do not understand what you are doing. You are not teaching it well. And I

> really kind of took offense at that because I do feel that we have gone deeper, and I do feel that the kids understand it.

Teacher D stated,

> That was pretty brutal. Not only for me, but I felt defeated for our grade level. Even looking around the room full of teachers, you could tell a lot of people were not pleased with that comment. It seems that a lot of our push with this new series was to stay on pace so the upcoming grade level teachers would not be at a disadvantage. We really wanted our students to be prepared for fifth grade and worked endlessly to stay on pace. I do not know, maybe she could have delivered that message differently with maybe a bit of a compliment instead of if you are on pace, then you are not going into enough depth. The pace was set by the district. If you did not think the allocated time was appropriate to get into enough depth, why did you set it that way?

Some positive comments from the workshop were about sitting with different teachers from different schools at the table. The previous workshops allowed for optional seating. With optional seating, the same elementary buildings sat together as groups. Teacher B said,

> It was nice to be able to sit with mixed groups and be able to feed off of what the other schools are doing. To see that they were on the same kind of pace as us, and they were doing the same type of things. I felt like I was not totally off base of what I was doing. So it was nice to kind of connect with them, and see how they were doing things in their classrooms.

Teacher D said,

> I liked sitting with different schools. It was good to hear the success stories and how well the students were doing. It was also interesting to hear that the same struggles and successes are so similar. It really validates your teaching of a new series.

Another positive comment from the workshop was from all the teachers who indicated they liked the paper strip activity to show improper fractions. One of these teachers liked the activity, but thought that she may have to make a few changes.

Teacher C said,

> I liked the paper activity she gave us. I like that, but for me it had too many variables just to hand out to one group six pieces of paper, one group three pieces of paper, and say okay, how many halves will that make? I can see just utter chaos in my room with them cutting or tearing it into pieces.

Teacher C approached the Math Coordinator during her break to see how she could implement the paper strip activity differently. Teacher C asked the Math Coordinator if she could have a control group first of all, where she would pass out pieces of paper and everybody had the same, and then do it on their own. And then once they felt they understood that concept, do it as a group where she would break them up and give one group six pieces, one group three pieces. Teacher C then added that the students might understand it a little better. The Math Coordinator explained that she could adapt it anyway that she was comfortable with, but not to change the objective of showing improper fractions. Teacher D added, “I liked how she used the paper strips to explain improper fractions. Even though we have already taught that lesson, this will be nice to use for future years.”

Emerging Theme

An emerging theme was how the trajectories were important, but could be difficult to attain if the previous grade levels did not get to a specific concept. Teacher D stated,

> Our grade level looks at the transition guide prior to planning for lessons. This gives us a guide of their foundation, their prior knowledge. This helped us because some of our chapters were not covered in third grade last year. Of course, it is not ideal to add more skills to teach when another grade does not cover a concept, especially if we are to remain on pace. However, this allowed us to bring the students back up to speed. It was nice though to look at fifth grade trajectories. We typically just look at third grade so we know what they have been taught. Looking at fifth grade made it more clear, apparent, that what we are doing is imperative for their success in math.

Teacher C said,

> Right now we cannot say that because a lot of what third grade has taught, like fractions, they did not teach last year. But in the future, we will be able to say okay, they should already know this. We can pick up here because when we started fractions, it scared me to death that we were starting with adding unlike denominators. Because they did not have this in third grade, the kids did not even know what a fraction was. And I thought, how in the world am I going to teach this when they may not even know what fractions look like, what they represent? You know that one fourth is one of four. So I did some pre-teaching before I even started just so that I would feel comfortable with beginning to teach the lessons.

Teacher B said,

> I mean obviously it is ideal that they know these things (trajectories) by the time they leave fourth grade. But if we are not on this pace, how are they ever going to know that? It jumps. For what we had to go back and reteach things that were not taught in the previous grade levels, so we are having to teach two grade levels of fractions. We taught third grade fractions and fourth grade fractions. So for them to be ready for fifth grade fractions it seems like a lot to ask of these kids.

Team Planning

For the February meetings, one of the things discussed was an email received from the Math Coordinator explaining that the upcoming workshop would be on decimals and adding and subtracting decimals. As a grade level, teachers were frustrated with attending the February workshop with suggestions on how to teach a chapter already taught and assessed (decimals). According to the original pacing guide, decimals were to be completed by the third week in January. Adding and subtracting decimals were not to be covered until May. The teachers discussed that the workshop concepts that were going to be covered should have corresponded with the pacing guide and the projected date of the workshop. The consensus was that the decimal lessons were beneficial, but not for the current students. Decimals would have already been assessed by the time the workshop date approached. Some teachers even mentioned that they would not remember the ideas for next year's students. They would have liked to have an upcoming chapter, according to the pacing guide. They would have liked to learn about teaching perpendicular and parallel line segments and squares and rectangles, which were the upcoming chapters.

February meetings also consisted of planning for the upcoming chapter. The next concept was angles. Each teacher took the Test Prep and discussed the answers, expectations of students, and how to grade the assessment. The grade level also went to Recall Prior Knowledge in the Teacher's Manual and looked at the transition guide. They decided to create a Powerpoint as a review from third grade trajectories.

During a grade level chair meeting, which was where one, constant representative from each grade level met with the administrator, there was discussion about the frustration with the pacing guide and adhering to it. There was also a discussion on the Benchmark Assessments given throughout all grade levels in math during the first week in February. The discussion was about how the test did not show student growth or knowledge because the answers must be explicitly stated. For example, if a pictorial was asked and a student answered correctly with the algorithm, the student would not get credit for the answers. There was just confusion regarding a situation where a student had the correct answer. Why did it matter if they showed a picture of it, teachers wondered? Another discussion was on how Benchmarks contradicted learning objectives. One teacher stated that students had to bar model on the assessment or not get credit. This teacher stated that the grade level did not do a lot of bar modeling. Most students in that grade did not get credit for those answers requiring bar modeling. A grade level chair teacher stated, "If you want real data, try using objective questions, not subjective ones. Why not a, b, c, or d answers or computerized tests since that is how Smarter Balanced is?" All the grade levels agreed that the last question on the scoring guide for the benchmark did not make sense. It just seemed to be extra work for the

teacher. The last question required teachers to analyze the students' answers by using a specific scoring guide.

Two grade levels (not fourth grade) stated that the last Math in Focus Professional development session was a waste of time. They explained that they went over the exact same anchor charts and how to write lessons. Another teacher mentioned that during the training they typically had post–its of questions that would like to be answered. A teacher indicated that when they went over it, the Math Coordinator was not present and the Math in Focus trainer responded that the question was a district question and the Math Coordinator was not there. So the question was never addressed.

During the February meetings after the workshop, the fourth grade level still tried to remain on pace. They thought it was important for fifth grade students and teachers to have a successful second year of Math in Focus next year. They also kept the students' learning in the forefront. They did not want to jeopardize their deep understanding and mastery of a concept. They continued to follow the pacing guide without jeopardizing the depth of the content they were teaching.

For the March meetings, the teachers continued to plan for angles. They created exit slips for each lesson in the chapter and free-standing angles for students to practice measure using their protractors. They also created a study guide to go with the Test Prep. They went over grading expectations, also. Much of March meetings were spent on how to prepare students for the upcoming state testing, SBA. This was the first time a computerized test was administered for state testing. Typically students took a paper-pencil assessment. The school district asked third, fourth, and fifth grade teachers to administer a practice test between March 30 and April 2. This practice test had the

students answer the test questions on the computer, and they also had to write down their answers on worksheets that mirrored the online test. Teachers were able to grade the paper version, as the computer test did not save or grade the answers from the students. The computer was used strictly to practice answering the questions and navigating through the tools provided on the test. The tools consisted of a flag button, which allowed students to come back to the question and a cross-off option that allowed students to eliminate answers. A highlighter was available to students, as well as a sticky note that allowed students to write short notes to themselves. Teachers could grade the paper assessments and look for problem areas that needed to be clarified for students before the state test. As a grade level, teachers discussed the online tools available to students and how the students fared on manipulating the computer. The consensus was that the students seemed to catch on quickly to the computerized test. They also discussed the frequently missed concepts in the classrooms and how these concepts needed to be reviewed.

For Collaborative Work, teachers decided to review multiplication utilizing four digit by one digit and two digit by two digit. The students would be required to show two different strategies when solving the multiplication problem. Dates for Essential Time and the post-test date was also set. Teachers thought this would be a good opportunity to review multiplication to see what information students had retained.

For April meetings, teachers began planning for the next chapter, perpendicular and parallel line segments. The pacing guide allotted nine days. The Test Prep was taken by all the teachers. They analyzed the assessment carefully, looking at vocabulary and wording of the problems. They found that the wording for the Test Prep could be quite

confusing for fourth graders, because as adults, they had to read and reread the problems to understand what was expected. The teachers created a Powerpoint to review background knowledge taught in third grade. They created the Powerpoint by borrowing a third grade teacher's manual, in order to remain aligned with Math in Focus. They noticed that this chapter required a tool called a drawing triangle. The teachers emailed the Math Coordinator to inquire the whereabouts of this tool. The Math Coordinator responded that those were not ordered. The Math Coordinator mentioned that teachers would have to follow the first Teach/Learn with the protractor and just draw the perpendicular line segments with that. The drawing triangle was just another way of doing the same thing with the protractor. For parallel lines, the students would do the same activity with a ruler or the straight edge of the protractor. Teachers also went through the Teacher Manual and looked at the Hands-on Activities. They discussed the expectations for the students and then made copies for all classes. They also ran all copies of worksheets from Math in Focus.

The teachers planned for another upcoming chapter on area and perimeter. The pacing guide gave 22 days. As they had with most chapters, the teachers began with taking the Test Prep. After this assessment was analyzed, a study guide was created to resemble the Test Prep. For the next chapter, symmetry, a Powerpoint was created utilizing the snipping tool, which allowed a person to take a screenshot of a screen by cutting and pasting it into a different document. They used the snipping tool to cut and paste symmetry examples and vocabulary from Think Central.

The teachers decided as a grade level to create some review assignments of the concepts and chapters taught throughout the academic school year. They focused much of the review on fractions, division, and multiplication.

For the month of April, it was quite stressful to complete the remaining chapters before the state assessment. The grade level meetings seemed rushed. Much of the lesson planning was delegated to teachers to create during their free time. They were not able to spend the time that they did in the past planning for the chapters. They were trying to squeeze in three chapters, review of past concepts, and practice with SBA on computers, all in the month of April. The state testing, SBA, was being administered to students during the first full week of May. This was the first year SBA was being implemented, and the stress level within the building was high. Much of the stress was finding the opportunity to practice on the computers. There were not enough computers in the building to accommodate four, third grade sections, four, fourth grade sections, and four, fifth grade sections.

Most discussion for the May meetings were in regards to preparing for end of year activities. Math planning was left up to the individual teacher. According to the pacing guide, the last chapter to teach was adding and subtracting decimals, tables and graphs. Though the planning was left up to individual teachers, the teachers still provided suggestions and created assignments or activities with the grade level.

Summary

The fourth grade teachers at Rams Elementary School attended at least five professional development workshops to assist them in the implementation of Math in Focus. The professional development had mixed results in regards to its effectiveness.

The majority of the content covered was proven beneficial. The ineffective portions of the professional development were when specific skills or concepts were discussed, it needed to be skills current at the time that could be applied to the first year of implementation for Math in Focus. The workshops were not typically relevant to the then-present concepts or chapters taught; instead focusing on concepts that had already been presented and assessed. The pacing guide should have been utilized to coincide topics covered at the professional development sessions with what was projected to be covered in the classroom. The professional development prepared the teachers by explaining the goal of Singapore math, which was that students should be able to visualize mathematics. There were non-negotiables for teaching, or what must be taught in every lesson. Those non-negotiables were concrete, pictorial, and abstract. The activities and information presented assisted the fourth-grade teachers with implementing Math in Focus, addressing the non-negotiables. The fourth-grade teachers also appreciated when the presenter presented the information to the teachers as active learners or as if the teachers were the students. Active learning allowed the teachers to see a lesson modeled and the questioning that should accompany the lessons to activate students' higher order thinking skills.

Although this did not occur at every workshop, the teachers did appreciate when notes from the workshop were provided, to better allow them to actively participate and listen to the presenter and teacher comments. The notes were also beneficial when questions would arise after the professional development. This proved to be a great resource or reference. There were times that different presenters would contradict one another. For example, the last part of the Test Prep had an extended response and should

not be used as a grade. But at a later workshop the teachers were told to use this as part of their assessment grade. Another example was how they were initially told to use the Chapter Review in the textbook as an assessment. They were later told to complete the Chapter Review together as a class. Instead they were told to use the Test Prep as the assessment.

The teachers felt that the pacing guide was not consistent throughout the school year. This caused frustration with the grade level. The pacing guide was to be strictly followed according to the Math Coordinator. The Math Coordinator wanted grade levels to communicate with her if the grade level was more than two weeks behind the pacing guide. However, the pacing guide changed frequently throughout the school year and an updated pacing guide was never reestablished. The fourth grade teachers at Rams Elementary School maintained their pace with the initial pacing guide and the emails from the Math Coordinator extending the time on chapters to estimate the pace. However, at the last workshop the Math Coordinator commented that if teachers were on-pace (we were on pace), then as a teacher you were not going into enough depth with the students. This created frustration and confusion with the fourth grade teachers.

For team planning it was important to continuously collaborate about the current chapters. Following the suggestion of the Math Coordinator, the teachers utilized this time to take the chapter Test Prep to identify unfamiliar vocabulary, to see what was expected of students, and to drive instruction. The teachers also followed the suggestion of the Math Coordinator by grading assignments and the Test Prep with grade level consistency. Assignments and assessments were given point allocations and expectations of students' answers were agreed upon. The Math Coordinator would send out emails

with tips and teaching strategies for chapters in Math in Focus. These tips and strategies were beneficial, as they always directed the direction of the instructional planning. The teachers would have liked these emails to have been more current with the expectations of the pacing guide. It seemed that some of the tips were chapters or concepts already taught. Teacher D stated this about collaboration,

> I loved it. I enjoyed hearing the same struggles and successes. It validated that what I was doing, especially when students struggled. I was not alone. I liked that when we created things to aid in their assignments, we had the input from all of us. We would discuss things that would work or that does not make sense and may cause confusion for the students. Or why not create it this way? We had four teachers looking at it with different learning styles in their classrooms and we knew what would benefit the students universally. Plus, our expectations were the same. We would not have to worry about one class doing a concept one way and grading it differently from the other teachers. We knew that our expectations were a grade level decision. The grades would not be inflated in one classroom and not the others. The grades earned in math were based on the same expectations across the grade level.

Teacher B stated this about collaboration,

> I felt we worked really well. We did a lot of data planning around Math in Focus and math skills. We all tried to stay on the same page. We conversed with another. I thought we did a really good job. We supported one another when we did not understand a concept. We helped one another out by running off all the

assignments and staying on-task. I enjoyed it. I thought it benefitted the program, and it benefitted the kids.

Teacher A stated,

> Overall I think we did really well. I feel like this is maybe the first year that we really all came together because the program is so structured that it does not really let you do much of your own style. It really had us come together and kind of do the same thing. So I feel like we were more on the same page now than we ever were.

Teacher B stated,

> We worked cohesively together. We bounced ideas, suggestions, frustrations, and successes with one another. It helped me because I knew that working with three additional minds from different perspectives would benefit the students and how we taught and presented our lessons.

Third Grade Feedback

Another part of this study was to check to see if third and fifth grade professional development was the same, when compared to the fourth grade workshops. One third grade teacher, Teacher 3, and one fifth grade teacher, Teacher 5, were interviewed after each professional development they attended. Teacher 3 was in her second year of Math in Focus, so her professional development was geared towards the second year of implementation. Her students were also in their second year of Math in Focus. Second year teachers for Math in Focus, which included kindergarten through third grade, only attended three workshops for the school year, which was different than first year teachers' workshop experiences, which included fourth and fifth grade. First year

teachers had two additional workshops held in June before the academic school year. Teacher 3 had three workshops that lasted three hours each, during the school day. A substitute teacher was utilized during her absence. A difference between the fourth grade workshops and the third grade workshops from the previous year was found in the very first workshop was on Calendar Math. Teacher 3 verified her first year workshop experience of Math in Focus, "So like last year, the very first one (workshop) was only on calendar. Because that is an everyday thing and that worked out really well." A common theme was the background knowledge of her students during her first year of Math in Focus. This was different from fourth grade teachers' experiences, because although it was their first year teaching Math in Focus, it was the second year for their students. The previous year, third grade had no Math in Focus background knowledge for any of the chapters or concepts. Teacher 3 commented, "Where last year we would have to go back and teach second grade before we could teach third grade." For fourth grade teachers who were in their first year of implementation, this was only comparable on some of the Math in Focus concepts, because their current students were in their second year of the program. In regards to her second year of training for Math in Focus, Teacher 3 also felt the September workshop was very beneficial. She commented,

> She [the presenter] really went through each part of the lesson, and gave a good example of what it should look like with kids. How we should be teaching, what the direct instruction should look like, what guided practice looks like, and are they ready for independent practice? Which was something I struggled with last year. I think I have a better handle on that for this year. A better way to know

> when the kids are ready to move and how to keep helping the ones that are not ready to move on.

Teacher 3 also added, "Our instructor has been very good. She is very clear. She draws it all out. She walks through it as if she were doing the lesson with the kids." A challenge the third grade teacher spoke about after her September workshop was meeting all the students' needs. Teacher 3 said,

> And I still think that meeting all the kids needs is challenging for me. The ones that are ready to move on and the ones that are not. I am always very good with the ones that still need my help because I can sit in small groups and do that, but the ones that move are ready to move and that is harder for me. We do have a list of questions. She did touch on that, but that is just one of those areas that I tend to struggle a little bit more with. I tend to focus on the ones that are not getting it than the ones who are ready to move on and be challenged. So that is something that I will have to work on.

Positive comments from the September workshop included listening to the student conversations. Teacher 3 added,

> Yesterday when we were doing mental math. I just put the problem up and asked them what do you know about this problem? And just to hear their conversation. I do enjoy the conversations that the kids are having about numbers that we never had before. It gives me a much better idea of what they really know versus what we did before.

She also added that she really enjoyed teaching multiplication, because it was similar to what she was doing before Math in Focus. She also added that being in the second year was very helpful. She said,

> You understand the different parts of a lesson, you understand the different things in the teacher's manual on how to do different things. So, yes, I think it is a very good building process that they are trying to do with the resources that we have.

For the November workshop the Math Coordinator emailed all the third grade teachers regarding the topics that would be discussed in the workshop, and this researcher inquired about how that topic was chosen. Teacher 3 commented,

> It is about where we should have been in the pacing guide and is what we should have been doing and approaching on. And it is something that I think a lot of us had expressed a concern on needing more instruction on.

This was different from the fourth grade workshops, because most of the topics discussed were already taught and assessed. The topic for the November workshops was bar modeling. Teacher 3 felt this workshop was highly effective. She mentioned the following about bar modeling,

> This presenter was much clearer on them, just much more flexible in how they present the problem versus the last one who was very strict. It had to be this way if it was this type of problem. So I felt more at ease with this presenter because she would let us all create a way that makes sense in our minds versus some strict presenter.

She also mentioned the positives about being in the second year of Math in Focus. Teacher 3 said,

> I have taught it all already. So I kind of have an understanding of what the focus is. I can fine tune a little bit. Things like, realizing, I do not have to give the whole worksheet. I only have to give a few problems. Being told that it is okay if I only get through three problems in an hour. More modeling, I think they have done a better job this year explaining to us how they want that gradual release to take place. I feel more comfortable with some of that.

She also added,

> I feel more trained this year than I did last year. But of course it is the second year so that makes a big difference. Having been through it once and knowing what to expect. And I find that each time we go to a workshop, we get a little bit more insight on things that you know.

When it came to the benefits for her students, Teacher 3 said,

> They were coming in and they knew what bar models are. They had done them. They knew what number bonds were. They had already done them. They know some of the language. That helps so they do have some of that background skill. I am not teaching both the second and third grade curriculum this year. I can focus and still go back and refresh if we have to with the curriculum. Like they did not get to mental math last year. So that was all new to the kids. But for the most part, they have touched on all those subjects, and the kids have some background knowledge.

Among the challenges mentioned by the third grade teacher was the pacing of the lessons. Teacher 3 commented, "With the curriculum, just the pacing of it. It is too fast.

We just cannot get through it in the pacing that they are wanting us to. I feel like we are doing an effective job." She also added the challenges for the second year,

> Just that I think that they are expecting us to get through it faster. But I do not think the kids or the teachers are ready to move at a much faster pace. We still need time. I think the kids still need that building time. They do not have enough under their belt to move. I know we can move a little bit faster. I just still think that the pacing is not appropriate for a second year school. The expectation of that application to the real world experience. I do not think they have had enough practice for that.

For the second year, the third grade pacing guide did not change from their first year. An insightful thought from Teacher 3 regarding assessments was,

> They do say that we need to be well aware of what is on that test. The last presenter, the first one of the school year, and I remember in our earlier training, they always say look at the Test Prep and be aware of what is on the test and make sure you are covering that material. That is one thing I am having a hard time with is the way it is presented in the text and then the way they test it is very different, and finding ways to make that connection. And I think a lot of that is left to the teacher with their questioning. There is a lot where they tell you to question the kids. There is a lot of conversation that has to take place to build on these, to help the kids be able to not just use the same type of problem, but apply it in a real-life situation. But there is not a lot of that, in my opinion, given in the text, in the material that we are giving to the kids. So it will present subtraction with regrouping and there may be one or two pages on missing numbers in a

> problem. But then the test will have like four or five things on it. So you have to be aware of what the test is stressing so you can stress that in class.

The third grade teacher also commented that the Benchmark Assessments did not match what the teachers had been testing and teaching in Math in Focus.

For the February workshop, the third grade teacher thought the workshop was ineffective. She felt that the last of her year two workshops in Math in Focus was a review and much more fitted for a first year teacher implementing Math in Focus. She mentioned that the workshop was supposed to be on fractions. Teacher 3 said, “But our workshop yesterday was supposed to be on fractions, maybe twenty to thirty minutes on fractions. Everything else was reviewing, differentiation, anchor charts. So there was very little instruction on how to teach fractions." She also added, "I still do not really have a clue what is in this chapter for fractions because all we talked about was those couple of manipulative things. Such a waste of time." Last year, during third grades first year of Math in Focus, the teachers were unable to teach fractions to their students, so this would be Teacher 3’s first year implementing Math in Focus fractions. When asked if she thought the workshop was helpful, Teacher 3 said,

> No, it was pretty much a review. It was just relisting everything we have been going over for two years. About lesson plans, making sure you understand the concept ahead of time. Because how many times have we gotten into the middle of something and thinking this does not make sense? Working the problems ahead of time so you can try to foresee any problems that the kids may have. Do you need manipulatives? Do you need pictorials? Are you at the algorithm? Very

> basic review stuff, that we really, in my opinion, literally we wasted the 2 hours in the morning on because that was stuff that we already know and have been doing.

In regards to benefitting from any information, Teacher 3 said,

> No, it was a waste of my time yesterday. What she showed us, one, I have been doing for years, having kids make fraction bars. That is not a new concept. That is something people have been doing for years. Have them take a piece of paper, this is a whole, now fold it in half. This is one half, etcetera. Things that I get. I do not need somebody to show me how to make a fraction bar. Then she talked about, take this whole and fold it in half. Now fold it in fourths. Look one half and two fourths, they are the same. We have been doing that for years. This is not a new concept.

She also added,

> And talking about if I have a big candy bar and I get half of that and I have a regular sized candy bar and get half of that. How is it that they are both one half, but different amounts? Well, because you started with a different size of a whole. So, yes, it was pointless. It is stuff we have already been doing. Stuff that you can look and read from the book.

When asked about creating assignments for the students, Teacher 3 commented,

> We have tried different things where they just use their math journal and keep information in that. A teacher found some stuff that goes with our book series on Teacher's Pay Teachers. We have printed that off and tried that. And they all are really great, but time becomes a factor with all of this. Everything takes so much time, and there is not that much time in a day to get and do it in a way that as a

> teacher I feel like I need to cover it. I probably spend twenty minutes in the morning on Calendar. Just from the time I asked the kids to come down and join me, I get certain ones settled, certain ones on task. I do have a calendar leader and the kids love doing that, but if they are not the calendar leader, it is the same ones that want to answer all the time. My ones that are struggling, they never want to answer.

One thing the third grade teacher did like from the workshop was the mixed seating. She enjoyed speaking with other third grade teachers in the school district. She also enjoyed finding out how they were teaching concepts.

One comment Teacher 3 said regarding the pacing guide was that the pacing guide did not take Benchmark Assessments into consideration. These assessments took time out of the allocated days for the pacing guide. Teacher 3's last comment about her frustrations was with math fluency. She felt the students needed a much more solid basis on multiplication. Teacher 3 felt like the Math Coordinator did not embrace algorithm and mostly valued concrete and pictorial approaches. The Math Coordinator mentioned to Teacher 3 that fluency was the mastery of a concept, not the memorization. She proceeded with a comment that the Math Coordinator's definition of fluency was not being able to give you an answer quickly and having it memorized. It was that you could figure it out and understand what it meant. She used an example from the Benchmark Assessment about how students did not know their math facts. An example problem was 'one hundred sixty divided by two.' She stated that a student drew two circles and drew eighty dots in each circle. Teacher 3 did not think that was fluent. An example about being fluent was the Benchmark Assessments. Teacher 3 commented,

> She is caught up in the concrete and pictorial because on benchmarks, just doing the algorithm, is never okay in an answer. She is always wanting those kids to do concrete and pictorial as well. We had kids on our benchmark this time who totally got the answers on a two-step word problem with extra, I mean it was a complicated word problem. They got the answer right using the algorithm, but out of four points, they could only get one point. Because they did not draw the picture, they did not label it, they did not do all of that. I mean it was obvious, it was about fences. They knew they had to take this person's fence and the next person's fence ten times longer. So they did an eight by ten. The next pig's fence was twice as long as the other. So they did eighty times two. They knew what they were doing, but it was not acceptable.

Regarding the pictorial and concrete, Teacher 3 realized that both were important. Teacher 3 commented,

> I think both are important, but the other thing I do not agree with is pigeon holing them. It is a problem solving type of process. Every kid visualizes and sees a math problem differently. So, if I can do it with a number line and you can do it with an array, both thirty-six. Or six times sixty is three hundred sixty. I should be able, if that is my way of thinking. I should be able to do that. If I am getting the right answer, obviously I knew. And these are not just simple problems. They have to understand the concept to get the right answer. And I just think we are doing them a disservice. I think we are frustrating our smarter math kids by making them draw everything out. I think that can be a frustration for the lower kids as well because they have to draw and build everything. Sometimes they get the concept, and they

> do not need to draw and build it anymore. But, they just need to learn their math facts so they can do it. She has a real problem with memorizing the processes. Again, that is what you are doing even when you build it. You are taking the forty-eight and dividing it into the four tens place. Or are taking the eight ones. It is memorization of processes. Whether it is a pictorial or an algorithm, it is memorizing. So I disagree in those regards which is why my benchmark score are always the lowest because she pigeon holes them, and I allow them to show, you know. I have some kids that are so low, but they have all the right answers. And I think that is wrong.

Summary

Finding the differences and similarities between the third and fourth grade professional development may not have provided the best comparison. Third grade was in the second year of Math in Focus, and fourth grade was in the first year of Math in Focus. Third grade had three half-day professional development workshops, and fourth grade had two full days and 3 half-day professional development workshops. The September workshop was considered beneficial by Teacher 3. In agreement with fourth grade comments, she felt that the presenter was effective, because she presented the information as if the teachers were the students. She also felt that the September workshop was beneficial, because she was in her second year of the program. The teacher manual and the different parts of the lessons were familiar. Another similarity was the pacing guide. Third grade thought the pacing was too fast, even for the second year of implementation. Fourth grade thought the pacing was also too fast when considering the amount of concepts the students had to learn. Even though fourth grade

teachers were in their first year of implementation of Math in Focus, they had students who were in their second year of Math in Focus.

The November workshop was also beneficial, according to Teacher 3. The concepts discussed were in accordance with the pacing guide. So it was relevant to the present teachings. Fourth grade struggled with the workshops, due to concepts or chapters covered that were already taught and assessed. The last workshop for Teacher 3 was not considered beneficial. An email from the Math Coordinator indicated that fractions were going to be covered. Teacher 3 said the topic of fractions was 20 to 30 minutes of the three-hour workshop. She felt as though it was a review of the last two years of Math in Focus. Teacher 3 and fourth grade did agree that mixed seating was a benefit, because it allowed for discussing math with other teachers from different buildings. Teacher 3 also mentioned that the presenter from her first year of training told the teachers they should look at the Test Prep before beginning a chapter. Fourth grade was told the same thing by their Math Coordinator; however they were told to take the Test Prep like a student and look for things that may be a struggle for students.

Fifth Grade Feedback

The fifth grade teacher was also interviewed after each professional development. Teacher 5 attended five workshops, which was what the fourth grade teachers were also required to do. This was the first year fifth grade teachers were implementing Math in Focus. Their students were also in their first year of Math in Focus, because the previous year fourth grade had not yet implemented the program. Kindergarten through third grade implemented Math in Focus the previous year. Fourth and fifth grade teachers would be in the first year of implementation during the academic school year examined in

this study. These workshops were held in June, September, November, and February. Each workshop was three hours in length, with the exception of the June workshop, which was two full days. The three-hour workshops were held during the school day. A substitute teacher was utilized during the absence from the classroom.

This was the second year this fifth grade teacher had been teaching at Rams Elementary School. Teacher 5 thought the June workshop had some good information. However, the only materials that fifth grade teachers were able to physically look at were the teacher manuals and Calendar Math. Instead of looking at raw materials, they looked at pictures. The usefulness of the workshop was explained by Teacher 5,

> I felt like we went through the program and understood the first chapter and what we needed to be doing and what components there were. How we would assess and how we would have the students practice versus some of the language was different than we have used in education. For example, the practice, it is more of the group work versus let's practice individually. Finding out the terminology, how it differed than what we are used to.

Teacher 5 was also using components of Math in Focus in his classroom the year before with students at Rams Elementary. He had gone through Math in Focus training at his previous elementary school in Blue School District before transferring to Rams Elementary. Teacher 5 explained his Math in Focus training, clarifying his prior training.

> So we had a training that was one day long, but we did not do Calendar Math that covered the components and what to do. And that was someone from Math in Focus. But then I transferred schools that summer and started back to Scott Foresman.

He also clarified how he taught Math in Focus the following year at Rams Elementary. "I did the components of it. Like I did a lot of the worksheets and practice book, but taught it with a mix of Scott Foresman and Math in Focus." He thought the training was similar to what he had previously been exposed to from his other school.

For the September workshop, he felt his workshop was helpful. He explained,

> I feel like this one was very helpful because it cleared up a lot of confusion. I do not think we got enough time. What she said, especially when we got into the assessment piece undid everything she said in the summer time. We were told how to test the kids and then now it became the study guide and we are supposed to use the Test Prep. The grading became more muddy because it was like they were trying to do standard based grading by assigning ones to it. And it is not fair to the kids. Going to the book and putting post-it notes throughout every page. This is what you do. This is what you say. This is what is helpful. How to start the chapters is completely different than they did at the summer training. So that kind of threw us all off because it was almost two days before you teach materials. You go through the teaching background in the section where they give a review of what they did in fourth grade. That just kind of threw us off because it was not mentioned before. We broke down the assessment piece to like 10 different things you can be assessing or should be assessing and before that it was two. She was very knowledgeable. This person seemed to know a lot more about Math in Focus than the previous trainer. It was strange to me that they were both trainers from Math in Focus and had very different approaches. And that really bothered me a lot.

In regards to changing the assessment, Teacher 5 said, "It was less inspiring because it is almost depressing because you are hearing what we should have been doing, but when you are following what the first person was saying, there was no consistency. That was really hard." The fifth grade teacher explained the confusion with the assessment,

> In the student textbook there is a study chapter test at the end of every unit. The previous trainers and our Math Coordinator said that is what you are supposed to use to test the kids. You have to come up with your own study guide to prepare them for that. The study guide in the book was the test. And this trainer said no that could be your study guide. It is too big to be a test, use the Test Prep. And in that training she mentioned that the Test Prep has novel or new items that kids have not experienced yet. And we had just taken the Test Prep (given the test to students before attending workshop) before that training and out of the 25 points on that test, five are the novel items. That is 20 percent of your test right there that is on items that they have not had, or they are not expected mastery of. So that was kind of hard. The hardest part was thinking, I just told my kids what their math test grade is, but it is really not that grade, it is a higher grade, if you take out the novel items.

He explained some of the confusion amongst the group of fifth grade teachers that were attending the workshop.

> A lot of people were thrown off because it is so different than what we had done in the summertime. I think it upset a lot of people. Our Math Coordinator pretty much stood up and said forget everything you learned over the summer and you are starting again today. So to me, it was very disturbing. If our next training is

> not with the same person because then are we going to hear it from a third or first persons point of view? It just seems very inconsistent. So with that, there are a lot of discussions going. That is not what we learned before. Oh, we can be doing that. For me, I was thrown off because of the amount of assessments that we could be doing and how to come up with the grade. A little bit different than what they told us before.

Teacher 5 elaborated on how to identify novel or new items on the Test Prep,

> I went to the chapter. She said it is in the book. I cannot find it where it says these are new or novel items. But I looked at what would I expect the kids to have mastery on based on the amount of teaching. In the last two questions, it had a 5 to 10 minute mini lesson to kind of introduce the concept, but they never were assessed on it. They did not have to do much work to independently show that they knew that.

Since students were also in their first year of Math in Focus, Teacher 5 explained how he addressed bar modeling with students who had never been exposed to it,

> I did not specifically teach it. I followed whatever that chapter beginner said to do and knowing. I am assuming that we are going to get into it in this chapter. So there is a little bit of instruction, but not, I would not consider it teaching. More exposing, but yes, they do not have a lot of the background and a lot of the terminology they do not have.

The presenter asked the fifth grade teachers to place post-it notes throughout a chapter. She explained that every time you see Learn in the Teacher Manual that should be heavy instruction, then practice time. Let's Practice should be independent work. Teacher 5

mentioned that the independent work was a good indication to determine if students were ready to go on to the next lesson. The Let's Practice should not be taken for a grade, but the workbook or the practice pages that followed could be used for grades. He also mentioned that the presenter mentioned that Reteach assignments were below grade level. They were told not to assess or take grades on it. Teacher 5 also mentioned that he would like to see a lesson in action. He stated,

> I would sit in a classroom or rather watch a video on it and watch it being done because I feel like there is a lot of, there is potential for a lot of kids do a lot of work. There are 20 pages for each lesson, how much do they need to do? So I would rather see it happen than have to assume the book is walking it through correctly. Since two different opinions now, I want to know, what does it look like in real practice?

A suggestion for future workshops from Teacher 5 was more time for training. He stated, "Even if we do three hours and spend the last three hours we spent with our team talking about what it would look like. Rather than saying go back to school or go home." For the November workshop, the Math Coordinator sent out an email for the upcoming topic, bar modeling and problem solving. The fifth grade teachers were told to skip that chapter until they attended the November workshop. Teacher 5 did not feel like he left with a better understanding of bar modeling after the workshop. He indicated that many people from the workshop seemed upset about bar modeling. Teacher 5 stated,

> I think people were starting to get angry because they did not understand what the reason for the training was because it did not follow what they would walk away with. And we did not always understand how the bar modeling is working.

> Sometimes she said it was an exact representation, other times it was an approximate representation. It was not the same level of instruction that was given before.

He clarified by adding, "The last workshop with the same person was pretty effective, we understood better. We walked away with a better understanding of Math in Focus. It was not a very well organized three hours." This workshop had the same presenter from September, which Teacher 5 thought was effective. He also stated that the presenter added, "You do not need to be bar modeling even though the lessons have it. It is not an emphasis for fifth grade anymore. They should be transitioning out of bar modeling and just doing the algorithm for math." Teacher 5 added,

> I think the confusing part was the book wants you to do bar modeling and we are being told that it is not important. It is a significant part of their workbook. Some of the problems, even based on language, are almost impossible for fifth graders to solve because it involves algebraic expressions. And that is something that we have not taught yet.

For the problem solving portion of the workshop, the language in Math in Focus seemed to be difficult. Teacher 5 mentioned that when the teachers from Rams Elementary School took the Test Prep, a significant number of problems answered by them were incorrect. The Test Prep was on multiplication and division of fractions. Teacher 5 explained how the language can be difficult, as he gave an example from a book assignment,

> The questions might, one question, for example, the kids would have to understand the concept of profit. And when we talked about it, she said the

> students need to know how to identify the term, how much does she make at the end of the day? Things like that are not well worded because you would think of your gross income not your net income. And that is another whole discussion that you would have to have with your kids before they can solve the problems independently.

Teacher 5 stated, "We are more nervous now and confused because if we cannot do it ourselves successfully, how do we expect our kids to do it without feeling frustrated?" Suggestions for upcoming workshops included going through a real lesson from the beginning to the end. Teacher 5 said,

> I do not like always acting like a kid, but I would like to be able to hear how as a teacher I am supposed to be presenting this material that is confusing. I know that sometimes when we have done that in our district, the problem is that the trainer gets frustrated with the “students” who are teachers. Because we are acting like the kids and questions they would say, that, well a kid would not ask that question, but they do. And so I do not know that, I mean I can follow the book just fine, I just do not know sometimes how to explain what the word problem or even some of the approaches they are asking. I sometimes have to revert to how I have taught in the past. And I am a pretty progressive teacher, but I have to refer to like my everyday math training to understand what to do with this book.

Teacher 5 closed the interview by stating,

> I was really disappointed. I felt like I could have used those three hours to do planning and figuring out math on my own. I did not follow the training this time. I felt like they really missed the boat with a huge number of fifth grade teachers

> not knowing how to teach better and feel confident that this program has long-term success. You know, one of the things that came up with Everyday Math was that they emphasize how much it changes the math thinker, long term. And that might be kind of a brainwashing effect, but we left Everyday Math training feeling good, understanding there was a purpose to what we were doing. We could also see the spiraling effect throughout the year and saw it grow. Here, I feel like if the kids do not have mastery, they are not going to get it again. Or if they miss some lessons, you have to have this one lesson in order to be successful a chapter later. I think that should be something we should go through and understand. This has to be a lesson where mastery is expected. This lesson is not. That is where I am with that. But I am kind of frustrated because they have added multiplication and division through common core this year to fifth grade, of fractions. And I am teaching something I have never taught before and I am watching other fifth grade teachers learn in this brief training, how to do it. I do not think we really know.

For the final workshop in February, Teacher 5 indicated that controversy was immediate during the beginning of the workshop. The presenter inquired to the whereabouts of their chapters in regards to concepts. Rams Elementary School was way ahead of the four other schools present from Blue School District. Teacher 5 felt like the teachers that were not from Rams Elementary School thought they were too far along. He stated,

> The controversy was more how did you get that far? I almost felt like they felt we were rushing the program. How do you know your kids know their stuff? So it became about us not assessing and knowing our kids. And we all kind of backed

> off a little bit from that. And then we talked with individual tables about what we were doing and how we accomplished the goals we had.

He mentioned that the Math Coordinator said to all the teachers that Rams Elementary School was following the pacing guide, and they were doing a good job. Teacher 5 also added that the consensus regarding why some schools were behind was,

> We just felt like we were spending too much time on calendar math versus actual instruction. Or they were trying to use every single component of the program versus determining where your kids are and moving on when they get it. I think they were looking at what to do with their differentiation of instruction because they were doing the same thing every day for a long time versus some kids were ahead and spinning their wheels.

Teacher 5 mentioned that the concepts covered at the workshop were items that Rams Elementary had previously taught. Teacher 5 reflected on his thoughts,

> Initially before we started, we were like well we are ahead and now we are being punished. But we kind of enjoyed it because I felt like it went over what we had done and verified the good teaching we had done, but also had determined some things we could do in areas where we struggled. There were some parts that were hard and it helped clarify some tools we could use.

He mentioned they were not going to go back and reteach and it would be utilized for the following school year. Trajectories were also addressed in this workshop. He mentioned that the pacing guide was written eight years out. In eight years, teachers should be able to do all the things at that pace. Teacher 5 did not feel that comment was helpful because eight years was so far away. The presenter went over the SBA items. The presenter

stated that the same writers who wrote Math in Focus helped with SBA questions. Teacher 5 also mentioned that SBA was looking for an exact answer and not for the work. Teacher 5 had concerns with differentiated instruction. He was not quite sure how to work with his low and high students. At the time, he was having his high students work ahead. They did a lesson a day, finished the book, but could not skip any lessons in terms of curriculum. In regards to finishing the book, he meant the workbook pages. Teacher 5 explained,

> Self- taught and do it themselves. And they are doing very well. They have to check in at the end of every chapter. It is just kind of something that I am doing on my own and been doing that for quite a while. I feel like that helps certain kids, but now my core group, I spend a lot more time.

Teacher 5 elaborated on having some students who work ahead,

> They are constantly moving ahead until they hit a road block. And they know they have to come back to the general instruction or they have to come in before or after school or recess. Then I can help them then.

Teacher 5 also explained that when he started a new lesson or chapter, he let the students progress independently. He stated,

> I let them do their own thing. After each lesson or two I have them show me their work, I grade their workbook, and make them go back and do corrections. If they have an excessive number of corrections, I encourage them to come back into the group. And they have to take all the assessments between each chapter. The most difficult part of the program is the language. There is not enough in the

> teacher support to explain how to solve certain problems they give you, the answer but I do not always know how to get that answer.

Teacher 5 clarified language by stating,

> I am a very black and white language person so I am good at dissecting the words and figuring out what words mean. This program is very abstract in its use of language. It leaves out words I would include to help direct students to a certain place. So I am having to interpret the language for the kids sometimes.

The fifth grade teacher felt like this workshop was much more beneficial. He explained,

> I feel like they really did take in our feedback from the last time because the previous session was so awful that we did not walk away being able to do anything. And here I felt like we had more resources, more tools, we understood how to use the manipulatives a little better, the place value chips and how to make it more meaningful and a little more interactive. Because I think that was a complaint, it was such a paper pencil program, almost to the point of overkill on how much they have to practice an item, gradual release, I guess, was tricky. It was like practice, practice, practice. Then it was the difficulty of the workbook pages were so much more difficult than any of the practice problems we did in class. So you think they are ready for it, let them go, and you are suddenly rushed with questions because the format in the workbook is so much different than what we were doing in class.

Teacher 5 compared the implementation of Math in Focus with another neighboring school district where he used to be employed that implemented a new math series. He thought the district should have a clear plan and training prior to the implementation year.

The training should include math trainers in every building that modeled a lesson and watched the teacher teach a lesson. Teacher 5 stated "In order to begin a new program, the math trainer would approve your teaching." He felt like Blue School District was doing it backwards. He added,

> They would see you at an upcoming workshops to see if you were teaching it correctly. Then the workshop is not specific to what you are currently teaching or is not previewing what you are about to teach to get new ideas.

Summary

Fifth grade was in its first year of Math in Focus, as was fourth grade. Fifth grade had two full days and three half-day professional development workshops. The June workshop was considered beneficial by Teacher 5. He felt the workshop prepared them for the first chapter for the first days of schools. Fourth grade did not feel like the June workshops were beneficial, as they felt unprepared for the first days of school. A contrast to fifth grade professional development was that fourth grade felt overwhelmed with summer planning for the first days of school. The September workshop for Teacher 5 was also helpful, because it clarified some confusion. Similarly to the fourth grade teachers' experiences, the fifth grade teachers were told to use the chapter review from the textbook as the assessment in the June workshop. However, in the September workshop, they were told not to use it, and to use the Test Prep instead. He was also told to not count the extended response on the Test Prep. Another similarity with fourth grade was how he would have liked to see a lesson taught as if the teachers were the students; active learning. Teacher 5 did not think the November workshop was beneficial. Bar modeling was discussed. The presenter stated that bar modeling was not an emphasis in

5th grade, but the Math in Focus series wanted students to do bar modeling. This was similar to the fourth grade experience, except the book expected the concrete or algorithm as the answer, but the district wanted more pictorial. Teacher 5 and Teacher 3 both had similar experiences in that the presenter told them bar modeling had to be an exact representation, then later told them it could be an approximate representation. Teacher 5 also mentioned that the presenter asked them to take the Test Prep on multiplying and dividing fractions. He stated that a significant number of problems were missed by the teacher. This was a concern, because if the teachers could not answer the problems accurately, how were they supposed to teach it? The final workshop in February was similar to fourth grade. The presenter inquired to the whereabouts of the chapters for each school. Like fourth grade, fifth grade was on pace. However, the Math Coordinator told them they were doing a good job. Unlike fourth grade where the Math Coordinator stated that those on pace were not going into enough depth. Teacher 5 felt like the other teachers that were not on pace felt that the fifth grade teachers at Rams Elementary were rushing the program. He also mentioned that the concepts covered at the workshop were previously taught. However, he liked that, because he felt it verified the good teaching. He did mention that they were not going to go back and teach to the suggestions of the presenter. They would use the information for the following school year.

Null Hypothesis 1:

Null H_1: The MAP scores at Cardinal Elementary will not improve relative to district and state averages over the time periods: (2011-2012, 2012-2013, and 2013-2014).

In order to test this hypothesis, the researcher conducted a series of *t*-tests and *z*-tests for difference, on the data obtained from the district's Executive Director of Assessment and Data. This data included scale MAP scores for all third grade students in the district for the 2011-2012, 2012-2013, and 2013-2014 administrations of the test. In addition, the district's Executive Director provided the researcher with Missouri Growth scores for the 4th and 5th grade teachers at Cardinal Elementary School in Blue School District. Missouri Growth Model data for third grade teachers was not possible, due to third grade being in the first year of state testing with no other years to compare to show growth.

To explore differences among third grade students, the researcher used the scale MAP scores of the students, comparing scores of students from Cardinal Elementary School and Rams Elementary School to the mean scores of 3rd grade students in the district.

To explore differences among fourth and fifth grade students, however, the researcher used the Missouri Growth Model data for the fourth and fifth grade teachers at Cardinal Elementary. Since these data measured actual growth in students' MAP scores from the previous school year, this was a more valid measure of the effect the teachers had on the students' learning. MODESE (n.d.d) explained that "the end goal of the Missouri Growth Model is to identify systematic differences in student growth among LEAs (Local Education Agencies) with comparable baseline performance" (para 4). MODESE (n.d.d) explained

> Rather than focusing on movement from one achievement level to higher achievement levels such as from "Basic" to "Proficient," the Missouri Growth

> Model uses scale scores to measure growth. This means that movement within achievement levels is as important as movement across achievement levels (p. 1).

A two-sample *t*-test was conducted comparing the Cardinal Elementary School's third grade students' MAP scale score to the scores of the rest of the third grade students in the district for 2011-2012, with a 0.05 significance level. A preliminary test of variances revealed that they were equal ($F = 1.097$, $p = 0.2647$). There was not a significant difference between the Cardinal Elementary School's students' MAP scale scores (M = 632.92, SD=34.04) and the scores of the rest of the district (M = 629.49, SD = 35.65); $t(1323) = 1.000$, $p = 0.1586$. This suggested that the Cardinal Elementary School's students' MAP scale scores were not higher than those of the rest of the district in 2011-2012.

A two-sample *t*-test was conducted comparing the Cardinal Elementary School's fourth grade teachers' growth model scores to the scores of the rest of the fourth grade teachers in the district for 2011-2012, with a 0.05 significance level. A preliminary test of variances revealed that they were equal ($F = 1.341$, $p = 0.2685$). There was not a significant difference between the Cardinal Elementary School's teachers' growth model scores (M=47.86, SD=5.28) and the scores of the rest of the district (M = 48.34, SD = 4.56); $t(52) = -0.224$, $p = 0.5882$. This suggested that the Cardinal Elementary School's teachers' growth model scores were not higher than those of the rest of the district in 2011-2012.

A two-sample *t*-test was conducted comparing the Cardinal Elementary School's fifth grade teachers' growth model scores to the scores of the rest of the fifth grade teachers in the district for 2011-2012, with a 0.05 significance level. A preliminary test of

variances revealed that they were equal ($F = 1.841$, $p = 0.1336$). There was a significant difference between the Cardinal Elementary School's teachers' growth model scores (M = 56.67, SD = 7.09) and the scores of the rest of the district (M = 50.35, SD = 5.23); $t(61) = 2.523$, $p = 0.0071$. This suggests that the Cardinal Elementary School's teachers' growth model scores were higher than those of the rest of the district in 2011-2012.

A one-sample *z*-test was conducted comparing Cardinal Elementary School's third grade students' MAP scale scores to the state average for 2011-2012, with a 0.05 significance level. There was a significant difference at a level of significance of 0.10; however not at a level of significance of 0.05, between the Cardinal Elementary School's students' MAP scale scores (M = 632.92, SD = 34.04) and the state average (M = 628.7); $z = 1.35$, $p = 0.0890$. This suggested that the Cardinal Elementary School's students' MAP scale scores may have been higher than the state average in 2011-2012.

A one-sample *t*-test was conducted comparing Cardinal Elementary School's fourth grade teachers' growth model scores to the state average for 2011-2012, with a 0.05 significance level. There was not a significant difference between the Cardinal Elementary School's teachers' growth model scores (M = 47.86, SD = 5.28) and the state average (M = 50); $t(4) = -1.03$, $p = 0.8202$. This suggests that the Cardinal Elementary School's teachers' growth model scores were not higher than the state average in 2011-2012.

A one-sample *t*-test was conducted comparing Cardinal Elementary School's fifth grade teachers' growth model scores to the state average for 2011-2012, with a 0.05 significance level. There was a significant difference at a level of significance of 0.10; however not at a level of significance of 0.05, between the Cardinal Elementary School's

teachers' growth model scores (M = 56.67, SD = 7.09) and the state average (M = 50); $t(4) = 2.10$, $p = 0.0516$. Consideration should be given to the small sample size. This suggests that the Cardinal Elementary School's teachers' growth model scores may have been higher than the state average in 2011-2012.

Table 1 summarizes the results of these *t*-tests and *z*-tests pertaining to the 2011-2012 MAP scores.

Table 1

Summary of Comparisons of Cardinal Elementary 2011-2012 MAP Scores with District and State Averages

	District			State		
Grade	z/t	p	Significance	z/t	p	Significance
3rd	1.000	0.159	Not Significant	1.35	0.089	Moderately Significant
4th	-0.224	0.588	Not Significant	-1.03	0.820	Not Significant
5th	2.523	0.007	Significant	2.10	0.052	Moderately Significant

A two-sample *t*-test was conducted comparing the Cardinal Elementary School's third grade students' MAP scale scores to the scores of the rest of the third grade students in the district for 2012-2013, with a 0.05 significance level. A preliminary test of variances revealed that they were equal ($F = 1.100$, $p = 0.2432$). There was not a significant difference between the Cardinal Elementary School's students' MAP scale scores (M = 631.10, SD = 31.64) and the scores of the rest of the district (M = 628.73, SD=33.18); $t(1382) = 0.792$, $p = 0.2143$. This suggests that the Cardinal Elementary School's students' MAP scale scores were not higher than those of the rest of the district in 2012-2013.

A two-sample *t*-test was conducted comparing the Cardinal Elementary School's fourth grade teachers' growth model scores to the scores of the rest of the fourth grade teachers in the district for 2012-2013, with a 0.05 significance level. A preliminary test of variances revealed that they were equal ($F = 2.676$, $p = 0.1737$). There was not a significant difference between the Cardinal Elementary School's teachers' growth model scores (M = 48.49, SD = 3.00) and the scores of the rest of the district (M = 47.21, SD = 4.91); $t(56) = 0.569$, $p = 0.2859$. This suggests that the Cardinal Elementary School's students' growth model scores were not higher than those of the rest of the district in 2012-2013.

A two-sample *t*-test was conducted comparing the Cardinal Elementary School's fifth grade teachers' growth model scores to the scores of the rest of the fifth grade teachers in the district for 2012-2013, with a 0.05 significance level. A preliminary test of variances revealed that they were not equal ($F = 3.238$, $p = 0.0194$). There was a significant difference at a level of significance of 0.10; however not at a level of significance of 0.05, between the Cardinal Elementary School's students' growth model scores (M = 54.81, SD = 5.86) and the scores of the rest of the district (M = 50.12, SD = 3.26); $t(4) = 1.761$, $p = 0.0766$. Consideration should be given to the small sample size. This suggests that the Cardinal Elementary School's teachers' growth model scores were may have been higher than those of the rest of the district in 2012-2013.

A one-sample *z*-test was conducted comparing Cardinal Elementary School's third grade students' MAP scale scores to the state average for 2012-2013, with a 0.05 significance level. There was not a significant difference between the Cardinal Elementary School's students' MAP scale scores (M = 631.10, SD = 31.64) and the state

average (M = 627.9); $z = 1.18$, $p = 0.1200$. This suggests that the Cardinal Elementary School's students' MAP scale scores were not higher than the state average in 2012-2013.

A one-sample *t*-test was conducted comparing Cardinal Elementary School's fourth grade teachers' growth model scores to the state average for 2012-2013, with a 0.05 significance level. There was not a significant difference between the Cardinal Elementary School's students' growth model scores (M = 48.49, SD = 3.0) and the state average (M = 50); $t(4) = -1.13$, $p = 0.8383$. This suggests that the Cardinal Elementary School's students' growth model scores were not higher than the state average in 2012-2013.

A one-sample *t*-test was conducted comparing Cardinal Elementary School's fifth grade teachers' growth model scores to the state average for 2012-2013, with a 0.05 significance level. There was a significant difference at a level of significance of 0.10; however not at a level of significance of 0.05, between the Cardinal Elementary School's teachers' growth model scores (M = 54.81, SD = 5.86) and the state average (M = 50); $t(4) = 1.84$, $p = 0.0702$. Consideration should be given to the small sample size. This suggests that the Cardinal Elementary School's teachers' growth model scores may have been higher than the state average in 2012-2013.

Table 2 summarizes the results of these t-tests and z-tests pertaining to the 2012-2013 MAP scores.

Table 2

Summary of Comparisons of Cardinal Elementary 2012-2013 MAP Scores with District and State Averages

	District			State		
Grade	z/t	p	Significance	z/t	p	Significance
3rd	0.792	0.214	Not Significant	1.18	0.120	Not Significant
4th	0.569	0.286	Not Significant	-1.13	0.838	Not Significant
5th	1.761	0.077	Moderately Significant	1.84	0.070	Moderately Significant

A two-sample *t*-test was conducted comparing the Cardinal Elementary School's third grade students' MAP scale score to the scores of the rest of the third grade students in the district for 2013-2014, with a 0.05 significance level. A preliminary test of variances revealed that they were equal ($F = 1.168$, $p = 0.1273$). There was a significant difference at a level of significance of 0.10; however not at a level of significance of 0.05, between the Cardinal Elementary School's students' MAP scale scores (M = 627.66, SD = 31.69) and the scores of the rest of the district (M = 623.17, SD = 34.24); $t(1307) = 1.450$, $p = 0.0736$. This suggests that the Cardinal Elementary School's students' MAP scale scores may have been higher than those of the rest of the district in 2013-2014.

A two-sample *t*-test was conducted comparing the Cardinal Elementary School's fourth grade teachers' growth model scores to the scores of the rest of the fourth grade teachers in the district for 2013-2014, with a 0.05 significance level. A preliminary test of variances revealed that they were equal ($F = 1.919$, $p = 0.2409$). There was not a significant difference between the Cardinal Elementary School's teachers' growth model scores (M = 47.28, SD = 2.87) and the scores of the rest of the district (M = 49.10, SD =

3.98); $t(55) = -1.081$, $p = 0.8579$. This suggests that the Cardinal Elementary School's teachers' growth model scores were not higher than those of the rest of the district in 2013-2014.

A two-sample *t*-test was conducted comparing the Cardinal Elementary School's fifth grade teachers' growth model scores to the scores of the rest of the fifth grade teachers in the district for 2013-2014, with a 0.05 significance level. A preliminary test of variances revealed that they were equal ($F = 1.144$, $p = 0.5139$). There was a significant difference at a level of significance of 0.10; however not at a level of significance of 0.05, between the Cardinal Elementary School's teachers' growth model scores (M = 54.00, SD = 3.50) and the scores of the rest of the district (M = 51.10, SD = 3.74); $t(54) = 1.660$, $p = 0.0513$. This suggests that the Cardinal Elementary School's teachers' growth model scores may have been higher than those of the rest of the district in 2013-2014.

A one-sample *z*-test was conducted comparing Cardinal Elementary School's third grade students' MAP scale scores to the state average for 2013-2014, with a 0.05 significance level. There was not a significant difference between the Cardinal Elementary School's students' MAP scale scores (M = 627.66, SD = 31.89) and the state average (M = 628.0); $z = -0.12$, $p = 0.5491$. This suggests that the Cardinal Elementary School's students' MAP scale scores were not higher than the state average in 2013-2014.

A one-sample *t*-test was conducted comparing Cardinal Elementary School's fourth grade teachers' growth model scores to the state average for 2013-2014, with a 0.05 significance level. There was not a significant difference between the Cardinal Elementary School's teachers' growth model scores (M = 47.28, SD = 2.87) and the state

average (M = 50); $t(5) = -2.32$, $p = 0.9660$. This suggests that the Cardinal Elementary School's teachers' growth model scores were not higher than the state average in 2013-2014.

A one-sample *t*-test was conducted comparing Cardinal Elementary School's fifth grade teachers' growth model scores to the state average for 2013-2014, with a 0.05 significance level. There was a significant difference between the Cardinal Elementary School's teachers' growth model scores (M = 54, SD = 3.5) and the state average (M = 50); $t(4) = 2.56$, $p = 0.0315$. Consideration should be given to the small sample size. This suggests that the Cardinal Elementary School's teachers' growth model scores were higher than the state average in 2013-2014.

Table 3 summarizes the results of these *t*-tests and *z*-tests pertaining to the 2013-2014 MAP scores.

Table 3

Summary of Comparisons of Cardinal Elementary 2013-2014 MAP Scores with District and State Averages

	District			State		
Grade	z/t	p	Significance	z/t	p	Significance
3rd	1.450	0.074	Moderately Significant	-0.12	0.549	Not Significant
4th	-1.081	0.858	Not Significant	-2.32	0.966	Not Significant
5th	1.660	0.051	Moderately Significant	2.56	0.032	Significant

Null Hypothesis 2:

H_2: The MAP scores at Rams Elementary will not improve relative to district and state averages over the 2013-2014 academic year.

A two-sample *z*-test was conducted comparing the Rams Elementary School's third grade students' MAP scale scores to the scores of the rest of the third grade students in the district for 2013-2014. There was a significant difference between the Rams Elementary School's students' MAP scale scores (M = 634.91, SD = 27.45) and the scores of the rest of the district (M = 622.79, SD = 34.30); $z = 3.987$, $p < 0.0001$. This suggests that the Rams Elementary School's students' MAP scale scores were higher than those of the rest of the district in 2013-2014.

A one-sample *z*-test was conducted comparing Rams Elementary School's third grade students' MAP scale scores to the state average for 2013-2014. There was a significant difference between the Rams Elementary School's students' MAP scale scores (M = 634.91, SD = 27.45) and the state average (M = 628.0); $z = 2.40$, $p = 0.0082$. This suggests that the Rams Elementary School's students' MAP scale scores were higher than the state average in 2013-2014.

For Cardinal Elementary School, the results were mixed. Third grade had some significant difference from state and district averages, but not consistently. Fourth grade showed no difference in state and district averages for all three years. Fifth grade consistently scored at least moderate in state and district averages. The results for Cardinal Elementary School and implementing the program in itself did not seem to make an impact. For Rams Elementary School, there was a significant difference in the MAP scale scores when compared to both the state and the district.

Table 4 summarizes the results of the t-test and z-test pertaining to the 2013-2014 MAP scores for Rams Elementary.

Table 4

Summary of Comparisons of Rams Elementary 2013-2014 MAP Scores with District and State Averages

	District			State		
Grade	z/t	p	Significance	z/t	p	Significance
3rd	3.99	< 0.0001	Significant	2.40	0.008	Significant

Addendum

The 2014-2015 MAP Growth scores for the year of the research became available to the researcher. The district Executive Director provided the researcher with Missouri Growth scores for fourth grade teachers at Rams Elementary School in Blue School District. In Blue School District for the 2014-2015 MAP Missouri Growth Scores, there were a total of 59 fourth grade classrooms which were large enough to measure for Missouri Growth. In examination of the previous years for 2011-2012, 2012-2013, and 2013-2014 for Rams Elementary, the data in fourth grade showed that the four individual teacher scores varied significantly.

In 2011-2012, the building did not have statistically significant growth as compared to the district, and the effect size was negative. Only one of the teachers had statistically significant growth and a positive effect size. One teacher had a significance difference in growth, but a negative effect size. Two teachers did not have significant growth or effect size.

In 2012-2013, the grade level showed statistically significantly higher growth than the district with a positive effect size of approximately 0.36. Two of the teachers showed statistically significant higher growth than the district and a positive effect size. Two teachers did not show significantly higher growth. Of the two teachers who did not

show significantly higher growth, one had non-significant growth with a positive effect size and the other had non-significant growth with a negative effect size.

For 2013-2014, the grade level did not show significantly higher growth than the district and had a negative effect size. One teacher showed non-significant growth with a positive effect size. Another teacher show significant growth with a negative effect size. Two teachers did not show significantly higher growth or a positive effect size.

In 2014-2015, the district mean for 4th grade math growth was 51.33, which was higher than the state mean of 50. From the four years previous, 2014-2015 was the only year the district mean for fourth grade was higher than the state mean. In 2011-2012, 2012-2013, and 2013-2014 the district mean was below 50, the state mean. This growth was evident in individual teacher scores and also as a grade level at Rams Elementary School. The grade level showed significantly higher growth and a positive effect size. All fourth grade teachers in the grade level had statistically significant growth higher than the district and a positive effect size that was twice that of 2012-2013, 0.79.

According the Director of Assessment and Data in Blue School District, the fourth grade teachers at Rams Elementary ranked one, two, four, and eleven in Blue School District, out of the 59 teachers in Missouri Growth. The building mean in fourth grade was 61.02 which was 9.69 higher than the district mean. Individual teachers' means were: 67.6, 61.1, 59.4, and 57.4. Each of these were noticeably higher than the state and district means. The 2014-2015 results can support that a positive change did occur to the grade level.

The Missouri Growth scores for the year of the research (2014-2015) are in Table 5.

Table 5

Rams Elementary School 4th grade MAP Scores for Implementation Year Compared to Past Years

		2014-2015 MAP	2013-2014 MAP	2012-2013 MAP	2011-2012 MAP
4th grade Teacher W	Cohen's Effect Size	1.27	0.38	0.68	0.70
	Statistically Significant	Yes	No	Yes	Yes
	P(T,=t) two-tail	1.1E-06	0.0514	0.0036	0.0009
	Missouri Growth	67.61	53.61	56.23	56.45
	Blue School District Mean Minus Teacher	51.75	49.07	47.85	48.21
4th grade Teacher X	Cohen's Effect Size	0.74	-0.37	0.89	-0.19
	Statistically Significant	Yes	Yes	Yes	No
	P(T,=t) two-tail	0.0026	0.0383	6E-06	0.1513
	Missouri Growth	61.10	44.80	58.76	46.15
	Blue School District Mean Minus Teacher	51.80	49.24	47.78	48.40
4th grade Teacher Y	Cohen's Effect Size	0.60	-0.09	-0.29	-0.83
	Statistically Significant	Yes	No	No	Yes
	P(T,=t) two-tail	0.0272	0.5234	0.1577	0.0008
	Missouri Growth	59.35	48.05	44.41	38.86
	Blue School District Mean Minus Teacher	51.85	49.18	48.06	48.53
4th grade Teacher Z	Cohen's Effect Size	0.44	-0.14	0.04	-0.36
	Statistically Significant	Yes	No	No	No
	P(T,=t) two-tail	0.0162	0.3863	0.7696	0.1695
	Missouri Growth	57.40	47.50	48.53	44.17
	Blue School District Mean Minus Teacher	51.87	49.19	47.99	48.36
4th grade Ram's Elementary School					
	Cohen's Effect Size	0.79	-0.07	0.36	-0.18
	Statistically Significant	Yes	No	Yes	No
	P(T,=t) two-tail	2.5E-10	0.4459	0.0009	0.1199
	Missouri Growth	61.02	48.40	52.09	46.40
	Blue School District Mean Minus Teacher	51.33	49.22	47.68	48.51

Berry et al. (2009) stated that studies showed that students performed better on math assessments when they attended schools with a higher level of teacher collaboration. This could create a tipping point for sustained school turnaround (pp. 3-4).

Missouri Growth Scores from state testing were released to teachers who taught fourth and fifth grade during the 2015-2016 school year for their students from the 2014-2015 school year at Rams Elementary School. The growth scores were provided by Blue School District's Executive Director of Assessment and Data. Third grade teachers were not given growth scores, as this was the initial grade level that students were assessed by the state. Therefore, there was no growth to compare to for third graders. Information provided by the Executive Director of Assessment and Data provided for each fourth and fifth grade teacher was their personal growth score for their class in the 2014-2015 school year, the mean growth for their grade level in their designated building and the total number of students who scored in a specific level achievement category. The numbers represented for the level achievement category were for the entire grade level in their building. The categories were advanced, proficient, basic, and below basic. Growth scores were also provided for the 2014-2015 school year for the mean growth in the district for grade level and the number of students who scored in a specific level achievement category. The numbers represented for the level achievement category were for the entire grade level in the district. Along with the data, all students in the building grade level for 2015-2016 who scored basic or below basic were listed. These were the MAP scores that the students received in their prior grade level. Missouri Performance Index (MPI) mean scores were also given for the individual teacher's classroom, the grade level, and the district. MODESE (2014b) explained MPI as a number reported

based on achievement levels that given to students based on the state assessment. Advanced was 5 points, Proficient was 4 points, Basic was 3 points, and Below Basic was 1 point. The points were added and divided by the number of students in the group measured. This number was then multiplied by one hundred which was the MPI (p. 15).

The fourth grade teachers at Rams Elementary School spent a minimum of one hour a week collaborating about Math in Focus, where in previous years they did not collaborate. Their success in the Missouri Growth Scores were evident and supported that collaboration confirmed this study of research that students performed better when teachers collaborated, with support from professional development and the Math Coordinator.

Chapter Five: Discussion and Reflection

This mixed-methods study explored data from an academic school year, 2014-2015, with six participants at Rams Elementary School, as they learned about and implemented Math in Focus, an elementary mathematics program. The six participants were four fourth-grade teachers; one third-grade teacher; and one fifth-grade teacher. For the four fourth-grade teachers, the purpose was to ascertain, through teacher perceptions, how the collaboration they practiced and the professional development they received supported the implementation of the new math program, Math in Focus. The inclusion of the third grade and fifth grade teachers was to confirm that the training at professional development and implementation were the same at these grade levels. Additionally, the research sought to examine quantitatively if there was an improvement with the students' MAP scores relative to district and state averages over the time period of the district's implementation of Math in Focus. The MAP scores were from the third grade classrooms at Rams Elementary School for the 2013-2014 academic school year. The state of Missouri assessed elementary students in third, fourth, and fifth grades for mathematics. Out of the three grade levels, the only state-tested grade in the implementation 2013-2014 school year was third grade. MAP scores from an additional elementary school in Blue School District, Cardinal Elementary School, were also analyzed. Cardinal Elementary School piloted Math in Focus for the 2011-2012; 2012-2013; and 2013-2014 academic school years. The MAP scores were from third, fourth, and fifth grade. The researcher sought to examine both schools quantitatively to see if there was an improvement with the MAP scores relative to district and state averages over the time period of the district's implementation of Math in Focus.

Research Questions and Hypotheses

The research project was guided by the following research questions and hypotheses:

RQ_1: What can we learn about an American elementary schools making a transition to Singapore math (in the form of Math in Focus) by following a grade-level team for the school year as they implement the program?

RQ_2: Did the professional development on Math in Focus prepare the teachers for implementation of the new program?

RQ_3: What was the teacher attitude and perception of Math in Focus?

The secondary data was analyzed using the following hypotheses:

H_1: The MAP scores at Cardinal Elementary School will improve relative to district and state averages over the time periods research 2011-2012, 2012-2013, and 2013-2014.

H_2: The MAP scores at Rams Elementary School will improve relative to district and state averages over the 2013-2014 academic year.

Interpreting Qualitative Data

RQ_1: *What can we learn about making a transition to Singapore math (in the form of Math in Focus) in an American elementary school by following a grade-level team for the school year as they implement the program?* There were a number of themes that emerged from the study; concerns with (a) sufficient resources, (b) the ups and downs of a pacing guide, (c) the adequacy of professional development for staff, and (d) communication between the Math Coordinator and teachers.

The interviews with teachers and the researcher's notes on the team planning meetings suggested that when implementing a program like this within a building, one requirement should be to have common plan time for teachers to collaborate. Blue School District provided common plan time for the teachers. The fourth grade team had 50 minutes of common plan time five days per week. The grade level met weekly for a minimum of one hour to discuss, plan, critique, review, analyze, and create resources for the new math program. The grade level team was grateful for the common plan time that was given by the district. This bears out findings from the literature. Poulos et al. (2014) agreed that to create collaboration, districts needed to set a structure and expectations for collaboration. This would include giving teachers an opportunity to work together. This does not mean when running into each other in the break room or when passing in the hallways, but scheduled, committed time outside of meetings and other commitments.

Throughout this entire academic year of the research, the common denominator that kept everyone hopeful regarding the implementation of Math in Focus was knowing that their frustrations, successes, and struggles were shared. The grade level teachers utilized each other to validate, help, adapt, or accommodate many parts of the math implementation during their common plan time or weekly meetings. Communication was important, within the grade level, but also with the Math Coordinator. The Math Coordinator was the specialist and was instrumental in the success of the Math in Focus implementation. Math in Focus emphasized a deeper understanding of math concepts and teachers had to change how they taught math. This change in teaching was constantly emphasized by the Math Coordinator through all communications. Towards

the end of the school year, teachers not only became more comfortable with the approach to the new math concepts, but understood its benefits. Teacher B said,

> I like how the program breaks down problems to start off, and the Reteach is really showing them an understanding of why they do what they do. I think that helps a lot of kids in the long-run. I know a lot of kids can just dive right into it. Those kids that struggle, I think it is a great strength of the program.

Teacher C stated,

> I feel like before we did not teach the why. Why things were why we did things the way we did. It was just this is how you do it, and memorize the steps and that is it. I feel that Math in Focus, it does take it deeper so they have a deeper understanding of it. They understand why we are doing things. We have tried to get them to have a better number sense because I feel like before, their number sense, they just had no idea why things were the way they were. But I feel like they have a perfect number sense now. No, I do not think they do, some of them. It is just too hard for them to have that knowledge at this time at their age, but I think some of them can grasp it better by learning the why. And I think Math in Focus does a good job with that.

Teacher A stated, "Math in Focus, it makes, it tends to make more sense because of the philosophy behind it, and why you have to do something that way." And lastly, Teacher D stated,

> I really like the why of why we do something. For example, division. I never really taught it concretely or with manipulatives before, but it really made sense. Instead of just saying put a one here, subtract, and bring the next number down, it

explained why we doing that instead of saying that is just the process of doing it. Now just keep repeating it until there are no other numbers to bring down.

A pacing guide was provided to all teachers, which included the chapters to be covered and the number of days allocated to teach each chapter. Pacing guides helped school districts maintain continuity across the schools. The Math Coordinator set a strict pace regarding dates by which chapters should be instructed and assessed. The Math Coordinator even reminded schools that if they were behind more than two weeks she should be notified, so she could help them get back on-track. The importance of the pacing guide kept teachers on-track, but also guaranteed for the following grade level that the topics and concepts would be covered. Students falling behind could put the subsequent-year teachers at a disadvantage. The Math Coordinator mentioned that trajectories were important, but could be difficult to attain if the previous grade levels did not get to the concept. The coordinator emphasized how important the pacing guide was in professional development workshops, emails, and through one-on-one communication. Falling behind the pace would put the subsequent grade level behind, not only with background knowledge, but could create a snowball effect, because that grade level was spending allocated time from the school district trying to catch students up instead of working on their grade level objectives. This example was evident during the 2014-2015 study year as the students were not exposed to fractions during their 2013-2014 school year, when studying with their third grade teachers. The third grade teachers did not have time to teach fractions within their allocated time on the pacing guide. Fourth-grade teachers had to maintain the fractions unit pacing guide while trying to accommodate third and fourth grade objectives.

The teachers appreciated the structure and the checklist aspect of the pacing guide, as it kept them apprised of the sequential order of teaching the chapters. However, some teachers felt the amount of days spent on the chapters were unrealistic and unattainable. The teachers felt like some concepts could not be taught in the allocated time frame set by the Math Coordinator. Because of the emphasis placed on staying on track with the pacing guide from the Math Coordinator, fourth grade was diligent in maintaining the pace of the chapters to be taught within the time frame designated.

When creating the number of days spent on the pacing guide, it was important to take interruptions and/or holidays into consideration when allocating a specific number of days to a chapter. Some examples would be school-wide assemblies, classroom parties, lack of background knowledge of a concept from the previous grade, students not mastering the concept, and application of Benchmark Assessments. These interruptions created gaps between the teacher's pace and the pace set by the district. One of the issues with the pacing guide was that it did not address the lack of development of student reasoning or understanding of mathematics. When some students did not understand a concept, it was the judgment of the teacher to continue or to slow down. If the teacher slowed down and took longer than the pacing guide appropriated, teachers risked falling behind the pacing guide. But if they moved on too quickly, they could sacrifice the depth of learning.

Throughout the school year, the pacing guide for fourth grade changed by extending the dates on chapters. The fourth grade team was relieved, because some of the concepts to be taught were taking longer than the time allotted. As Teacher B stated,

> For what we had to go back and reteach things that were not taught in the previous grade level (fractions because third grade did get to that chapter), so we are having to teach two grade levels of fractions. We taught third grade fractions and fourth grade fractions. So for them to be ready for fifth grade fractions, it seems like a lot to ask of these kids. This also goes with asking a lot of the teacher.

Teacher C said, “My struggle was where we are going from here and what kind of a timeline do we have to get those things done because it seems like our pacing guide always changes." Teacher A commented, "My struggle was pacing because I felt like I was on pace, but then the pacing has changed many times." One comment by Teacher 3 regarding the pacing guide was that the pacing guide did not take Benchmark Assessments into consideration. These assessments took time out of the allotted days for the pacing guide. Teacher 3 also commented, "With the curriculum, just the pacing of it. It is too fast. We just cannot get through it in the pacing that they are wanting us to and feel like we are doing an effective job.” Teacher D stated,

> My struggle was pacing. As a grade level, we have worked so hard to meet pacing deadlines with the initial pacing guide that was given to us. It has changed, and I am not really quite sure where we should be.

The Math Coordinator mentioned that many of the skills students were lacking could be addressed in Calendar Math. So moving on to the next concept or chapter could be justified. Calendar Math included many concepts that were either reviewed or slowly introduced to the students. Teacher A stated positively, "The Math Coordinator talked a lot about fractions within Calendar Math which I thought would kind of help catch them

up on what they missed in third grade. I guess that was something else that I looked forward to." Teacher D also added, “Not just Calendar Math, but we also have our Essential Time to teach the foundation of fractions.” Freeing up the time spent to teach third grade fractions by covering it in Calendar Math and Essential Time, helped with the pace of the pacing guide. Trying to get third and fourth grade fraction objectives in a limited number of days seemed insurmountable.

With regards to the pacing guide, the Math Coordinator had different roles and tasks to perform. She had to become familiar with six different math curriculums. She also had to be an expert in the instructional approach of all grade levels in an elementary setting, which were kindergarten through fifth grade. She had to coordinate, implement, and monitor a new math program. She also wrote out monthly tips and suggestions for every grade level, maintained the district website for all grade level teachers, and assisted and educated administrators of the new math series, just to name a few. With all these responsibilities on the Math Coordinator, it would be expected and understandable that there would be set backs or obstacles during the new mathematics program implementation.

The professional development on Math in Focus to prepare the teachers for the implementation of the new program was a concern for participants. According to the interviews conducted with the four fourth-grade participants, and the third and fifth grade teachers, reviews were mixed. (There were three professional development sessions for third grade teachers and five for fourth and fifth grade teachers.) The teachers found the professional development beneficial when the topic was relevant to their then-present teaching concepts. If past concepts that were already taught by the teachers were covered

at the professional development, those were beneficial, but not for the then-current students, considering that the concept had already been taught. The teachers wanted strategies that could be implemented immediately, as opposed to something that could be applied the following school year. Professional development presented teachers with a topic or ideas to implement in the classroom. According to Jovanova-Mitkovska (2010) Professional development involved training teachers with new knowledge and strategies in the classroom. It also involved integrating technology. Professional development also connected teachers with their colleagues, which allowed for meaningful collaboration.

All six participants also agreed that the workshop was especially beneficial when the presenter exposed the information as if the teachers were the students or actively learning. This allowed the teacher to hear the questioning that could hypothetically take place. Kramarski and Revach (2009) stated that students will have a much deeper understanding of how to eliminate unnecessary information when they know when, why, and how questions. By questioning the comprehension, connection, strategy, and reflection, students would develop a mental image or representation that would corroborate their findings or their answer (p. 379). The presenter from the professional development sessions would ask questions of the teachers as active learners and give examples of when, why, and how questions. These practical exercises posed questions, which facilitated greater understanding for teachers to apply in the classroom. These questions were examples of how teachers could question students in their thinking, thus assisting them by creating a mental image, so the students could explain their thinking to their solution.

Collaboration

There were two important forms of collaboration documented in this study: (a) between the grade level team and (b) among the grade level team and the Math Coordinator. Both forms of collaboration were important to the success of the implementation of a new program. There were some meetings that the grade level team requested with the Math Coordinator. On one occasion, they met in October about a question in Math in Focus on multiplication and division. The grade level was thankful that the Math Coordinator took the time to come to the building to explain in person the questions they had regarding multiplication and division. The grade level had some confusion on how to assess the chapter, because an email was sent out to all fourth-grade teachers regarding teaching the algorithm verses other different strategies. The end result of that meeting inspired the grade level teachers to create assignments that would cover the expectations of the school district that differed from Math in Focus, in regards to practicing and assessing the concrete, pictorial, and additional multiplication and division strategies that needed to be addressed. During the meeting, the Math Coordinator suggested taking the Test Prep as a grade level team prior to teaching the chapter. She also suggested grading the test as a grade level and coming up with a scoring guide on how all problems should be scored. This suggestion was instrumental in the success of implementing Math in Focus. This suggestion catapulted the grade level meetings with more confidence in the approach of planning and teaching a new chapter. It helped plan and guide instruction in all subsequent meetings. Taking the Test Prep prior to teaching the chapter allowed the teachers to see what the expectations were of the students. It also made the teachers cognizant to use the math vocabulary that was on the Test Prep during their instruction. Otherwise, these terms would have been unfamiliar to the students had

they not been exposed them to it in the teachings. An example of the vocabulary use was when one of the division questions asked, eight can be subtracted from 2560 how many times? This reminded teachers to repeatedly explain that division is repeated subtraction. During all the subsequent meetings where the dates were close to starting a new chapter, taking the Test Prep together was always the initial start of planning a chapter. Not only did the teachers take the Test Prep, but they also collaborated on how to grade the test with consistency throughout the grade level. Scoring guides with an answer key were created that showed the expectations of the students and also served as a reminder of allocated points for each question. During the planning of the chapter, the grade level also created additional assignments to go with the math series that allowed students to have additional practice on skills that were not provided by Math in Focus. The fourth-grade team needed to do this because some of the Math in Focus assignments did not match up with what the school district required. For example, use of pictorials was highly suggested by the Math Coordinator for fractions. An example stated by the Math Coordinator in professional development was when students were expressing fractions in simplest form, the algorithm explained by the Math in Focus textbook should not be taught. The algorithm was not an explanation. She wanted simplest form to be taught concretely or pictorially. The Math in Focus series did not give an adequate amount of practice with this. The teachers created assignments, but mainly to support the additional practice required of the students. This gave the students additional practice either concretely or pictorially. This type of initiative and enthusiasm was due to the Math Coordinator suggesting that teachers take the Test Prep and her emphasis on the concrete and pictorial aspect of teaching mathematics. Once again, it catapulted our planning in

that it gave us confidence in our instructional approach, what was expected of the students, and most importantly, what was best for the students.

Some examples of how the grade level went above and beyond was by creating additional templates, assignments, or assessments. A suggestion was made by a teacher to make a template for the students to show their work on the Test Prep. By making the template, teachers provided an organization tool for the student to show thinking in writing. Fourth graders still needed assistance with organization and neatness, as this was imperative in math. The template also had the problem written on top of the template so students were not confused with transferring problems from one piece of paper to another. After all, teachers were not grading them on transferring numbers, but understanding how to approach and answer a math problem. The Test Prep that came with the Math in Focus series was set up for students to write down their final answer of a math problem. With some concepts, the Math Coordinator wanted all students to learn multiple strategies or present their answer pictorially instead of using the algorithm for solutions to a problem. This template gave explicit directions to the students on the expectations for their answers.

Allen (2011) stated that the constructivist approach allowed students to explore which mathematical meaning worked best for them, allowed students to explore and discover their approach to an answer (p. 4). As a grade level, teachers added additional directions on the black line Test Prep for multiplication and division that required students to show all their thinking and to show their final answer by using at least two different strategies. The two strategies helped two-fold. It allowed students to check their answers on both strategies to make sure they were the same; in essence, checking their

answer. This would be a good indication if their solution to the problem was correct or not. And, it gave them a choice in their approach to the problem. Teacher D added that by taking the Test Prep in advance and knowing what the teachers expected the students to know, this definitely would be beneficial when the teachers teach it. She also stated that it would have been helpful if there was a better explanation and examples of all the different multiplication strategies that were expected of the students. After taking the Test Prep, teachers decided to create a study guide for the students on the Test Prep. This was created to resemble the Test Prep for chapter three, multiplication and division. The study guide mirrored the Test Prep; however it utilized different numbers and story problem examples. The study guide included the same template that was expected of the students in the Test Prep, which was to show their understanding pictorially or by using multiple strategies. This study guide also included an answer key with point allocations to the study guide for all the teachers. The teachers discussed how to effectively and fairly grade the test that would be given over multiplication and division. The expectations of student answers and work were hypothesized for universal grade-level grading.

The researcher was mindful and conscious within the grade level meetings. The researcher not only took a leadership role in the meetings, but also with the direction of Math in Focus. The three fourth-grade teachers were confident in the researcher's approach, suggestions, and ability to lead the meetings. Other fourth grade teachers also made significant contributions and suggestions to the implementation of Math in Focus. The teachers also felt safe and unjudged about the meetings. Suggestions and opinions were freely expressed without judgment. Jolly (2013) commented about collaboration in

that teachers needed to see the importance and influence of someone who was skilled at a specific concept. This person should be able to take a leadership role to guide and inspire others, not to intimidate or make someone feel inferior.

Interpreting Quantitative Data

Mathematics MAP scores for third, fourth and fifth grade students were collected from Cardinal Elementary School in Blue School District, which piloted Math in Focus for the academic school years 2011-2012; 2012-2013; and 2013-2014. The sample size for the data collection was approximately 25 students per classroom, with five sections of teachers per grade level. This gave an estimated total of 375 students in third, fourth, and fifth grades. In order to test the hypotheses, the researcher conducted a series of *t*-tests and *z*-tests for differences on the data obtained from the district's Executive Director of Assessment and Data. This data included MAP scale scores for all third grade students in the district. This research compared third grade Mathematics MAP scale scores with third grade district average (removing the data results from Cardinal Elementary) and MAP scale scores with the third grade state average. In addition, the district's Executive Director of Assessment and Data provided the researcher with Missouri Growth scores of the fourth and fifth grade teachers at Cardinal Elementary School. This data compared the 4th and 5th grade Mathematics MAP Missouri Growth scores with the fourth and fifth grade district average (removing the data results from Cardinal Elementary) and the state average Mathematics MAP Missouri Growth scores. Missouri Growth Model data for third grade teachers was not possible, due to third grade being the first year of state testing, with no other years to compare with to show growth. The data from third, fourth,

and fifth grades were analyzed to help determine if the scores improved relative to district and state averages over the three-year implementation period.

For Cardinal Elementary School, the results were mixed for the three-year period. Third grade had some moderate significant difference from state and district averages, but not consistently. The moderate significant differences occurred in 2012 when compared to the state mean, and in 2014 when compared to the district mean. The remaining years, when compared to the district and state mean, had no significant differences. Fourth grade showed no significant difference in state and district means for all three years. Fifth grade consistently scored at least a moderate significant difference in state and district averages. In 2012, they had significant difference when compared to the district mean and moderate significant difference when compared to the state. In 2013, they had moderate significant differences in both district and state means. In 2014, they had moderate significant difference when compared to the district mean and significant difference when compared to the state mean. The results for Cardinal Elementary School, when comparing all grade levels for all three years, and implementing the program did not seem to make an impact.

Cardinal Elementary School was a Title I school. Non-Public Educational Services (n.d.) explained Title I,

> Title I, formerly called Chapter I, is the nation's largest elementary and secondary education aid program. The program provides federal funds to schools that serve students who are economically disadvantaged and are at risk of falling behind their classmates or failing. Schools receive funds based on the number of low-income students they enroll; this calculation is generally based on the number of

> students who qualify for the federal free or reduced-price lunch program. If more than 40 percent of the student body is deemed low-income, the school is considered a school-wide Title I school and may use its funds to provide supplemental programs or services or hire staff members for the benefit of all students; if less than 40 percent of the student body is considered low-income the school is a targeted a Title I school and may only use its funds to improve the resources available to specific student populations. (p 1)

According to MODESE (n.d.c., p. 1), the percentage of free and reduced lunch for Cardinal Elementary in 2011-2012 was 40.1%; 44.1% in 2012-2013; and 42.9% in 2013-2014. MODESE (n.d.b., p. 1) reported the Blue School District's free and reduced lunch in 2011-2012 at 21.0%; 22.7% in 2012-2013; and 22.7% in 2013-2014. Cardinal Elementary School had almost twice as many students on free and reduced lunch when compared to the district percentage and about four times as many students as Rams Elementary School.

Cardinal Elementary School was one of the lowest schools in socio economic status in the Blue School District, and to have moderate significant differences against district and state means was impressive to this researcher. Improvements in MAP scores at Cardinal Elementary may be attributed to collaboration. There may have been differences in the way the grade levels collaborated in regards to math, their pace, and their teaching styles. Berry et al. (2009) stated that studies showed that students performed better on math assessments when they attended schools with a higher level of teacher collaboration. This could create a tipping point for sustained school turnaround (pp. 3-4).

Fourth and fifth grade scores were compared based on their Missouri Growth scores. Fifth grade, for all three MAP tested years, had significant or moderate differences in their scores. Fourth grade, however, did not make significant difference in all three years. Factors that may have contributed to making no significant growth could include the teachers' attitudes and beliefs about the new program. Teachers could have been resistant to the changes mandated by the district. Hochberg and Desimone (2010) asserted that the effect of professional development in regards to instructional practice depends on the teachers' will and skill to change. Research on teacher knowledge and the belief in change suggested that teacher philosophy and efficacy beliefs were important components in the change process, when joined with knowledge, a system of learning opportunities, and personal relevance (p. 97). Another contribution may have been that some of the teachers were uncomfortable with the new approach to teaching math. Allen (2011) explained that teachers teach the way they were taught. The new strategies used were not the way they learned math. Teachers also lacked confidence in the new approach to teaching. Teachers did not feel in control of their lessons. They feared questions may arise that they would be unable to answer or justify (p. 4). This might account for the differences in data for those who did not make significant difference.

For Rams Elementary School, there was a significant difference in the MAP scale scores for the 2013-2014 academic school year when compared to both the state and the district mean. These results were from the first year of implementation of Math in Focus for third grade. This suggested that the scores did improve, relative to district and state averages, with the implementation of Math in Focus.

The socio economic status of Rams Elementary School was more affluent than Cardinal Elementary School. When looking at Title I funding, according to MODESE (n.d.c., p. 1), Rams Elementary was at 10.9% in 2011-2012, 10.2% in 2012-2013, and 10.4% in 2013-2014. Cardinal Elementary School was at 40.1% in 2011-2012, 44.1% in 2012-2013, and 42.9% in 2013-2014. When comparing the third grade data results from Rams Elementary 2013-2014 MAP scale scores to Cardinal Elementary School's 2013-2014 MAP scale scores, Cardinal Elementary had 32.5% more students, or about four times as many students on free and reduced lunch. When comparing Cardinal Elementary to the district percentage of free and reduced lunch for the 2013-2014 school year, Cardinal Elementary School was 20.2% higher, or had about twice as many students than the district average.

Table 6 summarizes the percentage of students with free and reduced lunch.

Table 6

Summary of Free and Reduced Lunch for Cardinal Elementary, Rams Elementary, and the Blue School District

Year	Cardinal Elementary School	Rams Elementary School	Blue School District
2011-2012	10.9%	40.1%	21.0%
2012-2013	10.2%	44.1%	22.7%
2013-2014	10.4%	42.9%	22.7%

Personal Reflections

There were several factors that may have contributed to the success of the fourth grade teachers at Rams Elementary. My own role as both grade-level chair and doctoral

student researcher made understanding the implementation of Math in Focus a central feature of my professional and student life. Due to the research I was conducting, I was especially thoughtful and deliberate with grade level meetings. As I documented our planning and conversations for the research, it kept me hyper-aware of whether the other teachers and I felt we understood what we were to teach in each class and whether we felt prepared to do so. This transparent documenting of the process necessitated the grade level team to discuss and implement the program with fidelity. Each teacher went above and beyond the materials of Math in Focus. Through a collaborative division of labor, we were each delegated to create different types of formative assessments, practice assignments, and activities for the students.

The Math Coordinator was prompt and reliable when questions arose. She was always willing to meet us at our school. Communication was open and our grade level felt comfortable inquiring about Math in Focus. The Math Coordinator was influential in our success of this program as we approached each chapter with the suggestions and strategies suggested. The Math Coordinator sent out emails with tips and teaching strategies for chapters in Math in Focus. These tips and strategies were beneficial as they always assisted the direction of our instructional planning. There were times when we did not quite understand the reasoning; however, towards the end of the year, everything she encouraged us to do was evident in our students' awareness of math concepts. The suggestions from the Math Coordinator and professional development trainings were followed precisely as dictated by the presenter and Math Coordinator. Any and all suggestions were followed and implemented. Any questions or issues that arose were immediately communicated to the Math Coordinator or another colleague on the grade

level. The process of collaboration was often daily, always a center of attention at our weekly common planning time and on-going for the entire school year.

The grade level also maintained the pacing guide set by the Math Coordinator. The pacing guide was one of the main factors mentioned during every professional development training or communication sent out from the Math Coordinator. The Math Coordinator emphasized the importance of this pace, explaining that it would be instrumental in the students' success in subsequent grade levels. It also gave teachers a guide as to the chapters and topics that were to be covered and approximately how long each chapter should be taught.

Additionally, we employed a classroom practice centered on mastery and self-improvement, which also contributed to our success. Students were required to reflect on their math assignments by correcting any missed problems on their daily work. This reflection created a paradigm shift in the minds of the students. Instead of just grading an assignment, writing down how many problems students missed, and sending it home without feedback, students knew the expectation of correcting all of the missed problems, and understanding all the material. Graded work for corrections and feedback was immediate or given by the following school day. This encouraged the students to put forth their best effort and not work hastily. In the beginning of the year, some students seemed overwhelmed with the corrections. Different assignments were assigned each day, whether review or a new concept of a chapter, so if a student was correcting an assignment from a previous day(s), those had to be corrected first, along with completing their current daily assignment. This meant that a student could have multiple assignments on any given day. The students realized that completing an assignment

carefully and thoughtfully would eliminate the need to do a problem twice. And the excitement within the students when grading an assignment to see minus zero or only a few corrections was empowering to their sense that they had the ability to complete the math problems independently, carefully, and successfully. For those students who needed the extra support, small groups were created to assist the students. The small groups focused on honing in on the mistakes that were causing the miscalculations.

The teacher collaboration with weekly meetings also brought our grade level team together, especially important for those who did not feel as effective in the subject of Singaporean math instruction. Some teachers had more of a passion for math than the others, which allowed for colleague mentoring regardless of the teaching experience. Berry et al. (2009) stated that trust was a major element in collaboration. Teachers who worked in an environment with trust had a basis for inquiry and reflection into their own practice, allowing them to take risks, challenge and critique each other, and collectively solve tough problems as a team (p. 7). Teachers assisted one another with the online calendar, suggestions for remedial assistance, and giving forewarnings of obstacles presented during the initial introduction of a skill. Trust allowed us all to admit, within this team, what we did and did not understand, and what we could and could not yet do. Alternative ways of approaching a skill were suggested in our brainstorming sessions, allowing each of us to be more productive.

Collaboration amongst the fourth grade teachers was paramount in the successful implementation of Math in Focus. The teachers collaborated on what was best for their students by previewing, planning, rethinking, refining, and reflecting on their instructional practices. The curriculum, teaching strategies, essential materials, and

assessments were all examined and thoughtfully implemented. When teachers were able to collaborate, as opposed to working in isolation, they were able to improve their teaching effectiveness, which advanced student learning. Having common plan time everyday also played an important role. Even though we met once per week as a grade level, common plan time allowed for comments or questions that needed to be addressed before the weekly meeting. Collaboration could be intimidating to teachers, as they do not want to feel judged by their colleagues. The participants in this study were comfortable with everyone, as the discussions that took place were open and everyone felt valued.

Another important aspect of the success was the teacher expectations that students engage with the work. Students were to succeed at everything they possibly could and to believe in their potential and abilities. For example, we agreed that students had to articulate their math questions to the teachers with evidence – they could not get away with just saying, "I do not get it". In other words, the students had to show partial work in order for teachers to assist them with any questions on an assignment. This allowed the teacher to accurately assess the step with which the student was struggling. High expectations were also communicated to students, as they had to self-reflect on their mistakes in order to ameliorate the incorrect answers on all assignments. Students realized that it was not an option to complete and turn in assignments hastily. The classroom expectation they learned was that regardless of previous effort, the work had to be completed correctly, or it was to be reassigned for corrections. This created a mindset of mastery for students who may not have had high expectations for themselves; a paradigm shift.

Recommendations to the Program

The researcher has some recommendations for school districts who are implementing a new math program, Math Coordinators, people who present at workshops, and/or administrators. The first recommendation is regarding the professional development that was provided to the teachers - provide copies of the notes from the PowerPoints. This would allow the teachers to focus on the trainer's message, and not miss the message while copying notes. Teacher C said,

> I spent a lot of time writing down the word problem and then to copy down the bar model, and I guess I just do not multi-task very well. And I spent more time concentrating on getting the script written and drawing the bar model that by the time I got all that done, she was moving on to something else. And I had not heard the explanation. They should copy off the power point for us or give us pre-copied problems with the bar models on there so that we can just kind of look at her modeling, and we do not have to concentrate on writing all the problems down.

Teacher A also mentioned, "I feel like everyone in the room was not paying attention because you were too busy trying to write down the problems. So to have those in front of us would have been extremely helpful." Teacher D also stated, "Sometimes you focus too much on copying the problems that it is difficult to really listen to the conversations that are taking place."

The second recommendation concerns the professional development topics to be covered at the workshops. Teachers get excited and inspired to attend workshops so they can acquire innovative and creative ways to present information to students. The

recommendation is for the chapters or concepts presented to synchronize with the pacing guide's chapters or topics, along with the date of the workshop. If the workshop is in mid-January and the pacing guide indicates that fractions also start in mid-January, training on fractions would make it more applicable to the current classroom situation. When teachers attend the trainings, it should be relevant to their present teachings that were set by the pacing guide. Teachers would like to be equipped with current or upcoming concepts that they can apply immediately in the classroom.

Parental involvement is critical in education. It is important that parents support and assist their children in assignments. Math in Focus approaches math concepts much differently than the parents learned in school. The traditional algorithm is now taught differently, through multiple strategies that may be foreign to parents. A suggestion for this program would be to have parent informational meetings during the evening to explain and assist parents in understanding and applying the new approaches to the math concepts. It is difficult for parents to provide assistance when they themselves are doubtful of their abilities. It is also challenging for parents to embrace a new program that seems to question their own intelligence in elementary math. Once the parents understand the reasoning of the different strategies, they will be more inclined to welcome the new math program. As Hinde (2004) stated, parents oppose change because they are kept at a distance.

The final recommendation for this program would be to provide all teachers with formative assessments to administer throughout the chapters. Garrison and Ehringhaus (2014) explained formative assessment as a part of the instructional process. Formative assessments allowed the teacher to adjust teaching and learning while it was happening.

Formative assessments informed teachers about the student's comprehension at a point when timely adjustments could be made. These adjustments will help students achieve targeted standards-based learning goals within a set time frame (p. 1). Teaching one chapter in Math in Focus covered numerous topics in each chapter that built upon one another. It was imperative that students grasped the current concept in order to progress. Formative assessments given to students after the lessons in each chapter were created by the grade level team in this research. These quick assessments, or exit slips, had just a few problems, and gave the teachers an indication of the level of mastery or inefficiencies for each student. It evaluated their progression of learning. These exit slips allowed the teachers to identify different levels of achievement to ensure that learning continued, whether they were frustrated or needed to be challenged. This created an opportunity to drive and differentiate instruction for the betterment of the students. Although most teachers could identify which students were struggling with a concept, a formative assessment allowed the teacher to discern the students' approach, strategy, and most importantly thinking, on paper. It allowed the student to demonstrate their approach to the learning process. This would help a teacher identify errors or confusion that could lead students to misinterpret, misunderstand, or miscalculate. Garrison and Ehringhaus (2014) suggested using f*ormative assessments* as a part of the instructional process. Formative assessments would allow the teacher to adjust teaching and learning while it is currently happening. They can inform teachers about the student's comprehension at a point when timely adjustments can be made. These adjustments can help students achieve targeted standards-based learning goals within a set time frame (p. 1).

Recommendations for Future Research

Due to the short period (one academic school year) in which the fourth-grade team was studied, additional research can be conducted on the effectiveness of Math in Focus in the school district. It would be worthwhile to research grade level teams over longer periods of time in order to explore the effects of team collaboration and MAP Growth scores. MAP scores can continue to be analyzed by comparing teacher scores, grade level scores, building scores, and district scores. These scores can also be compared to the district and state means and compared over several years.

Additional research that can be conducted within the school district is getting feedback from teachers. Questions could be administered through a form or survey. Some questions could inquire about the effectiveness of team collaboration, comfort ability, and confidence with teaching the different math strategies or their instructional practices, the pacing of the lessons in accordance with the pacing guide, and the incorporation of technology. This feedback could assist the Math Coordinator in future workshops. If funding will not allow for additional workshops, correspondence via emails with tips or suggestions based on the feedback would still be beneficial.

Other research topics could be studied on how to tailor to struggling students in order to meet their individual needs in order for them to advance to grade level concepts. The same research could also apply to challenging those students who grasp concepts quickly. Teacher 3 mentioned,

> And I still think that meeting all the kids needs is challenging for me. The ones that are ready to move on and the ones that are not. I am always very good with the ones that still need my help because I can sit in small groups and do that but

> the ones that move are ready to move and that is harder for me. We do have a list of questions, she did touch on that but that is just one of those areas that I tend to struggle a little bit a more with. I tend to focus on the ones that are not getting it than the ones who are ready to move on and be challenged. So that is something that I will have to work on.

Another topic frequently brought up by all grade levels were the students' lack of basic math fact fluency. These basic math facts included addition, subtraction, multiplication, and division. Further research could see if Math in Focus improves fluency with their approach to teaching basic math facts in primary grades.

Conclusion

Implementing a new program takes time, patience, and dedication from everyone, especially when it demands a new approach to teaching math concepts. Professional development, support for team collaboration, and change in the pedagogical approach are essential for a successful implementation. In order to create a comprehensive implementation of new curriculum, many phases of change must occur. Teachers need to be open and flexible in how they teach and embrace the changes. Teachers need to focus on using several different approaches to teaching math, as opposed to a single solution. With Math in Focus being a new approach to teaching math concepts, teachers must plan to spend extra time previewing and familiarizing themselves with the lesson and taking time out from the classroom to attend professional development workshops. Having access to and relying on the advice of specialists in the field, whether the Math Coordinator or a teacher with a competence and expertise in math, must be embraced and utilized for continuous improvement. The Math Coordinator led our grade level through

a successful implementation with her guidance of emphasizing the importance of concrete and pictorial aspects of the math process and her suggestions on how to utilize the available resources from Math in Focus. Lastly, team collaboration is vital as it can have a prodigious influence on colleagues. Teachers will be able to support one another through frustrations and successes.

The 2014-2015 MAP Growth scores for the year of the research became available to the researcher. These scores were from the students of the fourth-grade teachers in this current study. There were a total of 59 fourth grade classrooms in Blue School District. In examination of the MAP growth scores for 2015, the district mean for fourth grade math growth was 51.33, which was slightly higher than the state mean of 50. In examination of the MAP Growth scores of previous years for 2011-2012, 2012-2013, and 2013-2014 for Rams Elementary, the data in fourth grade showed that the four individual teacher scores varied significantly. This fourth grade team did not always have significant growth as a grade level, with the exception of 2014-2015 results.

Out of the 59 teachers from the 2014-2015 MAP Growth Scores, the fourth grade teachers ranked one, two, four, and eleven in Blue School District. The building mean in fourth grade was 61.02 which was 9.69 higher than the district mean. Individual teachers' means were: 67.6, 61.1, 59.4, and 57.4. Each of these were significantly higher than the state and district means. The 2015 results can affirm that a positive change with Math in Focus did occur.

This study demonstrated that the implementation of Math in Focus was best supported by time-sensitive professional development regarding what was to be taught next, common plan time that allowed adequate time for grade level collaboration, and

provisions for additional materials that were not currently available through Math in Focus. When these were present, as they were in this study, teachers will feel confident in their instructional approach and teach innovatively, and students will master the material presented.

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Appendix A

Interview Questions for the Assistant Superintendent of Curriculum

Why is the school district making a math adoption change?

What was the process of choosing Math in Focus?

Why was Math in Focus chosen?

What is the cost of the program?

How was Math in Focus chosen? (Vote? Teacher buy in?) Was it a top down or a collaborative vote?

Appendix B

Interview Questions for the Math Coordinator for Elementary Schools

What type of professional development opportunities will be offered for teachers during the first year of implementation?

Besides the professional development that is being offered during the school year, will there be on-going training throughout the year?

Whom will teachers contact with questions regarding Math in Focus?

How will you monitor fidelity of implementation?

Will there be grade level or building representatives for questions? If so, how will these representatives be selected?

Will you be looking at Benchmark scores for math to see if Math in Focus is being followed?

In regards to bar modeling with the Singapore approach, what seems to be the common concern? With teachers? Parents?

Cardinal Elementary is in their fourth year of Math in Focus. Did their first three years of training look similar to schools in their first year of training?

What did you do for new teachers at Cardinal Elementary School?

How did you monitor fidelity at Cardinal Elementary School?

How do teachers help students with basic computation for fact fluency?

What are your thoughts about timed tests for math fluency?

Vitae

Suzette M. Pfanstiel currently teaches fourth grade. She has been teaching for sixteen years. The 2014-2015 school year will be her 10th year as a fourth grade teacher. Other grade level experiences include teaching third, fifth, and sixth grades.

Suzette M. Pfanstiel received her Bachelor of Arts in Elementary Education from The University of Central Oklahoma. She also has her Master of Arts in School Administration from Lindenwood University.