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Elementary Teachers' Perceptions of Practices and Professional Development for Differentiating Mathematics Instruction

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Abstract

Teachers and administrators in a Title I elementary school in a southeastern state are concerned that there has been a trend over the past 3 years of declining standardized assessment scores in mathematics for students in Grades 3, 4, and 5. The purpose of this qualitative case study was to explore teachers' perceptions of practices, and professional development (PD) for differentiating mathematics instruction. This study was grounded in the conceptual framework of Vygotsky's zone of proximal development and Tomlinson's differentiated instruction (DI). Purposeful sampling was used to select 8 teachers and 1 mathematics coach, who worked with students in Grades 3, 4, and 5 at the target school. Data were collected through interviews and classrooms observations with participants. Open coding and thematic analysis were used to identify emergent themes from the data. The key findings were that, while some teachers attempted to differentiate mathematics instruction for struggling students, the participants felt they needed more PD related to specific strategies for differentiation and more planning time to collaborate with other educators in order to implement differentiated instruction effectively for all students. In response to these findings, a PD project was created for teachers in Grades 3, 4, and 5 to involve them in construction of a variety of strategies for planning and implementing differentiated instruction in mathematics. Positive social change might occur when teachers feel supported by the district to schedule ongoing opportunities to collaboratively plan and implement effective differentiated mathematics instruction to advance students' mathematics achievement in the local Title I school.

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Dedication

This doctoral study is dedicated to my two daughters, Tavi and Aila. You are the reason that I decided to embark on this journey and you continued to be my reason and inspiration as I continued through it. There were many difficult and challenging times, but I never gave up because of you. I want you both to know how much I love you and that you mean everything to me. I hope that this shows you that you can achieve and accomplish anything you dream of as long as you work hard and never give up, despite the hurdles that might be in your way. I believe in you and love you both with all of my heart.

This study is also dedicated to my husband who encouraged me to begin my doctoral study. He cheered me on through the most challenging times, never allowing me to give up. Thank you for being my shoulder to cry on, being a good listener and advice giver during this journey. I appreciate all of your support and love you very much.

My doctoral study is also dedicated to my parents and sister. Thank you all for your encouragement during this journey. Mom, thank you for your generosity with your time and helping me with the girls so that I had time to work on my study. Your strength has inspired me in so many ways. Mom and dad, thank you both for all of your sacrifices. Sanja, thank you for the calls and texts filled with words of encouragement, I appreciated them throughout this journey. I love all three of you very much.

I love you all more than you will ever know.

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Section 1: The Problem

Introduction

Teachers who provide students with instruction that fosters their understanding of mathematical concepts are vital for improving student achievement. Sammons (2009) indicated that in mathematics, making connections with practical situations helps students build conceptual understanding and students who are able to connect related ideas develop a schema of mathematical concepts that they can use to solve problems. According to Richland, Stigler, and Holyoak (2012), teachers may be failing to teach students the necessary concepts, operations, and relations in mathematics that could help students create a base of mathematical understanding for current and future courses.

Sammons (2009) emphasized that teachers should plan differentiated mathematical instruction that includes a range of diverse strategies to help students make connections that strengthen their conceptual knowledge. But being able to offer differentiated instruction in mathematics that meets the diverse needs of students may require ongoing professional development (PD) for teachers.

According to Costley (2013), being prepared to teach deeper concepts gives teachers ownership over instruction in their own classroom and assurance that they will be able to meet the learning needs of their students. Gately and Gately (2001) wrote that teachers who are part of collaborative efforts experience increased feelings of appreciation, value, cooperation, and creativity for the aft of teaching. PD creates opportunities for teachers to find strategies that will be most effective for students; the

results could impact student achievement in mathematics. Relevant PD can influence teachers' perceptions and attitudes (Gurgur & Uzuner, 2010). Therefore, effective PD should provide teachers with the support and tools they need to make changes in their classrooms to increase student achievement.

The Problem Statement

Although the population demographics in one K-5, Title I school in a southern state remained the same, the standardized assessment scores in mathematics indicated that the number of students who were not meeting required criteria in Grade 3, Grade 4, and Grade 5 was trending upward. In this Title I school, 94% of students were receiving free and reduced lunches, which is an indicator that the majority of students come from low income families.

During the 2012-2013 school year, students who did not achieve the required standard in mathematics attended summer school, where they retook the Criterion-Referenced Competency Test (CRCT) test until they were able to meet the required standards. Specifically, 35% of Grade 3 students failed to meet the required standard on the CRCT in mathematics and 16.4% of Grade 4 students indicated the same deficits (GADoE, 2013). Among Grade 4 students, the lack of achievement in mathematics increased from 13.4% in 2012 to 16.3% in 2013. This pattern was also evident among Grade 5 students, where the mathematics deficit increased from 11.8% in 2012 to 23.7% in 2013 (GADoE, 2013).

Teachers in the school may also be affected by the lack of mathematics achievement. According to the National Council of Teacher Quality, teachers are evaluated based on their productive teaching techniques, differentiated lessons, communication, collaboration, and student achievement. In the new evaluation system, called the Teacher Keys Effectiveness System (GADoE, 2013) the Student Achievement section states that the teacher must be able to demonstrate evidence of students' academic growth. Therefore, when students' scores continue to decrease and the teacher is unable to show evidence of student growth in mathematics, teacher evaluation results are negatively affected, therefore possibly negatively impacting teacher's reputations and careers.

At the school level, administrators encourage teachers to meet the diverse needs of students by implementing differentiated instruction in mathematics. At this particular school, teachers have been required to attend PD in mathematics for the past 2 years, once per week for 45 minutes, with the goal of learning about additional research-based strategies that can be implemented for struggling students. The goal is that teachers will gain proficiency in implementing differentiated instruction (GCPS, 2015).

The problem has been addressed at the school level through PD in differentiated instruction and in teaching for conceptual understanding of mathematics for Grade 3, 4, and 5 mathematics teachers (GCPS, 2013). Follow-up sessions with mathematics coaches are focused on instructional strategies in mathematics that focus on conceptual

understanding. The sessions are designed to help teachers implement differentiated instruction for diverse students.

Student achievement in mathematics requires an understanding of mathematics concepts so that students can solve problems in future mathematics courses (NAEYC, 2003). Without the necessary background knowledge and the strong understanding of mathematics concepts that students need to do well in school, many could drop out of high school. Students could decide not to pursue careers focused on mathematics (Cole, 2008). For example, if students cannot achieve success in mathematics, then they may not be able to pursue a career in medicine, which requires a good understanding of mathematics.

Rationale for the Study

Students need a conceptual understanding of mathematics to retain what they have learned, so they can apply mathematical concepts to problem solving. According to Marshall (2006), students can use what they have learned in mathematics and apply what has been learned to each new learning situation; however, in order to apply the mathematics learned, students need to acquire mathematics knowledge that includes "conceptual structures which are richly interconnected, making up substance of mathematical knowledge stored in long-term memory" (p. 358). As a result of these interconnections and conceptual structures, students can develop a deeper understanding of what they have learned in mathematics. In order for students to have the long term memory of what they have learned in mathematics, they need a true understanding.

Chapko and Buchko (2004) indicated that students develop a true conceptual understanding of mathematics when they explain their thinking processes.

Teachers should differentiate instruction for students in order to help them develop conceptual understanding. According to Tomlinson (2003), differentiated classrooms provide ways in which content can be acquired and processed by students, and ideas can be understood so that resources can be created to help diverse learners learn most effectively. Sternberg (2006) indicated that all learners gain knowledge when taught in groups that match their pattern of abilities, enabling students to benefit from their own strengths and to work on their weaknesses.

Special Terms Associated with the Study

The research study includes terms associated with student improvement in mathematics, required standardized testing, and ways teachers are supported through PD. The following terms are defined to explain the context of their meaning and are derived from the literature.

Conceptual knowledge is helping students to make mathematical connections in order to strengthen their knowledge of mathematical concepts. (Sammons, 2009).

Criterion Referenced Competency Test (CRCT) was created as a standardized way in order to determine if and how well students are able to understand the standards and skills they have been learning. This assessment is state-mandated and provides information on academic achievement of students that can be used to determine individual student strengths and weaknesses (GADoE, 2013).

Differentiated instruction in mathematics is tailoring instruction based on a variety of student needs so that all students can learn. The "use of extensive modeling, guided practice and coaching with informative feedback, and numerous and varied opportunities for independent practice" (Troia & Graham, 2003, p. 76) in mathematics.

A *Mentor* is an experienced teacher who is assigned to a first year teacher (Ingersoll & Smith, 2004; Schlitchte et al., 2005; Wasburn-Moses, 2006). The purpose of the mentor is to coach the new teacher through the first year of teaching (Billingsley, 2004a, 2007a; SMHC, 2009; White & Mason, 2006). Using experienced teachers allows the new teacher to learn because "mentors base their instruction on their real life experiences" (Nigro, 2003, p. 36).

Professional development(PD) is the acquisition and sharing of knowledge among members of the educational community. Through PD in mathematics teachers are provided support to help guide them in creating differentiated instructional opportunities for students in mathematics (Darling-Hammond, 1994).

A *Regular classroom elementary teacher* is a full time, classroom teacher who works with students as a whole class, in small groups, or one-on-one to instruct students in all subject areas. (The Organization for Economic Co-operation and Development 2009).

Scaffolding is the process that allows a student to make progress and achieve greater understanding through gradual assistance from someone else (Wood, Bruner, & Ross, 1976).

Support is a school or district providing assistance to teachers through initiatives such as one-on-one mentoring, PD, and collaborative group sessions establishing a relationship based on trust (Billingsley, 2004b; Cookson, 2007; Norman & Ganser, 2004; Gagliolo, 2008; Mattoon, 2008; Schneider, 2009).

The guided mathematics workshop model is a structure for teaching mathematics where a student's learning is supported through differentiated instruction through mini-lessons, small group instruction, centers, mathematics journals, and independent practice. Students are supported through scaffolding from the teacher, conversations, and higher level questions about the mathematics that they have been learning (Newton, 2013).

The zone of proximal development (ZPD) is the variance of the achievement of a student with help and support and the achievement of a student without help and support (Vygotsky, 1978, p.86).

Significance of the Problem

Examining the factors that contribute to achievement in mathematics for students in Grades 3, 4, and 5 is worthy of inquiry because empirical findings may help design professional development for teachers to guide them in differentiating instruction to address gaps in students' mathematics achievement. Evidence from this investigation was intended to (a) provide school administrators, teachers, and parents with a more enlightened understanding of how students develop conceptual understanding of mathematics and as a result are making progress in their mathematics achievement and (b) provide teachers with the opportunity to improve collaborative practices amongst

themselves with an increased emphasis on PD in differentiated instruction in mathematics.

Educators must have a strong knowledge of the required mathematical skills (Graeber & Tirosh, 2008; Hill, Rowan, & Ball, 2005; Ma, 1999) and standards and how to teach them in order to develop mathematics instruction that is effective for all students (Davis & Brown, 2009; Grant, Hiebert & Wearne, 1998; Phillip, 2007; Thompson, 1984). Teachers may lack the ability to use a variety of strategies to differentiate mathematics instruction. Ma (1999) reported that some teachers do not possess an understanding of procedures for differentiating instruction. As a result of this lack of awareness and understanding, teachers prevent opportunities for students' academic growth. Rhoads, Radu, and Weber (2010) indicated that many mathematics teachers in the United States have conventional attitudes about how to implement instruction in mathematics. These attitudes prevent the use of strategies and methods in the classroom that help create student understanding and academic success for all students (National Council of Teachers of Mathematics, 1989, 2000).

Rhoads et al. (2010) and Neubrand and Seago (2009) demonstrated that educators have worked toward improving teachers' awareness and understanding of teacher education programs and PD programs. Improvements such as more PD opportunities for educators to collaborate with other teachers must be made so that students can have the opportunities to fully acquire an understanding of mathematical concepts.

Teachers can use a variety of instructional strategies to help students gain an in depth understanding of mathematical concepts. According to Niemi (1996), a conceptual approach allows an increase in student understanding and a deeper attainment of concepts through the building of meaningful experiences in the classroom. Swartz (2007) emphasized that no one is suggesting a retreat to the day when class time was filled with *drills and skills*; however, it is advisable that class time includes some focus on skills. After all, if students are to solve a problem correctly, they must master the skill to be applied.

Teachers may use small group instruction to help students gain conceptual understanding. Sammons (2010) contended that the teacher-centered, large group instruction model is still too common in the United States with mathematics instruction, and the conceptual understanding might not be developed in students. As a result of the limitations of large group instruction, students may be offered only certain ways in which to solve mathematical problems without understanding the underlying mathematical concepts. In large group instruction, the emphasis is often on a set procedure rather than on the application of a mathematical principle. Without a deep knowledge of the concepts, students have difficulty in the upper grades as the problem solving become more challenging (Sammons, 2010), they continue to fall further behind, making catching up more difficult.

Guiding Questions

The guiding questions for the study were derived from the problem statement and anchored in the purpose statement. Given the educational problem, the purpose of this qualitative case study was to explore the factors that contribute to a lack of student achievement in mathematics.

1. How do Title I elementary teachers describe their practice as they differentiate mathematics instruction for struggling students in the classroom?
2. How do Title I elementary teachers describe their professional development needs for implementing differentiated mathematics instruction for struggling students in the classroom?
3. How do Title I elementary teachers demonstrate and plan for differentiated instruction in observed lessons?

Review of the Literature

To identify prospective, peer-reviewed articles and books, the following databases Resources Information Center (ERIC), Thoreau, ProQuest, and Education Research Complete were searched for the years 2014-2017 using the following keywords: *differentiated instruction, zone of proximal development, small group instruction, mathematics instruction,* and *professional development in schools*. I used the Boolean operators to optimize the results. Abstracts were used to judge to decide whether or not an article was relevant to the research questions

This review of literature begins with the conceptual framework of the zone of proximal development (Vygotsky, 1978) and differentiated instruction (Tomlinson, 1992). The conceptual framework of the ZPD is supported by the review of literature on scaffolding. An understanding of differentiated instruction is reinforced by the literature on *small group instruction*, *critical thinking skills*, *collaborative groups,* and *guided learning*. Research to indicate how PD can influence instruction in a school and teachers' use of instructional strategies follows. The review concludes with the implications section, which emphasizes the goals of this investigative project study.

Conceptual Framework

In the conceptual framework, I examined literature that described the conceptual frameworks of Vygotsky's *zone of proximal development* (ZPD, Vygotsky, 1978) and Tomlinson's differentiated instruction (DI, Tomlinson, 1992). The review focuses on the ZPD and how it relates to creating effective instruction through scaffolding instruction. In addition, the literature review includes an emphasis on differentiated instruction and how it relates to establishing the most effective instruction through small group instruction, critical thinking skills, collaborative groups, and guided learning. The research questions were revisited and refined, interview protocols were developed and used to write up the findings and conclusions using the framework.

The Zone of Proximal Development

Vygotsky (1978) proposed that instructors guide each student's instruction in the individual's ZPD. The ZPD has been defined by Vygotsky as the space connecting

"actual development to potential development, which is determined by problem solving with the support of adult direction and collaboration with peers" (p. 86). Vygotsky described the zone of proximal development and emphasized that in order for learning to be beneficial, knowledge must be revived with a multiplicity of internal progressions. These processes and progressions are only able to function when students collaborate and interact with peers in their surroundings. When students embody these processes, they become a part of how the student learns and develops (p. 90).

Learning that is organized allows for mental development to occur and sets into motion various developmental processes that would not occur without interaction with other people. Vygotsky (1978) emphasized that learning is a necessity to the development of collective learning, growth, and development which allows for culturally organized and psychological human functions (p. 90). In addition, Vygotsky explained that learning at a school presents new ways for children to grow, develop, and learn, allowing for greater achievement of a child's independence (p. 85). Vygotsky's ZPD is a vital concept that expands on the different levels of learning, how children are impacted by the social interactions they achieve when learning in a school environment, and why these social interactions are imperative to a child's development (p. 85).

Vygotsky (1934/1986) described the maturation of intellectual constructs in terms of two levels. What a child gains and learns in the ZPD at stage one is transferred to the next stage, which is known as actual development. Therefore, this allows for the child to learn through collaboration at first in order to be able to complete tasks successfully on

their own later (p. 206). Vygotsky emphasized that functions in a child's development appear two times, at first as a communal function and later on the psychological level, therefore the student is able to use what is learned socially in order to become more independent and complete these same tasks in a successful way independently.

As proposed by Ngee-Kiong, Singh, and Hwa (2009), the manner in which collective and social transformations occur extrinsically and impact psychological understandings intrinsically is called internalization, occurring in the zone of proximal development. Vygotsky's theory has then been applied in education, how children learn by interacting with others socially, and how these social interactions impact a child's learning and achievement (Wood et al., 1976, p. 86).

Scaffolding

Wood, Bruner, and Ross (1976) were the first to use the term *scaffolding*. Inherent to scaffolding is Vygotsky's (1978) ZPD. Vygotsky expressed that to develop learning, there were two parts that had to be explored by the learner: the potential developmental level and the actual developmental level. Potential development is described as what a student is unable to complete or do independently, but is able to complete or do with the support of adult support or with the collaboration with peers. The ZPD is a space containing what a child actually understands, knows, and learns to what a child has the potential to understand, know, and learn. This is considered the instructional level and is where teaching should be directed to drive the most learning for students. Actual development is described as the independent level and is where students encompass skills

that have been mastered so that they can independently perform tasks successfully. According to Wood, Bruner, and Ross (1976), after a student gains knowledge, the actual developmental level has become more elaborate, shifting the ZPD. The ZPD is constantly changing as the student is acquiring knowledge, therefore scaffolding or scaffolded instruction allows the student to gain knowledge, so scaffolded instruction must continually be differentiated to be individualized in order to address the ZPD of each student.

Wood, Bruner, and Ross (1976) introduced the term *scaffolding* and defined it as the "process by which someone organizes an event that is unfamiliar or beyond a learner's ability in order to assist the learner in carrying out that event" (p. 17). Wood, Bruner, and Ross (1976) proposed that the level of potential development should be the goal for students. Students can only have this growth if supported by peers, teachers, and family to constantly evolve in the ZPD. Some examples of how to provide this support for students would be by modeling tasks for students, providing advice, and providing coaching in academic areas.

Wood, Bruner, and Ross (1976) used the term to describe how parents tutored and supported children in their language development. They emphasized that parents who were successful at scaffolding were parents who focused on motivating their children while keeping their children's attention on a given task. These parents were able to divide the tasks of into manageable parts so that the student's attention was directed to necessary and applicable features while keeping the tasks at appropriate levels of difficulty. As a

result, parents were able to help their child achieve success in completing the activity by providing necessary support through interventions that were suited for their child.

As described by Wood et al. (1976), scaffolding employs the interests of the child, decreasing the number of choices the child has, helping the child focus on the goals created, stressing the challenging aspects of the task, decreasing frustrations by providing support, and indicating the ways to take to achieve the success for the activity. Students were encouraged to complete the pieces of the activity that they could on their own while being provided support through scaffolding from the adults when necessary. After the student is able to achieve the task successfully and does so with mastery as a result of support from scaffolding, then scaffolding can be taken away step by step so that the student can learn how to achieve this same type of understanding and mastery independently. Scaffolding focuses on differentiated instruction and necessary support so that learners can increase their abilities and can be successful in the concepts being taught.

When instructing or scaffolding students in their ZPD, the focus of the teacher, according to Small (2009), is to create learning opportunities for each student that allow a student to have new ideas that are adjacent to what they already know and understand, making it easily feasible for the new information that is learned (p. 3). Any instruction that is given to students that is out of their ZPD is not beneficial to them. Chaiklin (2010) explained that a student's learning can be accelerated if the ZPD is identified properly because in the ZPD is when a person's ability and potential new learning is strongest (p.

5). According to Small, in order to determine a student's ZPD, teachers must use diagnostic tools to determine a student's level of mathematical sophistication, so that the needs of students can be determined (p. 4). However, according to Chaiklin (2010), the ZPD was not focused on the growth of a specific ability in a child or an exact task, but Vygotsky was instead focused on relating it to the child's development (p.3).

Differentiated Instruction

Tomlinson (1999) defined differentiated instruction (DI) as the means of "tailoring instruction to meet individual needs. Whether teachers differentiate content, process, products, or the learning environment, the use of ongoing assessment and flexible grouping makes this a successful approach to instruction" (p. 5). Differentiated instruction encourages educators to use strategies and approaches in their classrooms that will create chances for all students to succeed, including students who have diverse needs and that all necessary approaches are used to provide this support in a classroom setting (Tomlinson & McTighe, 2006).

However, Tomlinson (1999) emphasized that teachers in differentiated classrooms should begin with a strong curriculum which keeps students engaged. In order to engage all students, instruction needs to be modified to each student's individual needs. When differentiating instruction, Tomlinson (2003) argued that the focus must remain on creating opportunities for each child to learn from a rich and important curriculum filled with lessons that are engaging, demanding, and scaffolded.

According to Small (2009), the goal of differentiated instruction is to meet students' various instructional needs in the classrooms. Gregory and Chapman (2007) concurred with Small that teachers who implement strategically planned lessons are more likely to meet the diverse learning needs of students. De Jesus (2012) suggested incorporating a variety of differentiation strategies such as adapting "materials, content, student projects, products, and assessments" (p. 8) so that all students have the opportunity to be successful. Simpson (2010) maintained that incorporating differentiated instruction in mathematics can improve instruction, student discipline, attitude, and learning. Overall, Beecher and Sweeny (2008) maintained that differentiated instruction means changing things and *shaking up* what goes on in the classrooms so that students can be provided various avenues of receiving, learning, and making sense of information that is learned.

Mitchell and Hobson (2005) agreed that educators need to plan instruction that addresses a variety of needs instead of planning instruction that is not differentiated. Although, teachers become overwhelmed with creating extra activities for students, implementing a variety of differentiation strategies allows for the teacher to address learners' various needs.

The overall goal of differentiated instruction, according to Newton (2013) is for students to become proficient mathematicians who have "conceptual understanding, procedural fluency, strategic competence, adaptive reasoning, and mathematical confidence" (p.7). However, in order to achieve these goals, small groups are a necessity.

However, in order to implement differentiated instruction that is effective, the use of small group instruction, critical thinking skills, collaborative groups, and guided learning are necessary. Tomlinson (2001) summarized that a differentiated classroom helps students have a variety of ways of obtaining the content that is being learned. Tomlinson and McTighe (2006) also agreed that instruction that is differentiated provides ways for addressing the variety of ways students learn and how this should be considered as a critical part when educators are planning for instruction.

Small Group Instruction

According to Tomlinson and Allen (2000), differentiation promotes the idea of implementing routine small-group teaching in a classroom and using flexible groups. Flexible groups allow for group formations which can be changed over time to provide the best environment for every student based on individualized needs. Small group instruction allows a teacher to work with a small group of students on specific learning objectives and standards. Small groups consist of 2-4 students and provide these students with a reduced student-teacher ratio. Teachers can work more closely with each student, focusing on individual needs so that skills can be reinforced. Small group instruction can also be used by teachers to provide struggling students with intervention as well (OECD, 2009).

Wilson and Nabors (2012) contended that using small group instruction allows for students to be taught in skill-focused groups, while Jones and Henriksen (2013) agreed that small group instruction permits educators to focus on specific skills required by

different groups of children, so that each student is learning based on their individual readiness and needs. The key to small group instruction according to Diller (2007) is to have the child do more work than the teacher so that the teacher can find out what students can do (p. 8). Teachers should be aware of student understanding and mastery of standards and skills in order to assign students in collaborative small groups where they can be most successful. Sammons (2011) summarized, as a result of the using small groups, students can put math to functional use and have the ability to analyze, reason, and communicate effectively.

Critical Thinking Skills

Tomlinson and Allan (2000) stressed that it is crucial for educators to provide all students with academic materials and tasks that will keep students interested and engaged allowing them to have the same opportunities at gaining the necessary mathematical knowledge and skills as average and high students so that they can be successful. Paul and Elder (2007) emphasized that critical thinking skills are also vital for teachers to incorporate into classrooms as these skills will increase student engagement and allow for the interconnectedness of ideas that need to be learned. This will allow for the creation of opportunities for students of increased academic rigor and understanding of what has been learned.

Small (2009) pointed out that teachers must trust students to make the appropriate choices when, they are applying problem-solving strategies based on concepts already learned. When students' problem solving is based on mathematical concept application,

students can progress in the skills and strategies that they are learning so that their critical thinking skills are improved. Tomlinson (2006) indicated that giving students an array of choices through differentiation will provide students with a greater opportunity to achieve consistent success.

Collaborative Groups

Margolin and Regev (2011) emphasized that in a whole class discussion only a few students have the opportunity to articulate their thoughts or to expose their misconceptions publicly and the teacher cannot really know about the others' understanding or relate to their difficulties. Allowing students to communicate, respond to their peers and expose their challenges is necessary for the successful comprehension of mathematical concepts and the attainment of higher order thinking skills. According to Tomlinson (2001) “differentiated instruction is student-focused rather than teacher focused and student preference should also be considered when planning to differentiate instruction” (p. 3). White and Dinos (2010) also emphasized that cooperative groups allow for the development of reliance, trust, effective communication, unity, and structure. Ediger (2009) indicated that cooperative learning provides students with an increased worth of self in the classroom environment, helps students to grow and mature emotionally, and teaches students how to have respect from their peers through an increase in communication about ideas and concepts learned.

Guided Learning

When guiding students in their learning, Wedekind (2011) indicated that teachers start with the opening or the mini-lesson, which is the first chance for the whole class to be engaged and relate thinking to what is being learned (p. 3). The opening of the lesson begins by students meeting in one area of the room, usually on a carpet in the front of the room. During the mini-lesson, the teacher introduces or reviews skills and standards that will be the focus of that unit. During the opening, Wedekind (2011) also pointed out that the teacher guides students to the most important skills that will be learned and emphasizes them so that students can be encouraged to explore the concepts further in depth.

Tomlinson (2001) indicated that differentiated instruction is a mixture of "whole-class, group, and individual instruction" and that there are situations when teachers provide students with answers instead of guiding students to think and problem solve on their own. However, guiding students and giving them more responsibility for what they are learning while encouraging students to problem solve on their own is an essential part of differentiated instruction.

Sammons and Windham (2010) emphasized that using these instructional strategies, including those of guiding students during mathematics instruction in a mini-lesson, will allow students to master concepts and once skills have been mastered, students are given opportunities to continually practice the skills learned on their own in order to sustain and reinforce their understanding. This type of guided instruction is

provided to students by implementing a variety of differentiated instructional strategies, including centers. Sammons (2009) emphasized that students are often taught using a specific method of instruction, not a variety of strategies. However, a variety of strategies are needed so that there can be a deeper understanding of what is being learned. Sammons believed that students need instruction that is differentiated and individualized in mathematics so that their needs are met and so that they are provided with a deeper understanding of concepts, and allow students to develop long-lasting skills in mathematics.

Using guided learning also involves implementing a variety of strategies in order to support students of different learning styles. One of the strategies used in addition to mini-lessons is independent work stations where students are able to review and share what they know after guided learning has taken place. Diller (2010) described that when students are in this rotation of independent work, students are encouraged and interested to practice and learn on their own, instead of filling out worksheets (p.10). Overall, during independent work, students can use what has been learned during guided learning and become more independent completing these same tasks in a successful way on their own.

Journaling is an additional strategy teachers can use to give students opportunities to express what they have learned. During journaling, students are able to express their knowledge and understanding through expression and writing. According to Shannon (2013), journals are implemented to promote students' problem solving skills and are a

special place where students record and store their thinking in mathematics. Journaling is essential to students' expressing their understanding because they have to explain their thinking, reasoning, and the strategies they used to solve the problem through writing. As mentioned by Greenes (2009), group interaction, with its social and linguistic components, is critical to the development of mental operations.

Using mathematics centers in the classroom gives students opportunities to show their understanding of their learning while working in groups or in partner games. After guided learning has occurred, students are able to use hands on activities and mathematics manipulatives in mathematics centers in order to review and show their understanding. Students are provided several math centers in order to have several choices of review mathematics activities, which have been introduced and completed previously during guided learning. According to Westphal (2007) by providing students with several choices in the mathematics centers allows for the teacher to provide support and help students with various needs. Shumway and West (2011) emphasized that learners attain knowledge best when a variety of instructional activities are implemented. Additionally, students are able to learn multiple ways of approaching a problem and as a result can reason, determine relationships and solve problems.

Professional Development

An option for teachers who are struggling to differentiate instruction in mathematics is to participate in ongoing PD programs. This belief is supported by Telese (2012) who emphasized that the key component in teachers' lifelong learning process is continual PD that improves teachers' knowledge and skills, connecting them to student learning with an ultimate goal of helping students increase their achievement in mathematics PD of teachers is seen as an avenue to help young people teachers learn complex and analytical skills necessary for the 21st century, which requires education systems to provide more effective professional learning than what has been made available in the past (Darling-Hammond, & Richardson, 2009). PD for educators has to be focused on student learning and content so that student outcomes can be affected positively and so that the PD is effective and useful for educators. It is thought that PD of teachers will lead to more effective teachers (Mizell, 2010).

Hawley and Rollie (2007) explained that for the continuous improvement process to take place in schools, PD is necessary and must be driven by the needs of students, with goals focused on specific skills based on teachers' needs, while making the process for implementing these changes an ongoing one with continual support (p. 168). As a result, for differentiated instruction in mathematics to be implemented successfully, PD for teachers may be necessary. Providing PD for teachers would present expert advice in how to execute this model successfully. Hawley and Rollie also noted that when teachers participate in PD outside of the classroom, teachers are able to collaborate with other

teachers, providing them with additional expertise on how to implement successful instruction.

Effective PD contains data-rich information, mentoring, coaching, and opportunities for collaboration and planning. When teachers collaborate in PD sessions where they, analyze data, create curriculum maps, gather instructional materials, and plan lessons that differentiate instruction they are better able to plan differentiated instruction (Mizell, 2010). Blank & Smith (2007) claim that PD in mathematics should be designed to improve teachers' knowledge of mathematical content so that they can better explain mathematical concepts for students (Blank & Smith, 2007; Darling-Hammon & Richardson, 2009; Martin, 2007; Stevens, Harris, Aguirre-Munoz, & Cobbs, 2009; Telese, 2012).

Implications of the Study

Differentiated instruction was developed to meet the needs of students through the use of diverse strategies and small group instruction (Sammons, 2009). Differentiated classrooms vary from school to school, but all focus to provide students with content that can be understood through the use of resources, such as centers, small groups, independent practice, etc. (Tomlinson, 2003). However, many teachers interviewed felt unprepared to implement differentiated instruction and may need additional PD to feel they can do so successfully (Hawley and Rollie, 2007).

The research findings may positively impact social change by encouraging educational leaders to continue providing PD opportunities for the teachers and educators

in their district or school. Educators must be open to continuous learning and PD opportunities that encourage them to learn new strategies, such as those for differentiating instruction which will help all students to succeed. Responses from educators revealed that teachers want to learn more, but need additional support for the implementation of ideas and strategies. Therefore, the hope is that these responses will help provide an understanding for educational leaders so that they can create opportunities for teachers to have PD, but also to have times to collaborate and mentor one another, especially when new strategies are being tried or implemented.

Summary

The first section discussed a qualitative case study that investigated elementary teachers' perceptions, practices, and professional development (PD) for differentiating mathematics instruction. Educators and schools will be able to use the perceptions from this study to review data and implement changes needed. This study has the potential to change educator's perspectives about differentiated instruction, ways to implemented differentiation strategies, and the importance of providing PD opportunities to educators. The second section of the study covers the methodology of the research, how participants were selected, the procedures used for collecting and analyzing data, the limitations of the study, and the credibility and trustworthiness.

Section 2: The Methodology

Introduction

The research design and approach for conducting the research for this study are discussed in Section 2. In this section, the guiding research questions, the research design, the evaluations, and the outcome and performance measures addressed the problem and purpose of the study. The recruiting procedures, the criteria for selecting participants, and the number of teacher participants are also explained. Additionally, the measures taken to protect participants' rights are presented. The data collection and analysis techniques are described, along with their justifications. Finally, the study's assumptions, limitations, and delimitations are given.

Qualitative Research Design and Approach

The qualitative case study design was selected for this study because it allows more access to the site so that I was able to go to the site to conduct interviews and observations of participants (see Creswell, 2012). Access to teachers was necessary to obtain deeper, more detailed data from the eight teachers and one mathematics coach. In addition, Bogdan and Biklen (2007) specified that when using qualitative case study research spending substantial time in schools learning about educational topics and concerns is necessary. During the interviews and observations, time was spent in schools learning about and understanding educational concerns. As a researcher, it is important to spend time with participants of the study in their classrooms; this deepens understanding for the researcher (Hatch, 2002). Eight weeks were spent interviewing and observing

teachers; before the observation, each teacher's lesson plans—which matched the lessons observed—were collected. I was able to speak to educators and see them in their natural environments, which helped me gain a deeper understanding of their professional beliefs and practices.

In order to gain information, participants were interviewed and observed in their natural setting: their local school (Creswell, 2003). A qualitative case study allows researchers to investigate and report on phenomena using a range of data resources (Yin, 2003). Since interviews, observations, and lesson plans were used to collect data, a qualitative case study was chosen. The data collected included the effective strategies that teachers are using to help differentiate mathematics instruction for students. The results are expected to help other educators.

Purposeful sampling was used to recruit teachers who address students' diverse learning needs through differentiated instruction. According to Creswell (2012), purposeful sampling involves "intentionally selecting individuals and sites to learn or understand the central phenomenon" (p. 206). As a result, in this study a list of all Grade 3, Grade 4, and Grade 5 teachers who use differentiated instruction strategies was provided by the school mathematics coach. From this list of 23 teachers, eight teachers volunteered to participate. Purposeful sampling is the most beneficial for this study because as Creswell described (2012), it uses teachers and a mathematics coach who use differentiation strategies in mathematics to provide rich information. Therefore, since data collection in a case study is substantial and uses several pieces of information, such

as interviews, lesson observations, and lesson plans, I used participants who are considered to be knowledgeable in differentiation strategies, are easily accessible, and are willing to provide information pertinent to the study. After interviewing participants, I asked participants if they would be willing to allow me to come back and observe a lesson in differentiated mathematics instruction.

I interviewed nine participants—eight teachers and one mathematics coach—for approximately 45 minutes each and during the interviews I made plans to observe one mathematics lesson per teacher that gave permission for observation. Participants were interviewed in one of the school's conference rooms, not the teacher's personal classrooms. Creswell (2007) suggested that when conducting case study research eight participants who are interviewed for 45 minutes to an hour should provide the rich data that are needed to identify themes that will be analyzed. In addition to the mathematics coach, the participants consisted of classroom teachers, in Grades 3, 4, and 5, who use differentiated instruction strategies in mathematics with students in regular education classrooms. Each participant was presented with a written copy of a Consent Form to sign after each individual volunteered to participate. By signing the form, the participants agreed to be interviewed for approximately 45 minutes and participants were asked for permission to be observed teaching a mathematics lesson approximately 45 minutes in length. The purpose of the interviews was to investigate teacher's experiences using differentiated instruction strategies in mathematics. The purpose of the observation of teacher's lessons and lesson plans was to inform the development of the PD project. Data

from the interviews, lesson observations, and lesson plans were collected, compared and cross-checked to find common themes. Thematic analysis and open coding were used to identify emergent themes from the data. The thematic analysis was used with the data by applying a particular code to the sentences or paragraphs with common themes, then extracting them, and examining them in more detail. Open coding was used by identifying emerging themes from the data.

For this study, the qualitative research methodology was more effective in achieving the purpose of the study. Hatch (2002) identified that qualitative researchers employ unique strategies during the interview process. Qualitative interviewers provided an opportunity for a special kind of conversation during the interview process as the researcher is able to ask open-ended questions, encourage explanations of what participants share, and listen for any special terms and language that would allow for additional information that can be learned and understood (p. 23). Rubin and Rubin (2012) also asserted that when using qualitative in-depth interviewing, researchers are able to speak to participants who have an in-depth knowledge as a result of experience with the problem of interest. As a result, through interviews such as these, researchers can discover additional details in the experiences and opinions shared by participants. By having a conversation through the interview process and carefully listening to participants, research is able to encompass their intellectual and emotional reach across a variety of barriers (p. 3).

Before the interview protocol began, all participants signed the Consent Form for voluntary participation in the interview process. The interview protocol involved meeting and greeting participants. The interview lasted approximately 45 minutes with 10 open-ended interview questions, including probes to further clarify information. Observations of willing participants who implement differentiated mathematics lessons in a regular education classroom were also conducted.

The case study was used to focus on how teachers are planning and implementing differentiated instruction. The case study was the best approach for this study because as described by Merriam (2009), a case study can be defined by their particular case features which focus on the study of a specific “situation, event, program, or phenomenon” (p. 43). Therefore, the case study was an excellent choice of research design when the researcher wants to gain access to knowledge that may inform and clarify the boundaries and range or a variety of experiences (p. 46).

Participants

According to Creswell (2007), eight participants can provide rich data for case study research, therefore eight participants whose criteria fit the purpose of the study and might offer information to address the research questions were selected for this study. The participants were eight mathematics teachers from Grades 3, 4, and 5 and one mathematics coach. All participants used differentiation strategies during mathematics instruction with their students and were selected for this reason. As a result, purposeful sampling was necessary. Purposeful sampling involves "intentionally selecting

individuals and sites to learn or understand the central phenomenon" (Creswell, 2012, p. 232). Therefore, using participants who are experts in differentiated instruction was a must for this study so that the data needed could be collected.

Yin (2005) described purposeful sampling in selecting "information-rich cases of in depth study" (p. 262). The rich case for in-depth study is using educators who have experience and currently use differentiation strategies in mathematics to implement mathematics instruction. Therefore, purposeful sampling works this study because it includes teachers who are experts (Creswell, 2012) in differentiation strategies in mathematics which encourages students to obtain a conceptual understanding of mathematical knowledge and skills by providing data on which strategies are most effective and are being used.

For this study, the participants consisted of eight regular classroom elementary teachers and one mathematics coach all who work with students in Grades 3, 4, and 5 and implement differentiated instruction in mathematics with a variety of strategies. Each of the participants has been teaching mathematics and using differentiated instructional strategies for a minimum of 3 years. Each participant was presented with a written copy of a consent form to sign after agreeing to participate voluntarily. By signing the form, the participants agreed to participate in one approximately 45 minute interview. After the interview participants were asked for permission for me to observe one mathematics lesson when they differentiate instruction for an approximately 45 minute lesson. The purpose of the interviews was to investigate teachers' experiences using differentiated

instructional strategies in mathematics. Data was gathered from interviews, lesson observations, and lesson plans to inform the professional development project. Data from the interviews, lesson observations, and lesson plans were collected, compared and cross-checked to find common themes. Data triangulation uses multiple sources of data to corroborate findings (Creswell, 2003; Hatch, 2002; Yin, 2009). Thematic analysis and open coding were used to identify emergent themes from the data. The thematic analysis was used with the data by applying a particular code to the sentences or paragraphs with common themes, then extracting them, and examining them in more detail. Open coding was used by identifying emerging themes from the data.

My goal was to observe lessons of the teachers who were willing to have me come and observe. I asked the participants I interviewed if I could come and observe one differentiated lesson in mathematics in their regular education classrooms. The purpose was to gain information about how they differentiate instruction, so that information can be used for the development of professional training. The purpose of the observations was to determine teachers' lesson plans for differentiating mathematics instruction within the mathematics block.

Also, according to Bogdan and Biklen (2007), qualitative researchers spend more time in schools, with families, and in neighborhoods learning about educational concerns of the community. As I spend time in the school, I can better identify what teachers need for implementing differentiation strategies for students who are struggling. During the study, I interviewed participants to gain a greater understanding of teachers' experiences

in planning and implementing differentiated instruction and used the information to develop professional training.

Yin (2008) contended that the goal of qualitative research is to gather, assimilate, and show data from various sources as part of any given study. Therefore, I used interviews, lesson observations, and lesson plans to plan and implement differentiated instruction based on student's needs. According to Yin (2008), interviews and observations are used because they allow for the multifaceted and diverse use of participants and setting in the field, allowing for the finding of the best and most reliable results.

The interviews were approximately 45 minutes long and contained 10 open-ended questions (see Appendix A) so that all research participants were encouraged to answer honestly based on their own feelings and experiences (Creswell, 2012). Using interviews with open-ended questions increased the interviewee's options for response. Creswell, 2012). The validity, credibility, and trustworthiness of the data results were increased due to the use of the triangulation of the data collected from interviews, lesson observations, and lesson plans (Yin, 2008).

Methods for Ethical Protection of Participants

The Walden IRB application was submitted for approval and the principal was contacted through email with a letter explaining the study since he or she is the gatekeeper the school. The letter explained the purpose of the study, how it will have a positive impact on educators and students in the area of mathematics, and how it could

help achievement in mathematics. The Walden IRB gave permission for the study, Walden IRB No. 08-10-15-0189140. Once the principal of the school gave permission, eight teachers and one mathematics coach who were using differentiated instruction in mathematics in Grades 3, Grades 4, and Grades 5 were chosen to be interviewed and observed. The mathematics coach provided names of teachers who were implementing differentiated instruction in mathematics and they were chosen for participation in this study.

Once the mathematics coach gave me the names of these recommended teachers, I emailed them and the mathematics coach the letter of consent to sign and asked them to email it back to me once it is signed. I had a letter of consent for participants to sign before the interview. The letter of consent included the details of the study; procedures, risks, benefits, and a confidentiality statement. The mathematics coach had no supervisory relationship to the participants. The mathematics coach is a peer who works with the mathematics teachers to enhance students' learning.

Participants were given a consent form to sign and were informed that they can stop their involvement with this study at any time. The consent form was included so that if there were any unexpected or unforeseen events that require immediate attention, the research study could be stopped. One example would be if a participant decided to withdraw and stop their participation in the study. If such circumstances had occurred, I would have informed the participants and school. I would have also contacted the Walden IRB in order to adjust the research accordingly by requesting a change of procedures

form from the IRB in order to continue research. In order to protect the participants in the study, a list of all 3, 4, and 5 teachers using differentiated instructional strategies effectively was provided by the mathematics coach from the school. From this list, teachers were asked to participate voluntarily and eight teachers were selected for this study. Each teacher's identity was kept and will remain confidential through the use of pseudonyms. The mathematics coach has not and will not see the interview transcripts. They are locked in a cabinet in my home in order to protect the participants and retained for five years.

A neutral location, such as a conference room in the school, was used for interviews for privacy and in order to make it convenient for the teachers. The observations of mathematics lessons took place in the teacher's classrooms with the focus of gathering information on how teachers plan and implement differentiated instruction with mathematics. Additionally, teacher's schedules and availability were considered with the goal of respecting their time and also protecting their privacy by using a space in their school to conduct interviews. For the protection of the participants, the documents collected were given a number and that number was matched to a pseudonym. No names were used on any document, all names were matched to a pseudonym and the real names of the participants are and will be kept in my home and only known by myself.

All necessary steps were taken to ensure that the information that was collected from participants has and will be kept confidential. The data which was collected through interviews and all documents are stored on a personal computer, personal digital

recording device, and hand-written notes. All of the documents and data are kept at my personal home in a safe which can only be accessed with a numerical pass code. After the completion of the research study, all data will be deleted from my personal computer and recording devices after being kept securely for five years. In addition, all materials will be shredded and destroyed five years after this study has been completed as required by Walden University.

Data Collection Procedures

After receiving approval and permission from the Walden IRB to conduct my research, I contacted the school principal and asked permission to conduct my research study. Since the principal is considered the gatekeeper or individual who has the official role at the site (Creswell, 2012) where the research was conducted, having his or her permission was a necessary step. Once the principal gave permission and once a list of all Grade 3, 4, and 5 teachers using differentiated instructional strategies effectively was provided by the mathematics coach from the school. From this list, teachers were asked to participate voluntarily and eight teachers and one mathematics coach were selected for this study.

I provided the principal and school administrators with a letter stating why the school was chosen for the research study, what the goal of the study was, and what I hoped to accomplish with this study. Additionally, I also shared how much time I needed at the school site, how the interviews, lesson observations, and lesson plans would be used to gather data for my research, how I would report and use the results of the study,

and what I planned to do for a project. Overall, teacher identities were protected by using numbers and letters instead of names in order to protect their confidentiality. The permission of the onsite principal was asked after Walden's Review Board approved and gave permission through the Walden IRB for conducting this research study.

Interviews

The interviews were conducted with all eight teachers and one mathematics coach. To begin the interviews, I used the interview questions (Appendix C). The interviews were made up of ten open-ended questions to allow participants to share factual information in addition to their thoughts, feelings, experiences, and perceptions. Based on the conceptual framework for this study, I probed for further information when interview responses seemed related to assumptions (Knowles et al., 2011) by asking follow-up questions when necessary in order to gather additional information, as described by Hatch (2002) to learn about the experiences of the participants. Based on teacher and mathematics coach responses about differentiating instruction in mathematics (Tomlinson, 2014), I asked teachers to describe their experiences in creating classroom environments that provide differentiated mathematics instruction for all students. Based on the literature review, teachers were asked about strategies that are used for differentiating mathematics instruction (Moore, 2012) and the impact implementing these strategies has had on student achievement (Maehr & Zusho, 2009).

The interviews were conducted in a conference room at the local school to protect participants and minimize distractions and lasted approximately 45 minutes. A digital

recording device was used to record the interviews and field notes were taken on paper as well. Each teacher's identity was kept and will remain confidential through the use of pseudonyms. The interviews were transcribed and analyzed for findings. The mathematics coach has not and will not see the interview transcripts. However, the transcripts were shared with participants and checked for accuracy. All data and notes collected are locked in a cabinet in my home in order to protect the participants and will be retained for five years.

Observations

I asked participants if they would be willing to allow me to come in and observe an approximately 45 minute mathematics lesson where they differentiated instruction. Two participants (teacher E and teacher F) agreed to allow me to observe a mathematics lesson when they signed the consent form. The observations of mathematics lessons took place in the teacher's classrooms (Appendix E and F) with the focus of gathering information on how teachers plan and implement differentiated instruction with mathematics. When scheduling interviews, teacher's schedules and availability were considered with the goal of respecting their time and also protecting their privacy by. Merriam (2009) suggested including the following criteria when performing observations: the setting of the observation, participants in the study, activities in the classroom, conversation and interactions, subtle factors, and the actions of the researcher. In response to Merriam's recommendations, I created an observation considering these categories of the participant's time, availability, and neutral location in the local school.

Documents

Lesson plans and documents needed for the lessons observed were also collected as documents for this study. For the protection of the participants, the documents collected were given a number and that number was matched to a pseudonym. No names were used on any document, all names were matched to a pseudonym and the real names of the participants are and will be kept in my home and only known by myself. The documents have been kept locked in a cabinet in my home and will be retained for five years.

The Role of the Researcher

My responsibility as the researcher was to plan, implement, and summarize the research and results in their entirety. Participants for the study were recruited by me, the data was collected and analyzed, the findings were summarized and the interpretations of the findings were used for the development of the project which focused on increasing achievement in mathematics for students in Grades 3, 4, and 5 through mathematics instruction that is differentiated. During data collection, all of the interviews and observations were conducted by me and all of the lesson plans were collected as document samples. Extra precaution was taken to avoid research bias by considering previous relationships with the participants and how these relationships might influence the study.

Role of the Researcher in the Setting and With the Participants

I have 6 years of teaching experience as a First Grade teacher and was also a Parent Liaison for one year. Currently, I am a technology and robotics teacher at a private school for students in Grades Pre-K-8$^{th.}$ My role is a former colleague of some of the participants, as some of them worked with me at my former school. I have experience teaching students in a Title I school using the Guided Mathematics workshop model to differentiate instruction in mathematics. I conducted interviews, classroom observations, reviewed lesson plans provided by the participants.

Researcher's Experiences or Biases Related to the Topic

Creswell (2003) stated that in qualitative research, researchers must identify their experiences or biases about the topic being researched. Yin (2009) asserted that if a researcher is using a case study to prove a preconceived position, then the results of the case study may not be valid. In order to avoid the occurrence of preconceived positions effecting data collection while conducting the interviews, lesson observations, and lesson plans I focused on the participants and established a conversation about the topic. The purpose of this study was communicated to the participants and they were made aware of the purpose for the interviews. Participants were able to dialogue with me about the topic, which allowed me to gain insights into the participants' perceptions differentiating instruction in mathematics. Through contact with the participants during the data collection, interviews, and lesson observations, I was able to ensure understanding of their experiences. I had and have an interest in the results of this case study and believe

the results may be used by other researchers and educators in implementing differentiated instruction in mathematics that may help increase student achievement in mathematics.

The biases I had would be a result of past experiences where I had when I used differentiated instruction in mathematics and have seen that implementing these strategies can positively affect student achievement. However, I planned to control these biases with the realization that not all schools and students are the same. I focused on gathering data in a local school with the awareness that it is a different place, with different students, and may have different results. A peer reviewer was used and will remain anonymous. It is crucial to keep the reviewer's identity secret so that the reviewer is able to provide feedback honestly without being afraid of repercussions. The peer reviewer was a qualified and competent member of the education profession with no current research being personally deducted by the peer reviewer in the same field. The peer reviewer signed a confidentiality agreement. Peer review methods were used in order to uphold standards of accuracy, validity, and credibility.

Data Analysis

An important step in the process of analyzing interview data is exploring “the general sense of the data” (Creswell, 2012). In order to achieve this, all interviews were transcribed. A digital recording device was used to record all of the interviews. These recordings were used to transcribe the data. Letters and numbers were used to protect the participant’s identity. The transcripts were read several times in their entirety in order to ensure understanding of what each participant had to share and how the information

expressed by the participants was relevant to the research questions. Notes were made during the interviews and on the transcripts to keep track of the common material and to begin considering which codes would be best to use. After the data collection process had ended, I stored the transcribed documents in a secure location at my home and kept the recorded interviews on a secure digital file requiring a password.

During the second stage of data analysis, open coding and thematic analysis were used to identify emergent themes from the data. The interview transcripts, observation notes, and documents collected were examined to find common patterns using the conceptual frameworks. According to Stake (1995), a case study includes a thematic analysis of the data. Related patterns and themes were identified, reviewed, and recorded in order to identify which codes would be best to use in order to address the answering of each research question. After taking notes, underling, and highlighting responses, the data was sorted accordingly.

Interview Data Analysis

The final step of the interview process was the analysis of the gathered data. The researcher must take time during this phase to make "sense" of the found data and determine themes or codes from the groups of information that have been compiled (Creswell, 2003, 2007). Therefore, during this phase in the process, interview responses from each participant were summarized and placed into separate files so that additional themes could be found which address the research questions. Consistent phrases, expressions, or ideas were used to determine the themes or codes (Kvale, 2007). The notes from the

observation and document reviews were also sorted and filed with the correct participant code.

Many researchers employ a third party to review themes or codes so that the quality and effectiveness of the interview transcripts and findings can be determined (Creswell, 2007). A peer reviewer was used as a third party in this study. All coded data was forwarded to the peer reviewer so that any themes and patterns could be checked for logical development and thoroughness. Changes were made to the themes based on the suggestions received from the peer reviewer. The coded data were used to appropriately address each research question. In 6 weeks of the completion and final approval of this doctoral study, study results were released and shared with the district and local schools.

Credibility and Trustworthiness

Yin (2003) recommended that researchers continually judge the quality of their case study design. Creswell (2012) maintained that credibility is a method used to check for accuracy of the findings and these research findings were validated by transcribing the data collected, finding common themes and coding the data, using thematic analysis to identify common themes and a peer-reviewer. To increase credibility and trustworthiness in this study, participants were interviewed individually in a private conference room, so that they would feel comfortable sharing their true feelings and could respond in the way they desired. Additionally, a peer reviewer was used and will remain anonymous. It was crucial to keep the reviewer's identity confidential so that he/she was able to provide feedback honestly without being afraid of repercussions. The

peer reviewer was a qualified and competent member of the education profession with no current research being personally deducted by the peer reviewer in the same field. The peer reviewer signed a confidentiality agreement. Peer reviews can limit researcher bias through sharing opinions about the data and findings of the study (Creswell, 2008).

Limitations

Limitations are possible weaknesses of a study (Creswell, 2003). The limitations of this study were that I chose to observe classrooms which implemented differentiation strategies in mathematics instruction. Since this is a newer concept of implementing differentiated instruction with small groups, teachers might not have been prepared to implement it correctly, which would have had an effect on the data collected. I also conducted interviews with the teachers and mathematics coach who are working in classrooms where the differentiation strategies are being implemented. This may have limited the data to only those classrooms. I was also unable to control the environment of the participants in the study and could not minimize distractions during the interviews and lesson observations.

The Findings

The research findings for this study were determined based on participants' perceptions and understandings of how to differentiate mathematics instruction for students in regular education classrooms. An additional purpose of this study was to examine the strategies that regular education teachers use to differentiate mathematics instruction for all students. Another goal of this study was to determine what PD needs

teachers have so that continued implementation of effective and successful differentiated mathematics instruction would be possible.

Data were collected from interviews, classroom observations, and a review of lesson plans which provided answers to the research questions for this study. The interview data were transcribed, coded, and analyzed. Field notes were taken during the classroom observations and lesson plans were collected for review. In order to ensure credibility and trustworthiness, the findings were shared with the participants to be checked for accuracy. Opportunities for discussion were created so that the data the participants provided for the findings could be discussed with the researcher. In addition, all data were shared with the peer reviewer, who is a teacher in the local school district where the study took place.

In the following subsection, the research questions will be discussed in detail. The findings for Guiding Questions 1 and 3 are discussed together and have their own heading and Guiding Question 2 is discussed independently and has its own heading. The participant responses that addressed each research questions and the themes that emerged from the analysis of the responses are explained in detail.

Guiding Question 1 and Guiding Question 3

The first guiding question asks: How do Title I elementary teachers describe their practices as they differentiate mathematics instruction for struggling students in the classroom? The third guiding question was: How do Title I elementary teachers demonstrate and plan for differentiated instruction as evident in their observed classroom

lessons? Analysis of the data from the interviews, observations, and lesson plans revealed six common themes which addressed Guiding Questions 1 and 3.

- Scaffolding
- Differentiated Instruction is Essential to Student Learning
- Small Group Instruction
- Critical Thinking Skills
- Collaborative Groups
- Guided Learning.

All eight teachers and one mathematics coach shared positive perceptions about differentiating mathematics instruction for students. Table A shows the background of all the participants. Common themes with supporting statements from the interviews follow.

Table 1

Background of Participants

Participant	Grade	Subject	Years
Teacher A	4	*All and Math	5
Teacher B	4	*All and Math	4
Teacher C	3	*All and Math	34
Teacher D	3	*All and Math	21
Teacher E	3	*All and Math	9
Teacher F	5	*All and Math	7
Teacher G	5	*All and Math	5
Math Coach	K-5	Math Professional Development for	23

Note. *All means teachers are teaching all subjects, including science, social studies, language arts, writing, and mathematics.

Theme 1: Scaffolding

Wood, Bruner, and Ross (1976) defined the term *scaffolding* as the process by which a learner is supported during a challenging learning time by a peer or adult. All of the participants who were interviewed used scaffolding with their students. Teacher B shared that she was supported by the mathematics coach who comes in and observes her implement lessons and then "helps, supports, provides resources, and models lessons" so that the teacher can grow professionally. Another example of scaffolding that was shared was with Teacher E who emphasized that "conferencing with students is essential to success because they need that feedback from us in order to know what to do differently next time." Teacher A also shared that to support their learning, students need "the opportunity to draw, compose, decompose, have number talks, and have small group instruction" in math. Using these various instructional strategies allows students to increasingly move toward deeper understanding so that eventually they can independently be successful in their learning.

Theme 2: Differentiated Instruction is Essential to Student Learning

Overall, the teacher participants believed in the importance of differentiated mathematics instruction. They felt that in order for students to be successful various instructional approaches and strategies were necessary. In order to learn mathematical concepts, Teacher A emphasized that students need several "resources, such a manipulative, and feedback during conferencing, with the use of hands-on learning in small groups." Teacher D felt the same way and explained that "students need to have

center rotations, small group instruction, exemplar word problems, number talks, and be given the opportunity to share learning during conferencing." Teacher F also highlighted that differentiated mathematics instruction is necessary in order to "gain deeper understanding, re-deliver understanding, and allow students to take learning to the next level." Tomlinson (2014) agrees that differentiated instruction enables teachers to go beyond and help support students in their development of content mastery, efficacy, and ownership of their own learning. Therefore, these teacher interviews determined that because of student's various levels in mathematics, teachers need to use a variety of strategies to differentiate mathematics instruction in order to provide all students with the opportunity to learn and succeed.

Theme 3: Small Group Instruction

All of the participants agreed that small group instruction was necessary for differentiated instruction to be successful. For example, I observed differentiation through small group instruction in Teacher G's class. The students competed with each other for points in a game with fractions. They were engaged, involved and excited about learning fractions. Through the use of small groups, Teacher G addressed student's various needs. According to Sammons (2010), small group instruction allows teachers to observe students and their work closely, providing support for students who are struggling immediately. Additionally, several teachers were asked about what strategies for differentiation they found most effective when planning for instruction; they answered: small groups. For example, Teacher E shared that "small groups are necessary

to meet the student's needs" while Teacher F emphasized "manipulatives in small groups." Teacher C are highlighted that "breaking it down, hands-on in small groups is necessary so that students can show you where they are, show you what they know, so that you can build on success and teach the unknown." Everything that teachers shared about small groups emphasized how it was necessary for individualized mathematics instruction. Overall, they felt that small groups allowed students to be successful regardless of their different needs.

Theme 4: Critical Thinking Skills

The teachers and mathematics coach were in consensus on the importance of higher level thinking strategies, which they saw as necessary to facilitate student development and understanding of mathematical concepts. However, several of the teachers felt that there was not enough time to *dig deeper* with this conceptual understanding because of the required content standards for mathematics. They felt that before students could achieve this higher level understanding it was necessary to move on to other standards in order to cover everything that is required on the mathematics curriculum calendar for the school year. For example, Teacher C stated "there are too many standards and we need to have fewer standards so that we have time to *dig deeper* and build higher level thinking skills. We are forced to teach stuff to kids that are not ready because they don't understand the last thing fully that was learned."

Several teachers disagreed. They noted that during small groups using Guided Mathematics (Sammons and Fackler, 2009), there were opportunities to challenge

students to higher level thinking through differentiated instruction. Teacher F expressed that students are able to "gain deeper understanding, re-deliver learning, and understand why the answer is what it is because of small groups and Guided Mathematics." Teacher E agreed and stated that students need the "exposure and chances to practice" so that higher level thinking can be achieved and "improved over time." Teacher D also explained that the "use of exemplars allows students to work backwards, analyze what is wrong with the word problem, work it out, and explain which leads to conceptual understanding and application" of what is being learned. Overall, in order to challenge students and help them develop critical thinking skills, teachers used a variety of tools and strategies to cultivate these skills.

Theme 5: Collaborative Groups

Based on the conceptual framework, collaborative groups are used by teachers to differentiate mathematics instruction (Tomlinson, 2014) but also to create a team-work environment that encourages discussions (Margolin & Regev, 2011) allowing for students to learn from each other by problem solving together, sharing ideas, and having continuous discussions about what is being learned. According to Tomlinson (2014), teachers can differentiate instruction through content, process, product, and learning environment, which was evident in Teacher E's classroom where students were working in collaborative groups on a challenging word problem (Appendix F). Teacher E focused on all of the areas shared by Tomlinson; for example, challenging students in content and product by presenting students with a difficult word problem to be solve, changing the

students' learning environment by encouraging collaboration in groups to solve the problem, and allowing students to solve the problem through a specific process. Making all of these changes in the classroom environment and allowing students to work together to share other ways of thinking and problem solving allows for differentiated instruction to occur.

Margolin and Regev (2011) emphasized that in a whole class discussion only a few students have the opportunity to articulate their thoughts, whereas in collaborative groups, because they are smaller, students are able to share and discuss their ideas and thinking. Based on the conceptual framework, using collaborative groups to differentiate instruction through discussions, shared thinking and problem solving allows students to learn and grow in their own higher order thinking processes. When Teacher G's lesson was observed, the students in this class were working in collaborative groups to solve problems with fractions. Students shared their thoughts about the problem and made decisions in order to complete the given task by collaborating and working together. They discussed their ideas for solving the problem, shared different strategies that were used, and discussed their thinking processes. Having opportunities such as these are essential to differentiated instruction as students are able to reflect on their own thinking and problem solving techniques and make changes for personal improvement by observing and speaking with peers.

Theme 6: Guided Learning

Tomlinson (2001) has indicated that differentiated instruction is a mixture of "group and individual instruction" (p. 5). However, there are situations where teachers can provide students with answers instead of guiding students to solve the problem on their own. Both approaches are an essential part of differentiated instruction. All of the teacher participants followed Tomlinson (2001) and if necessary used a variety of differentiated approaches which could include guided learning, small group, and individualized instruction. Teacher B shared that "small groups, centers, cooperative, flexible groups, are all used in the classrooms," while Teacher G emphasized the use of "mini-lessons, small groups, independent practice, spiraling review lessons in centers, technology integration, and remediation." Teacher G also stated that "students need learn through technology integration, such as the use of Near-Pod lessons. Teacher E also explained that a combination of strategies are used when implementing Guided Mathematics, including "calendar, number talks, small groups, mini-lessons, constructive responses and exemplars with independent practice" for mathematics instruction in this classroom. Overall, guided learning aids students in their mathematical learning and understanding because it combines several strategies providing students with more exposure and chances to practice and improve over time.

Guiding Question 2

The second guiding question asks: How do Title I elementary teachers describe their PD needs for implementing differentiated mathematics instruction for struggling

students in the classroom? Upon analysis of the interviews, two categories of themes emerged: PD and additional planning time.

Theme 1: Professional Development

Telese (2012) emphasized that "a key component in teachers' lifelong learning process is continual professional development" (p. 103) which helps improve teachers' knowledge and skills, connecting them to student learning with an ultimate goal of helping students increase their achievement in mathematics). All of the participants have participated in PD in mathematics at the county and district level. They also participated in weekly PD at their local school.

Teacher A shared that recent PD sessions have allowed the "mathematics coach to model, observe, and give feedback" so that instruction could be improved. Teacher E also emphasized that the "mathematics coach at our school observes and videos us in real-world situations" so that the other teachers can watch and learn from our lessons. Teacher B shared that the mathematics coach at the school provides "help, support, and resources, and does lessons" in order to model effective differentiation strategies which can be used for mathematics instruction. The coach also helps "our mathematics leadership team creates lessons with more rigor to challenge students." Teacher F agreed and noted that the "mathematics coach helps in any areas where support is needed, such as centers and mini-lessons." Overall, the teacher participants shared that PD was necessary. A list of the areas that the participants felt was needed to provide students with effective differentiated instruction are listed in the table below.

Table 2

Professional Development Needs

Participant	Mini-Lessons	Centers	Mentoring	Conferencing	Small group lessons	Additional differentiation strategies
Teacher A		X			X	
Teacher B				X	X	
Teacher C	X	X				
Teacher D		X		X	X	X
Teacher E						X
Teacher F			X			X
Teacher G	X	X				
Math Coach					X	X

Table 2 shows that five teachers stated that they needed additional help with creating mathematics centers. Shaffer (2011) emphasized that implementing a variety of mathematics centers gives the opportunity for a more active role in learning to increase student motivation. According to Burns (2009), centers can include activities that review content or activities that deepen student understanding of current content being studied. Math centers are designed to accommodate a variety of ability levels and learning styles. During math centers, games are a great way to "motivate students, capture their interest, and are a great way to get in practice" (Burns, 2009, p. 26). The same five teachers needed support for small group lessons and additional strategies on how to spiral standards into lessons. Three teachers shared that they needed to learn how to use additional strategies, such as how to incorporate Science Technology Engineering Math

(STEM) lessons into the mathematics block. Two teachers discussed that they needed support to create mini-lessons ten to fifteen minutes long) that were both engaging and did not take up too much time in their mathematics block. They also needed help with student conferences.

All eight teachers reported that the most important factor in learning differentiation strategies was continuous PD and the weekly support from the school's mathematics coach. The coach shared that the PD and support she provided made a difference in the way teacher implemented the standards-based instruction and assessment of the mathematics program, such support they believed had the potential to improve the knowledge and understanding of students at their school. A Math Learning Team of teachers was created by the mathematics coach. The team met weekly. Each grade level had one teacher on the team. It was created to address the needs of each grade level and provide information on how to effectively plan differentiated mathematics instruction and assessment. The coach shared that teachers need to "plan for an appropriate amount of rigor with the use of standards." Assessment is a large part of planning for differentiated instruction according to the coach. Daily formative assessments were used to pre-test students on standards. An end of the unit assessment was also given in order to help plan for rigor by looking at assessment results and the standards students need additional support in.

Overall, the PD that teacher participants received provided them with the necessary skill and knowledge to effectively implement differentiated instruction in

mathematics. Continual PD with the support of a mathematics coach helped the teachers in areas which they struggled with. The coach felt that this support ensured that teachers provided students with the most effective differentiated mathematics strategies.

Theme 2: Additional Planning Time

Based on responses from participates, including the mathematics coach, when they participated in school and county training, workshops, and had continuous PD on differentiated mathematics instruction, strategies for differentiated instruction in mathematics were implemented more often with students than when PD in these areas was not provided. According to the NEA (2017), providing educators with PD is the best tool for improving student learning and performance. All of the participants were open to trying the strategies they learned but insisted that they needed additional planning time. Based on the conceptual framework, differentiated instruction in mathematics is necessary to help and support all students (Tomlinson, 2014), therefore providing teachers with the additional planning time is key to the improvement of teacher's practices and student achievement.

Davis (2015) emphasized that teachers who are experts in their area matter most to student success and should, therefore, be invested in more in education, therefore assuring that teachers have adequate planning time is a must for student success. According to the participants, additional planning time was needed in order to collaborate, share ideas, and ensure clear communication occurred with colleagues about what was taught. Teachers E and B expressed that "teachers have PD every day during

their planning times making it difficult to find time to plan lessons and collaborate with other teachers on the same grade level." Doing so the participants felt would allow teachers on the same grade level to be clear about how the curriculum would be differentiated so that alignment of instruction in all classrooms could occur.

Observations

Both of the teachers observed used the guided mathematics workshop model (Sammons, 2010) in their classrooms. It consisted of several differentiation strategies. The teachers began instruction with a mini-lesson which introduced what was being learned. Next, in both classrooms, the students were sent to mathematics centers, which consisted of different mathematics activities. In some, students had already completed the activity. In some centers, work was being reviewed, while in others new activities were started.

In both classes, the students worked in centers while the teachers met with small groups of students. In the small group, the teacher was able to work with students on standards the students needed more support in. Sammons (2010) explains that when students are instructed in a small group environment, the teacher can focus on individualized preparation, activities, review, and assessment based on students' needs. Small groups allow the teacher to address students' understanding and provide support immediately, helping student understanding. Typically, while the teachers were working with students in small groups, students who were in centers would come up and ask for

their work to be checked. If that happened, the teachers would get the group started on a task and then briefly conference with students from the centers.

Technology integration was also a big part of mathematics instruction in both classrooms. Both teachers used interactive boards to introduce the lesson and also posted information on the interactive boards during the mathematics block, for the mathematics centers and rotations. Whether they worked in centers or small groups, both teachers encouraged students and would help them refer to standards and strategies to model, explain, and draw out the lesson, to help them problem solve on their own.

Lesson Plans

Lesson plans were collected from both of the teachers observed in order to understand how they planned their mathematics block and created effective differentiated mathematics instruction. Typically, lessons were planned for all parts of the mathematics block. One mathematics block included mini-lessons, centers, small group lessons, and independent practice. The teachers shared that planning was done with a partner from their grade level team to help with the load of work it takes to plan mathematics lessons. Additionally, planning with partners helped with the amount of time that was needed to create lessons. The lessons collected indicated that both teachers used the mathematics standards to differentiate. The lessons also used various differentiated strategies like the use of technology, small group support, and enrichment for students meeting or exceeding standards was done by giving students exemplars, which are very difficult

word problems. In this district, exemplars are used to challenge student thinking and problem solving.

Discussion of Themes

Considerable research has been done on how to differentiate instruction for students and which strategies are most effective at differentiating instruction in mathematics for students of all levels (Tomlinson, 2009). However, educators are still trying to determine which strategies work best and are most effective for all students. The results found participants' perceptions and understanding about how to differentiate mathematics instruction for students in regular education classrooms. An additional purpose of this study was to explore the experiences of regular education teachers as they planned and used to differentiated instruction strategies in mathematics. Another goal was to determine what PD needs teachers have so that the implementation of effective differentiated mathematics instruction is possible.

The implementation of the qualitative research design was undertaken with the goal of understanding how differentiated mathematics instruction could improve student achievement in mathematics. Data was collected from interviews, classroom observations, and lesson plans which provided data to engage the research questions for this study. Participants in the study included eight regular education teachers from Grades 3, 4, and 5 and one mathematics coach. The interview data was transcribed, coded, and analyzed. Field notes were taken during the classroom observations and lesson plans were collected for review. In order to ensure reliability and validity, the findings were

member checked by the participants for accuracy. In addition, all data was shared with the peer reviewer, who is a teacher in the local school district where the study took place. The participants were interviewed and observed in their natural setting; their local school (Creswell, 2003, p. 4), which allowed me to gain a deeper understanding through a more personal view of teachers and their classrooms. All teachers had training in differentiated instructional strategies for teaching mathematics and had positive attitudes about using these strategies with students.

The findings were organized according to the three guiding questions. The findings based on guiding questions 1 and 3 consisted of six themes: Scaffolding, differentiated instruction is essential to student learning, small group instruction, critical thinking skills, collaborative groups, and guided learning. The findings based on guiding question 2 consisted of two themes: PD needs and additional planning time for teachers. Teachers expressed the belief that since implementing differentiated instruction in mathematics student understanding of mathematical concepts and standards had improved. Teachers also expressed that weekly PD at their local school was helpful, but additional planning time was needed for their grade levels.

The outcomes of the analysis provided insight into the perceptions of teachers about themselves and the implementation of differentiated instruction in mathematics. In addition, revealed by the results were the needs for PD in the areas of Common Core mathematics standards, strategies for implementing differentiated instruction in mathematics, and the need for additional planning time to plan and prepare differentiated

lessons and activities for students. In relation to the conceptual framework of Vygotsky's (1987) zone of proximal development and Tomlinson's (1999) differentiated instruction, based on the outcomes, in order to provide students of all levels with the possibility of mathematical knowledge, concepts, and skills, teachers must embrace implementing mathematics instruction that is differentiated.

The study outcomes provided insight into teachers' perceptions and understanding of the mathematics curriculum and differentiated instruction strategies currently being implemented at the local school site. The experiences of the participants reported in the findings indicated that an ongoing PD program is necessary so that the implementation of the differentiation strategies in mathematics can continue. Additionally, participants shared that more planning time is needed so that teachers have time to collaborate and plan with other educators. Therefore, based on my research findings a PD project was proposed and developed. The project is explained in detail in Section 3. A literature review that supports the project is included. Section 3 also includes the project implications, possibilities for social change, and the importance of the project at the local level.

Section 3: The Project

In Section 3, the project is discussed along with a review of related literature. The project goals, rationale, implementation, evaluation, and implications for social change are presented. Many education stakeholders believe that all students are receiving a good education in today's classrooms, regardless of their academic abilities or socioeconomic status. But according to the OECD (2012), "students from low-socioeconomic backgrounds are twice as likely to be low performers." Students in Title I schools, such as the one in this study, where 70% or more of students come from low socioeconomic households, are more likely to have a higher rate of absenteeism or leaving school altogether. They are more likely to develop delays in their learning than students who do not live in poverty (NCES, 2014). According to the U.S. Department of Education, the purpose of Title I funding, "is to ensure that all children have a fair, equal, and significant opportunity to obtain a high quality education and reach, at minimum, proficiency on challenging state academic achievement standards and state academic assessments" (p. 20). The OECD explains that educators can make a difference through practices that improve student learning in classrooms. With improved teaching, students from low-socioeconomic backgrounds have more opportunities for success with academic content in the classroom and with formative and summative assessments. Differentiated instruction is an effective teaching method. Tomlinson (1999) described differentiated instruction as a set of behaviors that enable a teacher to (a) teach students where they are, (b) engage students in instruction through different learning modalities, (c) prompt

students to compete more with their own past performances than with others, (d) provide specific ways for each student to learn, (e) be flexible in the use of classroom time for each subject, and (f) act as a diagnostician, providing the best possible instruction for each student. It is used by regular education teachers in Title I schools to ensure that all students, including those on different academic levels and those with learning disabilities, are given a good education based on their individualized needs. In order to achieve effective implementation of differentiated methods, teachers need to collaborate and plan with other educators and attend continuous PD (Sammons, 2010).

The participants in this study were regular education teachers in Grades 3, 4, and 5 and one mathematics coach from a local Title I school. The study was conducted in order to learn about (a) teachers' preparations, practices, and opinions about differentiating mathematics instruction for struggling students, (b) teachers' needs for collaboration and planning, and (c) teachers' PD needs. The PD plan was created based on data results from this study. The data were gathered using interviews, classroom observations, and lesson plans. Although teachers practice differentiated instruction in mathematics, during interviews they emphasized that they needed additional PD with opportunities to collaborate and plan [plan what?] with other educators. Professional collaboration empowers educators to build community through partnerships. Professional collaboration takes place when highly qualified people work together to achieve a common goal: meeting the needs of students (Howland, 2003; Lam et al., 2002; Singh & Shifflette, 1996; Villa, Thousand, & Nevin, 2004). Collaboration is necessary to achieve

differentiated instruction practices that are effective for a range of learners (Gregory, 2003), English language learners (Heydon, 2003) and particular content areas (Chapman & King, 2003).

Providing teachers with PD that focuses on differentiating instruction in mathematics, collaborating and planning with other educators will build confidence, reliance, and a community among them (Hammond, 2009). The types of PD needed in this Title I school were determined based on the themes identified from the study. After the data was collected, the data are analyzed through thematic analysis and open coding in order to identify emergent themes. The interview transcripts, observation notes, and documents collected were examined to find common patterns. The first common theme identified was teachers' concern for the lack of time they have for preparing differentiated lessons and activities for students in the classroom; additional time for collaborating and planning for differentiated instruction is needed. The second theme identified was teachers' need for additional PD focusing on Common Core mathematics standards, helping teachers to identify and overcome their anxieties about implementing strategies for differentiated instruction in their classrooms, and understanding how ongoing PD is relevant and beneficial for all educators. The two main themes that emerged, were a need for additional PD that focus on differentiating instruction in mathematics and additional collaborating and planning time with other educators. The data collected from interviews, classroom observations, and collected lesson plans allowed for the identification of themes.

Description and Goals

Teachers need additional PD focusing on strategies for differentiating instruction with time for collaborating and planning for differentiated instruction based on the themes that emerged from the data. The social change plan that resulted from the study is a PD project based on data from teachers targeted at the implementation of effective differentiated instruction in mathematics for all students.

The results from the study showed that teachers needed to better understand various ways to differentiate instruction in mathematics and needed additional time to collaborate and plan. As a result, I developed a 3-day PD workshop for teachers who teach Grades 3, 4, and 5 and differentiate mathematics instruction in their regular education classrooms.

The workshop created focuses on helping teachers better understand Common Core mathematics standards, identify and overcome their anxieties about implementing strategies for differentiated instruction in their classrooms, and provides teachers with additional time to collaborate and plan for differentiated mathematics instruction. The implementation plan for this PD 3-day workshop is to have teachers in Grades 3, 4, and 5 attend a PD during the summer so that teachers can plan for the upcoming school year. Each day of the workshop would begin with a speaker in the main theatre of the school where the workshop was being held covering the topic of the day. For example: Day 1: Strategies for Differentiating Mathematics Instruction; Day 2: Common Core Mathematics Standards; and Day 3: Collaborating and Planning for Effective

Differentiated Instruction in Mathematics. The educators would meet in the theatre at the beginning of each day to listen to a speaker. Speakers would be local mathematics experts. Next, they would split into groups by grade level, go into separate rooms to discuss what was learned, and explore the topic of the day in depth with other teachers on their grade level. According to Helterbran (2008) planning collaboratively is linked to student achievement and effective planning makes learning purposeful and is a necessary element of effective instruction. Therefore, giving educators the time to collaborate, plan, and share ideas with other educators while finding a deeper understanding of topics discussed is necessary and of vast importance to this 3-day PD workshop. The goal of providing educators with these activities during the workshop is that their confidence will increase in implementing differentiated mathematics instruction and their relationships will improve and strengthen with other educators, so that ultimately teacher efficacy for differentiating mathematics instruction improves as well as student achievement in the classroom.

Professional Development Project Goal

The goal and purpose of the project is to inform teachers about a variety of strategies used to differentiate mathematics instruction and to provide teachers with additional time to collaborate and plan for differentiated instruction. The lessons and examples presented will provide teachers with the information they need to implement differentiated mathematics instruction into their regular education classrooms and help support students based on their individualized needs. Teacher's self-efficacy and attitudes

might improve once they completely understand the various strategies for differentiating mathematics instruction and begin implementing these strategies, this will allow for students to become more successful as well.

Project Rationale

The rationale and content for the project are presented in the following sections.

Project Genre Rationale

The purpose for conducting this study was to better understand teachers' perceptions, practices, and opinions about differentiating mathematics instruction for struggling students and teachers' perceptions of their PD needs. The findings from the data indicated that participants felt PD is important for their professional growth, allowing for mathematics instruction could be differentiated effectively. Mizell (2010) agreed that in order to improve teaching qualities of teachers and as a result increase student achievement, continuous PDs are a must. An additional result of the findings was the need for clarification of Common Core mathematics standards and various strategies for differentiating mathematics instruction caused anxieties among teachers. Teachers felt they needed additional time to collaborate and plan for differentiated instruction in mathematics so that they would feel the instruction to be effective and helpful for all students. Killough (2011) emphasized that when teachers' collaboration is focused on student instruction, increases in student achievement occur, therefore providing additional time for teacher collaboration is a goal all schools need to have if improving student achievement is a goal. The PD workshop would focus on strategies for

differentiating mathematics instruction in regular education classrooms which would allow teachers to become more successful and would improve their attitudes towards differentiated mathematics instruction.

Project Content Rationale

A PD workshop is necessary for regular education teachers that addresses differentiating mathematics instruction for all students. The 3-day workshop training will benefit teachers in numerous ways. The findings from the study showed that teachers wanted to decrease their anxieties about implementing differentiated instruction in mathematics and that they wanted to be able to implement strategies for differentiated instruction successfully. A PD workshop can focus on these areas by providing teachers with ways to face their anxieties and overcome them by providing teachers with time to collaborate and plan with other professionals. The PD will be planned deliberately so that it is most effective. As Mizell (2010) emphasized in order for PDs to be effective, they have to be planned with thoughtfully and deliberately and followed by careful and good implementation. As Tomlinson (2014) explained, a range of activities and strategies can be used to differentiate instruction for students; therefore, presenting teachers with examples of effective strategies for differentiated instruction in mathematics will allow teachers to plan and implement successful differentiated mathematics instruction for all students. The workshop would provide school and county administrators with a better understanding of teacher's needs for continuous PD in the implementation of

differentiated mathematics instruction for regular education students in Grades 3, 4, and 5.

Review of the Literature

To identify prospective, peer-reviewed articles and books, the following databases Resources Information Center (ERIC), Thoreau, ProQuest, and Education Research Complete were searched for the years 2014-2017 using the following keywords: *differentiated instruction, zone of proximal development, small group instruction, mathematics instruction,* and *professional development in schools*. I used the Boolean operators to optimize the results. Abstracts were used to judge an article's relevancy to the research questions. These resources were used to locate current research on topics related to the project material and project study. After saturation, a project was designed for regular education teachers in Grades 3, 4, and 5.

Common Core Mathematics Standards

According to the National Council of Teachers of Mathematics (2013), the widespread adoption of the Common Core State Standards for Mathematics presents an unprecedented opportunity for systemic improvement in mathematics education in the United States. By implementing these standards successfully, states and districts will be able to increase the strategies and approaches which will allow teachers to reach more students and teach them with higher standards in mathematics. The EPE Research Center (2013) explained in a survey taken from 599 teachers who had implemented Common Core Standards finding that the implementation and use of

these standards was helping them with their knowledge of state standards and would therefore improve their pedagogical skills. During the interviews, participants expressed that in order to differentiate instruction effectively, a deeper understanding of Common Core standards was needed. Therefore, in order to successfully implement mathematics standards and help students understand these higher standards so that they can succeed in the classroom and on standardized tests, teachers have to be experts on the standards they are teaching and implementing.

The National Council of Mathematics Teachers (NCTM, 2013) explained that when properly implemented, the Common State Standards will support all students' access to, and success in, high-quality mathematics programs. Such programs lead to knowledge of mathematics content and reasoning skills that enable students to apply mathematics effectively in numerous careers and in everyday life. The standards "set a rigorous definition of college and career-readiness, by helping students develop a depth of understanding and ability to apply mathematics to novel situations as college students and employees regularly do and stress not only procedural skill, but also conceptual understanding" (Common Core State Standards Commission, 2010, p.1). The Common Core State Standards Commission (2015) concluded that the advantage is that as educators find solutions to teaching to specific standards or addressing particular challenges, over time they become experts in the standards. Having a deeper understanding of Common Core standards would address one of the concerns teachers shared during interviews. Additional training during the workshop would give

teachers the time to develop a deeper understanding of these standards and would allow for effective implementation of these standards, as a result positively impacting student achievement.

Collaborative Planning

Participants expressed that more time for collaboration is necessary so that an exchange of ideas can occur, mentorships can happen, and lessons can be planned collaboratively. According to NCTM, developing policies that "promote teachers' mathematical learning, teamwork, and planning can provide necessary resources to overcome classroom, community, institutional, and system-wide barriers to young children's mathematical proficiency" (p. 2). Areas of concern for teachers were additional time to collaborate and plan with other educators because help and support was needed for the enhancement of pedagogical practices. Goddard & Taschannen-Moran (2007) reported that "collaborative school improvement practices are related to student achievement" and collaboration with other educators focusing on students' instruction results in a rise in student achievement (Killough, 2011). Therefore, providing teachers with extra time to plan and collaborate would contribute to improving student achievement, which was the goal of this study. Students exhibited higher gains in mathematics achievement when their teachers described having frequent conversations and time to collaborate with other educators focused on math (Leana, 2011). Overall, research about professional collaboration shows a promising picture of success when it comes to meeting student needs through collaboration with highly qualified educators

working together toward a common goal (Howland, 2003; Lam, et. al., 2002; Singh & Shifflette, 1996; Villa, Thousand, & Nevin, 2004).

The Impact of Teacher Anxiety on Student Instruction

Despite the knowledge teachers may have of standards and PD, teachers still exhibit anxieties about implementing new strategies, such as those found in Differentiated Instruction (Ramirez & Levine, 2010). Mathematics anxiety has been defined as feelings of tension and anxiety that interfere with the manipulation of numbers and the solving of mathematical problems in a wide variety of ordinary life and academic situations mathematics anxiety can cause one to forget and lose one's self-confidence (Tobias, S., 1993). During the interviews, several participants shared their anxieties and concerns about implementing strategies to differentiate mathematics instruction. When someone shows mathematics anxiety it can influence their learning, which can also impact performance (Ramirez & Levine, 2010). Teachers with mathematics anxiety are hesitant to perform mathematical tasks in front of their peers, perform poorly in testing and problem-solving situations, avoid mathematical situations and instruction, and develop learned helplessness (Beilock, Gunderson, Ramirez & Levine, 2010; Brady & Bowd, 2005; Gresham, 2007; Trujillo & Hadfield, 1999; Vinson, 2001). Therefore, providing teachers with the support they need to lessen their anxieties about implementing differentiated instruction is necessary, so that teachers and the instruction they provide to students is not impacted because of the anxiety they feel. Supplying

teachers with the necessary support, such as planning time and PD will decrease these anxieties (McAnarney, 2004).

Mathematics Efficacy

In order to achieve results of a certain level and attain goals we set for ourselves, we have to believe in ourselves and that we possess the abilities necessary to succeed (Usher & Pajares, 2009). Self-efficacy is defined as the beliefs we have about ourselves and our ability to complete tasks effectively (Galore, 2010). In order to continue to learn, grow, and succeed professionally, one has to have high levels of self-efficacy (Nabila, Simon, Bale, & Attach, 2016). Mathematics self-efficacy was defined by Bandura (1997) as the belief or perceptions one has in their mathematical abilities. Ferla, Valcke and Cai (2015) suggested that individuals possessing mathematical self-efficacy had the confidence to solve mathematical tasks successfully. According to Habila, Simon, Bala, & Attah (2016) "teacher self-efficacy is the teacher's personal beliefs in his ability to plan and execute instructional objectives in mathematics successfully" (p. 93). As educators, our self-efficacy is important because it also effects our students. Bandura (2015) emphasized that students with high sense of self-efficacy exhibit strong motivation and approach difficulties as challenges to be mastered; whereas students with low sense of self-efficacy exhibit weak commitment and approach difficulties as threats and with anxiety.

Therefore, teachers who have higher self-efficacy also show a stronger sense of motivation. As a result, when teachers possess high self-efficacy their effectiveness in the

content they teach is increased (Gavora, 2010). According to Henson (2001), teachers who have high self-efficacy in mathematics are more open to trying new ideas and show more wiliness to embrace innovations, which allows for students to learn more from the teachers who have higher self-efficacy. Overall, also allowing students to learn how to attain a high form of self-efficacy for themselves in mathematics and other content area(s) they are learning.

Professional Development

In order to implement effective differentiated instruction and decrease teacher anxieties, support for teachers through PD and mentorships is necessary. Teacher efficacy decreases when self-doubt and anxiety are involved leading to hesitation and doubt when planning for learners of various needs (Dixon, Yssel, McConnell, & Hardin, 2014). These concerns are addressed through PD and can impact teacher's knowledge, attitudes, and efficacy in a positive way (Heck, Banilower, Weiss, & Rosenberg, 2008; Penuel, Fishman, Yamaguchi, & Gallagher, 2007). PD also support the formation of teacher's positive attitudes (Kosko & Wilkins, 2009) leading teachers to be more open to activities that improve their skills, knowledge and expertise professionally (OECD, 2009). During interviews, all participants expressed that PD and professional collaboration are important to them, so that they can continue to learn and grow professionally and have opportunities to have help and support from other educators. Weber (2013) emphasized when a paradigm shift happens, teachers need the support of other education professionals.

David and Bwisa (2013) explained that almost all PD given to teachers are an attempt focused on improving teacher's skills and knowledge (p. 225). Mansour, Alshamrani, Aldahmash, and Alqudah (2013) described PD as an intensive, ongoing, and systematic process. Teachers who receive PD use the information they learn to increase their effectiveness and raise student performance (Dana & Yendol-Hoppey, 2008). Since teacher excellence is a critical factor that influences student success (Cochran-Smith, 2006), it is essential that PD are created to help teachers improve their knowledge and skills (Blank & Smith, 2007; Darling-Hammon & Richardson, 2009; Martin, 2007; Stevens, Harris, Aguirre-Munoz, & Cobbs, 2009; Telese, 2012), especially since a link between student success and teacher efficacy has been made (Goddard, Hoy, & Woolfolk, 2000). This connection strengthens when the PD is geared towards a specific subject matter (Powell-Moman & Brown-Schild, 2011). Overall, educators must have PD that enable them to have the knowledge and skills they need to address students' learning challenges and help all students to succeed (Mitzell, 2010), putting the knowledge acquired into practice (Petras, Jamil, and Mohamed, 2012).

Project Implementation, Potential Resources, Existing Supports, and Potential Barriers

Developing a workshop training for regular education teachers in Grades 3, 4, and 5 that focuses on improving understanding on how to differentiate mathematics instruction, analyze Common Core standards to create a deeper understanding, and provides time for educators to collaborate and plan to develop lessons that differentiate instruction is the goal of this project. The necessary resources to implement this training

workshop successfully is a school theater or cafeteria where all the teachers in Grades 3, 4, and 5 can meet at the beginning of the day to hear a speaker, classrooms for teachers to split into small groups daily with their grade levels, internet access, projectors for the speaker's presentations, and tables and chairs for teachers.

For the PD workshop to be implemented, a 3-day time slot will be scheduled during the summer of 2018. The place of the training will be determined as well as the times educators need to be there during the 3-day training. Once this information is determined, it will be presented to the principal of the school, who will need to give permission before the training is added to the local school's calendar. The potential barriers that exist are: scheduling conflicts, educator's willingness to participate, and resistance from veteran teachers. To address these barriers, scheduling workshops during the summer will be done in advance and put on the local school's calendar, so that teachers can plan the workshop around their summer commitments and travel plans. In order for the workshop to be successful and impact change in participant's pedagogical practices and student achievement, educators have to be open to attending the workshop, trying their best during the training, and have little resistance from veteran educators who are set and comfortable in their current teaching practices and are therefore resistant to change. To address these barriers, veteran teachers will be paired with a teacher from their school who will be their assigned mentor. This will help provide veteran teachers with peer support they need and help them to become more open to implementing differentiated instruction in mathematics with their students.

Proposal for Implementation

The PD training workshop will take place over a 3-day period. On the first day of training teachers will be presented with the agenda, purpose, and speakers for the training in a common area, like a school theater or cafeteria. Next, a local mathematics coach, the speaker for the first day of the workshop will speak to teachers about blogs, websites, or books about implementing differentiated instruction successfully. Participants will learn how to differentiate mathematics instruction using a variety of strategies such as: flexible small groups, centers, math journals, interactive math games, math tubs, mini-lessons, and independent math work, all part of Guided Mathematics. In addition, the speaker will discuss how to implement these strategies over time with peer support, in order to lessen teacher's anxieties. After the speaker is finished, teachers will have a break and then meet with their grade levels. A math expert will lead these small group sessions. Teachers will use this time to plan for mathematics instruction that is differentiated. Participants will also have time to reflect, share concerns, ask questions, and collaborate during this time.

On the second day, the focus will be to analyze Common Core mathematics standards, discuss lesson plan ideas and resources for implementing mathematics standards effectively through differentiated instruction. Once the speaker is finished, teachers will be divided into groups based on their grade levels; Grades 3, 4, and 5. Teachers will have a break to have a snack, use the bathroom, and go to the classroom where their grade level is meeting. A math expert will lead these small group sessions. In these small grade level groups, teachers will be given time to use the information given

by the speaker to address concerns, questions, reflect, and collaborate to plan lesson plans for their grade level.

On the third day of the workshop, teachers will meet in the common area to hear another speaker. On this day the speaker will be an academic coach or administrator from the local school district who will discuss how to successfully plan collaboratively and why collaboration among educators is important to everyone's success, including the students. Teachers will than split into their grade level small groups to have time to reflect and review what was learned. A mathematics expert will lead these small group sessions. Additionally, they will collaborate to plan differentiated mathematics lessons for their grade level. At the end of the third day, all participants will go back to the common area where they will meet to be invited to participate in the evaluation of the workshop.

Roles and Responsibilities

As the researcher, my roles and responsibilities are to plan, develop, and implement the project based on the review of literature and data acquired from the research. Once the training is added to the local school's calendar, speakers will be arranged, materials will be gathered, and agendas will be created for the workshop training sessions by myself, the project manager (Appendix A). The school location will be secured and I will make sure that internet access is available. A theater or cafeteria will be available for use of the common meetings with speakers, teachers have classrooms with desks and chairs to go to when they split into small grade level groups,

and the PowerPoint presentation (Appendix A) will be completed including introductory information to be used on the first day of the training.

At the end of the third day of training, a formative evaluation will be given to teachers regarding the training they received so that they can provide feedback on their experiences and what changes teachers feel are necessary for future workshop implementation. In addition to the aforementioned components, teachers will be asked to provide specific feedback regarding the workshop training, including things that worked and did not work. The second evaluation will be outcome based. Teachers will be given the opportunity to express their experiences, feelings, and suggestions for the future based on the feedback they provide in the open-ended evaluation. After the 3-day workshop training is completed, the evaluations will be collected for analysis (Appendix C).

Implications, Applications, and Directions for Future Research

The intention of this project study is for all educators who participate to be encouraged, inspired, and empowered. All the participants will develop a deeper understanding of Common Core standards, strategies for differentiating mathematics instruction, and the importance of collaboratively planning with others. Additionally, this PD workshop training can be shared among other schools in the local school district, allowing more educators to feel empowered. The information gathered from this project can also be shared with other school districts in the surrounding areas. An extensive implication of the project will be the positive effect on teachers' implementation of

differentiated mathematics instruction, resulting in an acceleration of positive student outcomes and an increase in student achievement and performance. These outcomes can create opportunity to positively affect other educators' performance through the training in other local school districts. Hopefully the participants will find the training experiences and results positive and share them with other educators. Other local school systems will be encouraged by the results so that they can also plan, organize, and implement their own project study to support improving teachers' mathematics instruction. Implementing these programs would encourage teachers to implement differentiated instruction in mathematics, fundamentally, positively impact students' learning and achievement in mathematics.

Conclusion

This PD training project focuses on assuring teacher understanding of mathematics standards, differentiated mathematics instruction, and collaborative planning. Providing teachers and mathematics coaches with the resources needed so that they can feel more successful in implementing differentiated mathematics instruction to meet the individualized needs of all learners, was my personal goal. The intent for this project is to supply teachers and administrators with the resources needed to successfully attack concerns about differentiating mathematics instruction.

In section four, the project's strengths and weaknesses will be reviewed, recommendations for remediation of limitations will be shared, analysis of self as a

scholar, developer, and practitioner will be made, and goals for social change will be discussed.

Section 4: Reflections and Conclusions

Introduction

The goal of this study was to determine teachers' preparations, practices, and opinions about differentiating mathematics instruction for struggling students, their needs for collaboration and planning, and their PD needs in order to increase student achievement in mathematics. Therefore, a 3-day PD workshop was designed to teach educators a variety of strategies for differentiating mathematics instruction and to give them additional time to collaborate and plan for differentiated instruction.

In Section 4, the following topics are covered: strengths and limitations of the project; reflections about myself as a researcher, practitioner, and project designer; and recommendations for social change and future research.

Project Strengths

The strength of my project came from the data I collected, which guided the project's development. This study and PD training addressed teachers' needs for better understanding of the Common Core mathematics standards, for exploring a variety of strategies for differentiating mathematics instruction, and for granting teachers additional time for collaborating and planning. My literature review showed that when teachers are given the time and opportunity to attend PD they are able to learn new strategies, make standards they teach more rigorous, and deepen their understanding of strategies and standards (Hattie, 2012). The participants in this study reported that they needed additional time to collaborate and plan for instruction. Giving teachers the chance to

collaborate outside the classroom can lead to an increase in efficacy (Shidler, 2009). Training teachers on the most effective strategies for differentiating mathematics instruction will allow them to implement best practices in their classrooms successfully. Making these changes in students' instruction, will give every student the opportunity to learn and succeed in mathematics, thus increasing student achievement, and fulfilling the purpose of the PD. By participating in PD, educators can help each other's PD needs.

Recommendations for Alternative Approaches

There is another way to address the problem of Grades 3, 4, and 5 students having difficulty meeting standards in mathematics and passing required standardized tests in mathematics. According to NCTM (2016), many of the challenges students have in mathematics, later on, can be reduced if addressed in elementary grades. To address these early challenges, a project needs to be designed that would focus on fundamental mathematical concepts, that is, mathematics standards and skills, conceptual understanding, anxiety students have about learning and understanding mathematics, and student's negative attitudes towards mathematics as a result of negative experiences.

First, the alternative project in the future could focus on the importance of learning mathematics and help students connect the understanding of mathematical concepts to real-world situations, such as careers that require knowledge and understanding of mathematics. Second, the project would focus on the negative experiences students have experienced that have impacted and shaped their negative attitudes towards learning mathematics and the anxieties created as a result. By

addressing all of these challenges and the problem in this way, it would be possible to help students from an early age have less negative experiences with the learning of mathematics and as a result have less anxiety as well. As a result, giving students the opportunity to focus on learning and understanding concrete mathematical concepts with deeper understanding that would possibly increase their passions about learning mathematics, also leading them to be more open to careers requiring mathematical knowledge.

Scholarship

The many experiences that I have had and learned from during this process and project, have been life-changing. I now understand the importance of the reasoning and purpose behind the information that is found. I also know that data and the interpretation of facts that come from research are very important in the field of education as they are the keys to future learning, understanding, and growth for professionals in this field, including myself. Creswell (2008) suggested that a good reflection of scholarship is the ability to use appropriate peer-reviewed literature. I feel that my understanding of scholarly research has deepened as a result of this study. I have embraced being skeptical of certain sources as to determine if they are truly ones I feel would be best to include and represent in my research and study. Using the Walden library and resources has been helpful with finding quality resources needed for the literature reviews guiding the development of the PD workshop training project. Because of this journey I have a better understanding of the importance of sharing information learned with my peers and others

in the education field. I have realized that I am a scholar and that I can be a part of influencing positive change in the field of education and on our society. Collaborating with others is one key way of doing this, and while working with peers during this process, I have been able to become more open to others' ideas, feelings, and views. Working together through differences to plan, collaborate, and do what is best for our students is one of the many lessons I take away from this journey.

Project Development and Evaluation

I began this study because I had seen remarkable results in my own classroom when implementing differentiated strategies in mathematics with my students. My goal was to conduct a study that would determine if implementing differentiated strategies in mathematics made a vast impact on student learning, understanding, and achievement. My hope was to help educators who are reluctant to change and implementing new strategies, such as differentiated strategies in mathematics. Additionally, my hope was to show educators the importance and positive impacts of PD.

During the development of the project study, I learned that to identify a specific problem, having a focus and being organized are extremely important. After determining that teachers' biggest needs were additional time for collaborating, planning, and understanding new strategies for differentiating mathematics instruction, I focused on creating a project that would provide teachers with the support they needed to decrease these concerns. According to Larson (2013), programs should complement participants' learning needs and include engaging activities that enhance their knowledge, skills, and

understanding of the problem identified in the study. I wanted to investigate effective strategies that would help teachers differentiate mathematics instruction effectively allowing for an increase in mathematics achievement for all students. The next step was to determine ways to solve this problem and the most effective strategies to use, so I began to read and search for related literature. Because of this, the research questions for this study were developed. A connection between the research questions and the specific problem I wanted to solve was necessary. After the questions emerged and the guidelines were developed, I planned and organized the goals of what I wanted to attain with this study.

A 3-day PD training workshop was developed for educators as a solution based on the evidence from the findings. The goal of the PD training is to help educators gain a better understanding of mathematics standards and strategies for differentiating mathematics instruction effectively while providing educators with additional time to collaborate and plan for instruction. While designing the project, I learned the challenges of creating a PD and realized the importance of details and resources necessary for such training to be successful and useful for educators and the school. Many educators are overwhelmed for assorted reasons and feel they do not have the time to attend PD and that such learning is a waste of time. By conducting interviews and researching PDs in depth, I have found that PD is a key and essential component to educator's professional growth. PD allows educators to collaborate with peers, learning new knowledge and skills that can be implemented with students in the classroom.

Leadership and Change

In order to impact immense change, great leadership that is effective becomes necessary. Foster (1986) emphasized that leadership is a necessity so that organizations can create change and (Northouse, 2007) explained that effective leaders are those who possess a vision and can communicate it to others. Writing this study and creating this project has helped me to realize that we are all capable of impacting and influencing positive change in education. School leaders especially have this ability because of their position, however, they must possess a vision for change and be able to communicate this vision to others, while showing the paths to making these changes so that they can become a reality. One way of implementing such changes would be through the development of a PD workshop. Developing and executing PD would empower teachers to implement effective instruction that is differentiated with all their students, providing all students with the opportunity to attain academic success. All stakeholders must be involved and supportive so that change can be achieved.

Lee (1991) shared that teacher empowerment involves an environment in which teachers are treated and respected as professionals (p. 37), explaining in depth that empowerment means that school leaders have to give teachers the authority to come to decisions so that they have a voice in how they can deepen their knowledge and improve their teaching. As a result, professional relationships of support are a must amongst leaders, teachers, and the community so that great change can occur. Lucas (1991) shared that the most effective leaders give power to their teachers and allow teachers to have

ownership of the school's goals and mission. I have a true passion for impacting change in my district and state, so that all students have the same opportunities in learning mathematics, regardless of the changes and obstacles they face.

As an educator, my impact goes beyond my own classroom and school because I know and understand the changes I need to implement to achieve the ultimate goal. By providing teachers with the resources to be more effective in their classrooms, I can positively impact and help teachers make changes which will help students now and in the future. Finishing the development of the PD workshop training project has allowed me to grow as an educator. Professionally, I have gained confidences as a result of this experience. During the interviews with teachers and while working closely with school administrators, I began to truly understand the immense amounts of knowledge I possess and how that knowledge can help others. It empowered me to truly know that I can initiate change and make a difference.

Analysis of Self as Scholar and Practitioner

When I began this journey, I had no idea the immense impact this journey would have on me and my life. I have grown professionally and learned much more than I ever anticipated. I really wanted to positively impact the way mathematics instruction is implemented in classrooms, but I did not realize the positive impact this study would have on my writing, research skills, and understanding of other educators. I used the Guided Mathematics Workshop in my own classroom and had witnessed the colossal impact it had in helping all students grown academically in a short amount of time, which

is why I chose to focus my study on this topic. Going through this process has allowed me to become more aware of what needs to be done for change to take place, how to implement change, with for example something such as this PD project, and to help all educators make slight changes gradually so change can occur over time.

Reading articles and being immersed into information while learning how to conduct my own research through interviews and observations with analysis helped me to learn and grow as well. Understanding the process of how articles and studies are developed, written, and published grew my appreciation for the work and impacted my knowledge in the field of education. As a result, I now know how great the impact of written work, such as research literature can be on our field of education if the information is analyzed, used, and implemented. I have always been passionate about education, but this opportunity has allowed for that passion to cultivate into greater purpose, passion, and desire to impact change in the education field.

All of these experiences have expanded by views, and as a scholar, I understand how important it is to communicate and how to apply what I have learned not just in theory but in practice. Additionally, because of the experiences of this study and professional experiences in the classroom, I have grown from being a classroom teacher to being a practitioner. I have been a member of several committees, including two committees at the county level which allow educators to work collaboratively in solving educational concerns of educators at the local and school district levels. Meanwhile, I was also conducting research for this study which allowed me to learn additional

strategies that could help solve some of the educational concerns that were discussed. I feel empowered and more confident as an educator and know that I can be a part of helping other educators resolve concerns resulting in students' academic success and school improvement.

Analysis of Self as Project Developer

As I developed the PD workshop training I realized that I have grown immensely as a professional. I made the decision to attend Walden's program in Teacher Leadership and feel that Walden has contributed to allowing me to set and achieve professional goals during my career as a result. The experiences of developing the project have been some of the most rewarding because they have taught me additional organizational, communication, and planning skills which have helped me grow personally and professionally. I have a deeper understanding of how data is collected and how data analysis is used to develop PD workshop trainings. Additionally, this project helped me to reflect and analyze the PD I have attended. Reflecting on my subjective experiences helped me when creating the PD project for other teachers. It allowed me to focus and ensure that as a result of my planning, the PD training workshop would be designed to help teachers improve practices and have the support needed to be successful. Frias (2013) explained that giving the teacher the proper understanding and knowledge of new concepts and strategies being implemented is the most effective way to have teachers use what they have learned and apply this new knowledge in their own

classroom with their students. As a result, helping teachers improve and grow professionally is the most effective and best way to improve the educational system.

My goal as a project developer was to create a training that would help and support teachers in regular education classrooms who wanted to differentiate mathematics instruction for all students. During the planning stages for the project, I took the audience into consideration. I wanted to include the experiences and perspectives of the educators. This was done through the collection of data from educators and organizing the PD project based on their needs. I used the information learned from this project and study to help me when addressing educational concerns at my school.

The Project's Potential Impact on Social Change

Because of this project, social change can be promoted in regular education classrooms through teaching practices. Teachers need to be encouraged and empowered to attend PD workshops so that these changes are possible. PD will allow teachers to be better informed on various strategies for differentiating mathematics instruction, better preparing students for future grades through academic success in mathematics. During the PD training workshop participants will be able to share their experiences and expertise while collaborating and planning with one another to improve mathematics instruction. Through the completion of this PD workshop training, educators will be provided with strategies on how to help their students and other educators at their local school and community. Because of this workshop training, educators will have the ability to positively impact other educators through grade level meetings, discussions, and PD at

their local school. In addition, community events can be organized at the local school for parents or guardians of students to attend, such as lunch-and-learns about strategies of differentiated learning and how to implement these strategies at home. These resources will provide parents with the tools they need to help their child or children at home with strategies found in differentiated instruction so that students are supported at home as well. These opportunities for students to succeed with teacher and parents working together will influence social change at the local school level, other schools in the district, and community.

Implications, Applications, and Directions for Future Research

The PD training workshop was designed to address the concerns, problems, and interests of educators at the local school setting of implementing differentiated mathematics instruction in regular education classrooms. This training workshop would be most effective if teachers attend the PD over the summer. This would allow teachers to be ready when the school year begins and implement the new strategies and practices learned throughout that school year.

Probable future implications could include additional PD for teachers at the local school setting by the teachers who have attended the summer training so that they could share what was learned and impact other educators' practices at their local school. Teachers visiting other classrooms and learning how to implement differentiated instruction in mathematics by observing other teachers could also be an additional implication and be included in the trainings at the local school. The creation of mentor

programs would also benefit teachers by giving them extra support in implementing new strategies for differentiated instruction for mathematics in their classrooms.

This project study has probable future applications. There is need for further research and project development to implement differentiated strategies in mathematics in all grades, not just Grades 3, 4, and 5, while also providing teachers with continuous PD. Modifications can be made to the current project to help implement these PD training workshops for teachers.

This doctoral project study has created opportunities for potential future research. In order to conduct future research, data from the evaluations of this project can be used. The data will help indicate if the PD workshop trainings were effective and how they should be implemented in the future. In direct relation to this project, a research study can be conducted determining the effectiveness of differentiated instruction and of the implementation of the strategies for differentiated mathematics instruction in grades 3, 4, and 5. Additionally, research can be piloted to determine the teacher's role in the success of the strategies implemented. When conducting my research and collecting data, many teachers shared the need for additional time to plan and collaborate. A study could be conducted to determine how much extra time is needed and if providing extra time to teachers would impact student achievement.

Conclusion

In this study, regular classroom educators' attitudes towards differentiating mathematics instruction in Grades 3, 4, and 5 were investigated. In Section 4, my

project's strengths and limitations were discussed. The implications, applications, and recommendations for PD workshop trainings were included. While reflecting on experiences throughout this project and the scholarship, I have realized that I have grown as a result of this study personally and professionally, as a scholar and lifelong learner. As a result of my commitment to this study and project I have learned how to analyze literature, develop, and implement a project that has positive effects on educators and can positively affect social change in the field of education. As a result of this study, educators will be provided with strategies on how to help their students and other educators at their local school and community. As a result, educators will have the ability to positively impact other educators through grade level and community meetings, discussions, and PDs at their local school. This will influence social change at the local and district levels, and in their community.

References

Anderson, K. (2007). *Tips for teaching: differentiating instruction to include all students.* Retrieved from file:///C:/Users/VaRaJiCi/AppData/Local/Microsoft/Windows/INetCache/IE/9015F0IV/10.1.1.655.2551.pdf

Anthony, G. & Walshaw, M. (2009). Characteristics of effective teaching of mathematics: A view from the west. *Journal of Mathematics Education*, *2* (2), 147-164.

Au, K., Raphael, T., & Mooney, D. (2008). What we have learned about teacher education to improve literacy achievement in urban schools. In L. Wilkinson, L. Morrow, & V. Chou (Eds.), *Improving literacy achievement in urban schools: Critical elements in teacher preparation*. (pp. 159–184). Newark, DE: International Reading Association.

Baker, E.L., Barton, P.E., Darling-Hammond, L., Haertel, E., Ladd, H.F, Linn, R.L., Ravitch, D., Rothstein, R., Shavelson, R.J., and Shepard, L.A., (2010). Problems with the Use of Student Test Scores to Evaluate Teachers. *Economic Policy Institute*, 1-29.

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

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

and company.

Baxter, P., & Jack, S. (2008). Qualitative case study methodology: Study design and implementation for novice researchers. *The Qualitative Report, 13* (4), 544-559. Retrieved from www.nova.edu/ssss/QR/QR13-4/baxter.pdf

Beecher, M. & Sweeny, S. (2008, April). Closing the achievement gap with curriculum enrichment and differentiation: One school's story. *Journal of Advanced Academic*, 19, 502-530.

Beilock, S.L., Gunderson, E.A., Ramirez, G., & Levine, S. (2010). Female teachers' math anxiety impacts girls' math achievement. *Journal of Proceedings of the National Academy of Sciences of the United States of America*, *107*(5), 1860-1863.

Billingsley, B. (2004a). Promoting teacher quality and retention in special education. *Journal of Learning Disabilities*, *37*(5), 370-376.

Billingsley, B. (2004b). Special education teacher retention and attrition: A critical analysis of the research literature. *The Journal of Special Education, 38*(1), 39-55.

Billingsley, B. (2007). A case study of special education teacher attrition in an urban district. *Journal of Special Education Leadership, 20*(1), 11-20.

Blanton, M. L. (1998). *Prospective teachers emerging pedagogical content knowledge during the professional semester*. (Doctoral dissertation). Available from projects.ncsu.edu/crmse/research_papers/blanton_diss.doc

Blazer, C. (2005). *Unintended consequences of high-stakes testing. Retrieved from* ERIC database. (ED 1008).

Bogdan, R. & Biklen, S. (2007). *Qualitative research for education: An introduction to theories and methods*. Boston, MA: Allyn & Bacon Publishers.

Boushey, G. & Moser, J. (2007). *The daily five*. Portland, ME: Stenhouse Publishing.

Brady, P., & Bowd, A. (2005). Mathematics anxiety, prior experience and confidence to teach mathematics among pre-service education students. *Teachers and Teaching: Theory and Practice*, *11*(1), 37–46.

Braun, H. (2005). *Using student progress to evaluate teachers: A primer on value-added models*. Policy Information Perspective. Princeton, NJ: Educational Testing Service.

Buck, S., & Greene, J.P. (2011). Blocked, diluted, and co-opted. *Education Next, 11*(2). Retrieved from www.educationnext.org/blocked-diluted-and-co-opted.

Burns, M. (2009). *Win-win math games*. Retrieved from http://www.mathsolutions.com/documents/WinWin_MathGames.pdf

Bushaw, W.J., & Lopez, S.J. (2011). Betting on teachers: The 43rd annual Phi Delta Kappa/Gallup Poll of the public's attitudes toward the public schools. *Phi Delta Kappan Magazine*, 93(1), 8-26 Retrieved from http://www.pdkintl.org/poll/docs/pdkpoll43_2011.pdf

Chaiklin, S. (2010). The Zone of proximal development in Vygotsky's analysis of learning and instruction. *Journal of Vygotsky's educational theory and practice*

in cultural context. Cambridge, UK: Cambridge University Press.

Cho, Y., Weinstein, C. E., & Wicker, F. (2011). Perceived competence and autonomy as moderators of the effects of achievement goal orientations. *Educational Psychology*, 31, 393–411.

Christie, K. (2009). Professional development worth paying for. *Phi Delta Kappan, 90*(7), 461-463.

Clark, C., Moss, P. A., Goering, S., Herter, R. J., Lamar, B., Leonard, D., et al. (1996). Collaboration as dialogues: Teachers and researchers engaged in conversations and professional development. *American Educational Research Journal*, 33(1), 193-231.

Clements, D.H. & Sarama, J. (2009). *Learning and teaching early math: The learning trajectories approach.* New York, NY: Routledge.

Cochran-Smith, M. (2006). *Policy, practice, and politics in teacher education.* Thousand Oaks, CA: Corwin Press

Cohen, L., Manion, L., & Morrison, K. (2007). *Research methods in education.* New York, NY: Routledge.

Cole, R. (2006). *Educating everybody's children: Diverse teaching strategies for diverse learners*. Alexandria, VA: Association for Supervision and Curriculum Development.

College Board. *College Board Standards for College Success: Mathematics and Statistics, (*2006) New York: College Board, Author.

/www.collegeboard.com/prod_downloads/about association/academic/mathematics-statistics_cbscs.pdf

Common Core State Standards Initiative. (2010). *Mathematics standards*. Retrieved from www.corestandards.org/Math/.

Common Core State Standards Commission. (2015). *Development process*. Retrieved from http:// w w.corestandards.org/about-the-standards/ development-process/

Cookson, P. (2007). Supporting new teachers. *Teaching Pre K-8, 37*(5), 14-15.

Costley, K. (2013). Ongoing professional development: The prerequisite for and Continuation of successful inclusion meeting the academic needs of special Students in public schools. *Retrieved from* ERIC database. (ED 1008).

Creswell, J. (2003). *Research design: Qualitative, quantitative, and mixed methods approaches.* Thousand Oaks, CA: Sage Publications.

Creswell, J. W. (2009). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches* (3rd ed.). Thousand Oaks, CA: SAGE publications.

Creswell, J. W. (2012). *Educational* r*esearch: Planning, conducting, and evaluating quantitative and qualitative research* (4th ed.). Boston: Pearson.

Cronin, J., Kingsbury, G. G., McCall, M. S., & Bowe, B. (2005). *The impact of the No child left behind act on student achievement and growth: 2005 edition*. Lake Oswego, OR: Northwest Evaluation Association.

Dana, N. F., & Yendol-Hoppey, D. (2008). *The reflective educator's guide to*

professional development. Thousand Oaks, CA: Corwin Press.

Darling-Hammond, L. (1994). Teacher learning that supports student learning. *Strengthening the Teaching Profession, 55*(5), 6-11.

Darling-Hammond, L., & Richardson, N. (2009). Teacher learning: What matters? *Educational Leadership, 66*(5), 46–53.

Darling-Hammond, L. Chung Wei, R., & Andree, A. (2010). *How high-achieving countries develop great teachers.* Retrieved from edpolicy.standford.edu

David, M. & Bwisa, H. (2013). Factors influencing teachers' active involvement in continuous professional development: A survey in Trans Nzoia West District, Kenya. *International Journal of Academic Research in Business and Social Sciences, 3*(5), 224-235.

Davis, B. & Brown, L. (and Cedillo, T., Chiocca, C.-M., Dawson, S., Gimenez, J., Hodgen, J., Jaworski, B., Kidd, M. & Siemon, D.), Jaworski, B. (Ed.) (2009). Development of teaching in and from practice. In R. Even & D. L. Ball (Eds.), *The professional education and development of teachers of mathematics: The 15th ICMI study* (pp. 149–165). New York: Springer.

Davis, J. (2015). Give Teachers Time to Collaborate. *Education Week Journal, 35*(4), 26-28.

Deci, E. L., & Ryan, R. M. (2000). The "what" and "why" of goal pursuits: Human needs and the self-determination of behaviour. *Psychological Inquiry, 11,* 227-268.

DeJesus, O. (2012). Differentiated Instruction: Can Differentiated Instruction Provide

Success for All Learners? *National Teacher Education Journal,* 5 (3), 5-11.

Dharan, V. (2014). *Beginning teachers and diversity: Why the need for extended critical professional support*. School of psychology and pedagogy, Faculty of Education, Victoria University of Wellington, New Zealand.

Diaz-Rico, L. T., & Weed, K. Z. (2006). *The cross-cultural, language, and academic development handbook: A complete K-12 reference guide* (4th ed.). Upper Saddle River, NJ: Pearson.

Diller, D. (2007). *Making the most of small Groups: differentiation for all.* Portland, ME: Stenhouse Publishing.

Diller, D. (2010). *Math work stations: Independent learning you can count on, k-2*. Portland, ME: Stenhouse Publishing.

Dixon, F., Yssel, N., McConnell, J., & Hardin, T. (2014). Differentiated instruction, professional development, and teacher efficacy. *Journal for the Education of the Gifted*, 37(2), 111–127.

Donaldson, S. I., Ensher, E. A., & Grant-Vallone, E. J. (2000). Longitudinal examination of mentoring relationships on organizational commitment and citizenship behavior. *Journal of Career Development*, 26, 233-249.

DuFour, R. (2015). *What is a professional learning community?* Retrieved from www.washougal.k12.wa.us/teach_learn/images/plc_article.pdf

Duncan, A. (2012). *How do U.S. students compare with their peers around the world? U.S. department of education*, Retrieved from

www.ed.gov/blog/2012/12/how-do-u-s-students-compare-with-their-peers-around-the-world/

Ediger, M. (2009). Seven criteria for an effective classroom environment. *College Student Journal, 43*(4), 1370-1372. Retrieved from ERIC database.

Education Northwest. (2010). *Spotlight on the common core state standards*. Retrieved from educationnorthwest.org/sites/default/files/resources/common-core-brief-parents.pdf

Eisenman, L., Pleet, A., Wandry, D., & McGinley, V. (2011). Voices of special education teachers in an inclusive high school: Redefining responsibilities. *Remedial and Special Education, 32*(2), 91-104.

EPE Research Center. (2013). *From adoption to practice: Teacher perspectives on the common core.* Retrieved from www.edwcck.org/media/ewrctcacherscommoncore

Eshach, H., Ziderman, Y., & Arbel, Y. (2011). Scaffolding the ‘‘scaffolding’’ metaphor: from inspiration to a practical tool for kindergarten teachers. *Springer Science and Business Media, 7* (20), 550-565.

Feldlaufer, H., Midgley, C., & Eccles, J. S. (1988). Student, teacher, and observer perceptions of the classroom environment before and after transition to junior high school. *Journal of Early Adolescence*, 8, 133-156.

Fennema, E., Franke, M., & Levi, L. (1999). *Children’s mathematics: cognitively guided instruction.* Portsmouth, NH: Heinemann.

Ferla, J., Valcke, M., & Schuyten, G. (2010). Judgments of self-perceived academic competence and their differential impact on students' achievement motivation, learning approach and academic performance. *European Journal of Psychology of Education, 25,* 519–536.

Fisher, D., Frey, N., & Lapp, D. (2010). *Text complexity: Raising rigor in reading.* Newark, DE: International Reading Association.

Flem, A., Moen, T., and Gudmundsdottir, S. (2000, September). *Towards inclusive schools: a study of how a teacher facilitated differentiated instruction.* Paper presented at the European Conference on Educational Research, Edinburgh, UK.

Fleming, N. (2011). Some states, districts abandoning performance pay. *Education Week.* Retrieved from www.edweek.org.

Foster, W. (1986). *Paradigms and promises: New approaches to educational administration.* Buffalo, NY: Prometheus Books.

Fountas, I. C., & Pinnell, G. S. (2010). *Guided reading: Good first teaching for all children*. Portsmouth, NH: Heinemann.

Franke, M. & Levi, L. (2007). *Thinking mathematically: integrating arithmetic and algebra in elementary school*. Portsmouth, NH: Heinemann.

Frias, R. (2013). *Science scores in title I elementary schools in North Georgia*. *Retrieved from* ERIC database. (ED 1008).

Friend, M., & Cook, L. (1992). The new including: How it really works. *Instructor, 101*(7), 30-36.

Gagliolo, C. (2008). Help teachers mentor one another. *Learning and Leading with Technology, 36*(2), 39.

Garza, R. (2009). Latino and White high school students' perceptions of caring behaviors: Are we culturally responsive to our students? *Urban Education, 44*(3), 297-321.

Gately, F.J., & Gately, S.E. (2001). Understanding co-teaching components. *Teaching Exceptional Children, 33*(4), 40-47.

Gavora, P. (2010). Slovak pre-service teacher self-efficacy: Theoretical and research considerations. *The New Educational Review 21*(2) 17-30.

Georgia Department of Education, (2012). *Great teachers and leaders*. Retrieved from www.doe.k12.ga.us/Race-to-the-Top/Pages/Great-Teachers-and-Leaders.aspx

Georgia Department of Education, (2013). *Great teachers and leaders*. Georgia department of education: Retrieved from www.gadoe.org/Curriculum-Instruction-and- Assessment/Assessment/Pages/CRCT-Statewide-Scores.aspx

Gerber, M., Jiménez, T., Leafstedt, J., Villaruz, J., Richards, C., & English, J. (2004). English reading effects of small-group intensive intervention in Spanish for K-1 English learners. *Learning Disabilities Research & Practice, 19*(4), 239-251. doi:10.1111/j.15405826.2004.00109.x

Goddard, Y. L., Goddard, R. D., Tschannen-Moran, M. (2007). A theoretical and

empirical investigation of teacher collaboration for school improvement and student achievement in public elementary schools. *Teachers College Record, 109*(4), 877-896.

Goddard, R. D., Hoy, W. K., & Woolfolk Hoy, A. (2000). *Collective efficacy: Its meaning, measure, and impact of student achievement. American Education Research Journal, 37,* 479–507.

Goldenberg, C. (2013). Unlocking the research for English learners. *American Educator*, *37*(2), 4-11.

Graeber, A. & Tirosh, D. (2008). Pedagogical content knowledge: Useful concept or elusive notion. In P. Sullivan & T. Wood (Eds.), *Knowledge and beliefs in mathematics teaching and teaching development* (pp. 117–132). Rotterdam, The Netherlands: Sense.

Grant, T. J., Hiebert, J. & Wearne, D. (1998). Observing and teaching reform-minded lessons: What do teachers see? *Journal of Mathematics Teacher Education*, 1, 217–236.

Greenes, C. (2009). Mathematics learning and knowing: A cognitive process. *Journal of Education*, 189, 3.

Gregory, G. & Chapman, C. (2007). *Differentiated instructional strategies: One size doesn't fit all.* Thousand Oaks, CA: Corwin Press.

Gresham, G. (2007). A study of mathematics anxiety in pre-service teachers. *Early Childhood Education Journal, 35*(2), 181–188.

Grimes, K., & Stevens, D. (2009). Glass, bug, mud. phi delta kappan, *90*(9), 677-680.

Gurgur, H., & Uzuner, Y. (2010). A phenomenological analysis of the views on co-teaching applications in the inclusion classroom. *Educational Sciences: Theory & Practice, 10*(1), 311-331.

Gwinnett County Public Schools, (2010). *Race to the top: Gwinnett county schools LEA scope of work. Georgia department of education*, 89, 1-54.

Habila, E., Simon, Z., Bala, K., & Attah, G. (2016). Pre-service teachers' mathematics self-efficacy and mathematics teaching self-efficacy. *Journal of Education and Practice, 7*(14), 93-98.

Hammond, L., Wei. R., Andree, A., Richardson, N., and Orphanos, S. (2009). *Professional learning in the learning profession: A status report on teacher development in the United States and abroad*. NSDC and the School of Redesign Network Stanford University.

Hargreaves, A. (1996). Transforming knowledge: blurring the boundaries between research, policy, and practice. *Educational Evaluation and Policy Analysis*, *18*(2), 105-122.

Hassel, E. (1999). *Professional development: Learning from the best*. Oak Brook, Illinois: North Central Regional Educational Laboratory.

Hatch, J. (2002). *Doing qualitative work research in education settings*. Albany, NY: State University of New York Press.

Hattie, J. (2012). *Visible learning for teachers: Maximizing impact on learning*. Retrieved from www.egfl.org.uk/sites/default/files/SUMMARY%20OF%20VISIBLE%20LEARNING.pdf

Hawley, W. D., & Rollie, D. L. (2007). *The Keys to effective schools: educational reform as continuous improvement.* Corwin Press & Sage Publications.

Heck, D. J., Banilower, E. R., Weiss, I. R., & Rosenberg, S. L. (2008). Studying the effects of professional development: The case of the NSF's local systemic change through teacher enhancement initiative. *Journal for Research in Mathematics Education, 39*, 113–152.

Hetterbran, V. (2008). *Planning for instruction: Benefits and obstacles of collaboration.* Chicago, IL: University of Illinois.

Heydon, R. (2003). Literature circles as a differentiated instructional strategy for including ESL students in mainstream classrooms. *Canadian Modern Language Review, 59*(3), 463-75.

Hill, H. C., Rowan, B. & Ball, D. L. (2005). Effects of teachers' mathematical knowledge for teaching on student achievement. *American educational research journal*, *42*(2), 371–406.

Holmstrom, A. (2010). A district finds the right equation to improve math instruction. *Journal of Staff Development, 31*(6), 58-62.

Howland, J. (2003). Into the province of shared endeavor. *Independent School,*

62(3), 12-17.

Ingersoll, R., & Smith, T. (2003). The wrong solution to the teacher shortage. *Educational Leadership, 60*(8), 30-33.

Jiménez, R. T., & Gersten, R. (1999). Lessons and dilemmas derived from the literacy instruction of two Latina/o teachers. *American Educational Research Journal, 36*(2), 265-301.

Johnson, D, Johnson, R. & Roseth, C. (2010). Cooperative learning in middle schools: interrelationship of relationships and achievement. *Middle Grades Research, 5*(10), 1-18.

Jones, C. & Henriksen, B. (2013). Skill-focused small group literacy instruction in the first grade: An inquiry and insights. *Journal of Reading Education, 38*(2), 25-30.

Jorgenson, O. (2012). What we lose in winning the test score race. *Principal,* 91, 12-15.

Kearsley, G. (1996). *Social development theory. Open learning technology cooperation*. Retrieved from educationau.edu.au/archives/CP/041.htm

Kearsley, G. (2005). *Social development theory*. Theory into practice database. Retrieved from tip.psychology.org/vygotsky.html

Killough, L (2011). *Research shows teacher collaboration helps raise student achievement*. Retrieved from blogcea.org/2011/09/30/collaboration-raises-achievement/

Kirkman, Ellen E., Richelle Blair, and James W. Maxwell. Statistical abstract of

undergraduate programs in the mathematical sciences in the United States: Fall 2010 CBMS Survey. Providence, R.I.: *American Mathematical Society*, 2012.

Knowles, M.S., Holton, E.F. & Swanson, R.A. *The adult learner.*, Oxford, UK: Elsevier, 2011.

Kobrin, Jennifer L., and Anne E. Schmidt. *The research behind the new SAT*. New York: College Board, 2007.

Kolb. D. A., & Fry, R. (1975). *Toward an applied theory of experiential learning*, in C. Cooper (ed.) *Theories of Group Process*, London: John Wiley.

Kosko, K., & Wilkins, J. (2009). General educators' in-service training and their self perceived ability to adapt instruction for students with IEPs. The Professional Educator, *33*(2), 1–10. Retrieved from http://web.b.ebscohost.com.ezp.waldenulibrary.org/ehost/pdfviewer/pdfviewer?vid=223&sid=5fc9176a-fd4f-4ccb-99dbc583672a38f%40sessionmgr110&hid=115

Krefting, L. (1991). Rigor in qualitative research: The assessment of trustworthiness. *American journal of occupational therapy*, *45*, 214-222.

Kvale, S. (2007). *Doing interviews.* Thousand Oaks, CA: SAGE Publications.

Lalik, R., & Niles, J. (1990). Collaborative planning by two groups of student teachers. *The elementary school journal*, *90*(3), 319-336.

Lange, S. (2014). *Strategies to promote critical thinking in the elementary classroom.* Retrieved March 16, 2016 from p21.org/news-events/p21blog/1435-strategies-to-promote-critical-thinking-in-the-elementary-classroom

Lau, S., & Roeser, R. W. (2008). Cognitive abilities and motivational processes in science achievement and engagement: A person-centered analysis. *Learning and individual differences, 18,* 497–504.

Lam, S., Yim, P., & Lam, T. W. (2002). Transforming school culture: Can true collaboration be initiated? *Educational Research, 44*(2), *181-196.*

Leana, C. (2011). *The missing link in school reform*. Stanford, CA: Stanford Social Innovation Review.

Lee, W. (1991). Empowering music teachers: A catalyst for change. *Music Education Journal, 78*(1), *36-39.*

Li, Jing. *Personal communications*, May and June, 2013.

Lodico, M., Spaulding, D., & Voegtle, K. (2010). *Methods in educational research: From theory to practice.* San Francisco, CA: Jossey-Bass.

Lucas, S., Brown, G.C., & Markus, F.W. (1991). *Principals' perceptions of site-based management and teacher empowerment*. NASSP Bulletin, *75*(357), 56-62.

Lutzer, David J., Stephen B. Rodi, Ellen E. Kirkman, and James W. Maxwell. Statistical abstract of undergraduate programs in the mathematical sciences in the United States: Fall 2005 CBMS Survey. Providence, R.I.: *American Mathematical Society*, 2007.

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

MacGillivray, L., and Rueda, R. (2001). Listening to inner city teachers of English

language learners: Differentiating literacy instruction. *Education research and development centres program*. Retrieved from ciera.org/library/archive/200105/0105McRued.htm [March 15, 2016].

Maehr, M. L., & Zusho, A. (2009). Achievement goal theory: The past, present, and future. In K. Wentzel & A. Wigfield (Eds.), *Handbook of motivation at school* (pp. 77–104). New York: Routlege.

Mansour, N., Alshamrani, S., Aldahmash, A., & Alqudah, B. (2013). Saudi Arabian science teachers and supervisors' views of professional development needs. *Eurasian journal of educational research*. 51, 1-27.

Margolin, I. & Regev, H. (2011). From whole class to small groups instruction: Learners developing mathematical concepts. *Issues in the undergraduate mathematics preparation of school teachers*, *2*(10), 1-13.

Martin, T. (Ed.). (2007). Mathematics teaching today: Improving practices, improving student learning (2nd ed.). Reston, VA: *National council of teachers of mathematics.* Monk, D. H. (1994).

Mattoon, D. (2008). CTE teacher succession: Insuring a smooth transition. *Tech directions, 68*(4), 20-22.

McInerney, D.M. (2004). A discussion of future time perspective. *Educational psychology review*, *16*(2), 141–151.

McIntyre, E., & Hulan, N. (2013). Research-based, culturally responsive reading practice

in elementary classrooms: A yearlong study. *Literacy research and instruction, 52*(1), 28-51. doi:10.1080/19388071.2012.737409

Mercer, C. D., Jordan L, Miller, S. P. (1996). Constructivist math instruction for diverse learners. *Learning disabilities research & practice*, 11, 147-156.

Merriam, S. (2009). *Qualitative research: A guide to design and implementation*. San Francisco, CA: Jossey-Bass.

Mitchell, L., & Hobson, B. (2005). One size does not fit all: Differentiation in the elementary grades. *SAGE*, 1-8.

No Child Left Behind Act of 2001. Pub. L. No. 107-110, § 115 Stat. 1425.

Mizell, H. (2010). *Why professional development matters.* Oxford, OH: Learning Forward.

Moore, N. (2012). Alternative strategies for teaching mathematics. Retrieved from digitalcommons.brockport.edu/cgi/viewcontent.cgi?article=1132&context=ehd_theses

National Association for the Education of Young Children (NAEYC), (2003). *Early childhood curriculum, assessment, and program evaluation: Building an effective, accountable system in programs for children birth through age 8*. Joint Position Statement. Washington, DC: NAEYC.

NCTM, (2013). Mathematics in early childhood learning. Retrieved from nctm.org/Standards-and-Positions/Position-Statements/Mathematics-in-Early-Childhood-Learning/

NCTM, (2016). *Early childhood mathematics: Promoting good beginnings*. Retrieved from oldweb.naeyc.org/about/positions/psmath.asp

NCTQ, (2009). A race to the top scorecard: How the "great teachers and leaders" assurance area can help states maximize their odds of winning a "race to the top" grant. *Retrieved from* ERIC database. (ED 1008).

NCTQ, (2011). *A race to the top scorecard*. Retrieved from nctq.org/dmsView/Race_to_the_Top_Scorecard_NCTQ_Report

NCTQ (2012). *Teacher performance evaluation*. Retrieved from nctq.org/docs/81-07.pdf

NEA (2017). *Providing ongoing professional development.* Retrieved from nea.org/home/20785.htm

Newton, N. (2013). Guided math in action: Building each student's mathematical proficiently with small-group instruction. Larchmont, NY: *Eye on Education*.

Ngee-Kiong Lau, P., Singh P. & Hwa, T. (2009). Constructing mathematics in an interactive classroom context. *Spring science and business media*, 10, 1-19.

Niemi, D. (1996). Assessing conceptual understanding in mathematics**:** Representations, problem solutions, justifications, and explanations. *Journal of Educational Research, 89*(6), 63-351.

Nieswandt, M. (2007). Erratum: Student affect and conceptual understanding in learning chemistry. *Journal of research in science teaching*, 44, 908–937.

Nigro, N. (2003). *The everything coaching and mentoring book.* Avon, MA: Adams

Media Corporation.

Norman, D., & Ganser, T. (2004). A humanistic approach to new teacher mentoring: A counseling perspective. *Journal of humanistic counseling, education and development, 43*(2), 129-141.

No Child Left Behind Act (2001). Retrieved May 2013 from ed.gov/policy/elsec/leg/esea02/index.html

OECD, (2009). *Creating effective teaching and learning environments: First results from TALIS*. Retrieved from oecd.org

OECD, (2009). *Statistics: PISA (2009, 2012)*. Retrieved from oecd.org/statistics/

Owen, I. (2012) States need to fill in the gaps on expanded learning time: Troubling lack of detail seen in no child left behind waiver applications. *Retrieved from* ERIC database. (ED 1008).

Parrish, S. (2010). *Number talks: Helping children build mental math and computation strategies, Grades K-5*. Sausalito, CA: Math Solutions.

Patsula, P. J. (1999). *Applying learning theories to online instructional design*. Athabasca University, Seoul. *Retrieved from* patsula.com/usefo/webbasedlearning/tutorial1/ [March 15, 2016].

Paul, R., & Elder, L. (2007). *Critical thinking competency standards*. Dillon Beach, CA: Foundation for Critical Thinking.

Penuel, W. R., Fishman, B. J., Yamaguchi, R., & Gallagher, L. P. (2007). What makes

professional development effective? Strategies that foster curriculum implementation. *American Educational Research Journal, 44*, 921–958.

Petras, Y., Jamil, H., & Mohamed, A. R. (2012). How do teachers learn? A study on the policy and practice of teacher professional development in Malaysia, *KEDI Journal of Educational Policy, 9*(1), 51-70.

Phillip, R. A. (2007). *Mathematics' teacher's beliefs and affect*. In F. K. Lester (Ed.), Second handbook of research on mathematics teaching and learning (pp. 257–318). Charlotte, NC: Information Age.

Powell-Moman, A. D., & Brown-Schild, V. B. (2011). The influence of a two-year professional development institute on teacher self-efficacy and use of inquiry based instruction. *Science Educator*, *20*(2), 47–53. Retrieved from http://web.b.ebscohost.com.ezp.waldenulibrary.org/ehost/pdfviewer/pdfviewer?vid=320&sid=5fc9176a-fd4f-4ccb-99db dc583672a38f%40sessionmgr110&hid=115

Protheroe, N. (2007). What Does Good Math Instruction Look Like? *Principal, 87*(1), 51-54. 18

Race to the Top (2012). *Race to the top. Georgia report. Year 1: School year 2010-2011*. US Department of Education. *Retrieved from* ERIC database. (ED 1008).

Randolph, K. (2012). Is no child left behind effective for all students? Parents don't think so. *Retrieved from* ERIC database. (ED 1008).

Reddell, S. (2010). High stakes testing: Our children at risk. *Retrieved from* ERIC database. (ED 1008).

Reform Support Network (2012). *Race to the top at a glance evaluations of teacher effectiveness: State requirements for classroom observations.* Retrieved from ed.gov/about/inits/ed/implementation-support-unit/tech-assit/evaluations teacher effectiveness.pdf

Rhoads, K., Radu, J., & Weber, K. (2010). The teacher internship experiences of prospective high school mathematics teachers. *International Journal of Science and Mathematics Education*, *9*(4), 999-1022.

Rhodes, W. (2012). *Attrition and Retention of Special Education Teachers in an Urban High School. Retrieved from* ERIC database. (ED 1008).

Riches, C., & Genesee, F. Literacy: *Cross linguistic and cross modal issues*. (2006). *Retrieved from* psych.mcgill.ca/perpg/fac/genesee/25.pdf

F. Genesee, K. Lindholm-Leary, W. Saunders, & D. Christian, (2006). *Educating English language learners: A synthesis of empirical findings*, pp. 64-108. NY: NY, Cambridge University Press.

Richland, S. & Stigler, H. (2012). Teaching the conceptual structure of mathematics. *Educational Psychology 47*(3), 189-202.

Riddle, E. M., and Dabbagh, N. (1999). *Lev Vygotsky's Social Development Theory*. Retrieved from chd.gse.gmu.edu/immersion/knwledgebase/theorists/constructivism/vygotsk

y.htm [March 17, 2016].

Roberts, J., (2010). *The heart of coaching.* Retrieved from kelseyrush.com/wp-content/uploads/2010/06/The-Heart-of-Coaching-Crane-Chapter-Excerpts.pdf

Rubin, H. & Rubin, I. (2012). *Qualitative interviewing: The art of hearing data*. Thousand Oaks, CA: SAGE publications.

Rueda, R., Goldenberg, C., and Gallimore, R. (1992). *Rating instructional conversations*: *A guide national centre for research on cultural diversity and second language learning*. Retrieved from ncela.gwu.edu/pubs/ncrcdsll/epr4.htm [March 17, 2016].

Sammons. L. (2011). *Building mathematical comprehension*. Huntington Beach, CA: Shell Education.

Sammons, L. (2010). *Math stretches: Building conceptual understanding grades K-2*. Huntington Beach, CA: Shell Education.

Sammons, L. & Fackler, D. (2009). *Guided math: A framework for mathematics instruction*. Huntington Beach, CA: Shell Education.

Sammons, L. & Windham, M. (2010). *Math stretches: Building conceptual understanding grades 3-5*. Huntington Beach, CA: Shell Education.

Santamaria, L. J. (2009). Culturally responsive differentiated instruction: Narrowing gaps between best pedagogical practices benefiting all learners. *The Teachers College Record, 111*(1), 214-247.

Santamaria, L. J. & Thousand, J. S. (2004). Collaboration, co-teaching, and

differentiated instruction: A process-oriented approach to whole schooling. *International Journal of Whole Schooling, 1*(1), 1-36.

Sartain, L., Stoelinga, R, & Krone, E. (2010). *Rethinking teacher evaluation: Findings from the first year of the excellence in teaching project in Chicago public schools*. Chicago, IL: Chicago School Research at the University of Chicago.

Schertz, _. (2015). *Guided math and math workshop: A common core approach to mathematics instruction*. Retrieved from file:///F:/Ed.D/80907/Schertz%20Presentation%20Guided%20Math.pdf

Schlichte, J., Yssel, N., & Merbler, J. (2005). Pathways to burnout: Case studies in teacher isolation and alienation. *Preventing School Failure, 50*(1), 35-40.

Schneider, R. (2008). Mentoring new teachers: Learning to mentor pre-service science teachers. *Journal of Science Teacher Education, 19*(2), 113-116.

Schön, D. (1996). *Educating the reflective practitioner: Toward a new design for teaching and learning in the professions*. San Francisco: Jossey-Bass, Inc.

Schwartz, A. (2007). New standards for improving two-year mathematics instruction. Education Digest: *Essential Readings Condensed for Quick Review, 73*(2), 39-42.

Shaffer, P. (2011). *Why should you use learning centers?* Retrieved from http://mathcenterideas.blogspot.com/2011/01/why-use-centers-in-math.html

Shambaugh, N., and Magliaro, S. (2001). A reflexive model for teaching instructional design. *ETRandD, 49*(2), 69-92.

Shumway, J. & West, L. (2011*). Number sense routines: Building numerical literacy every day in grades K-3*. Portland, ME: Stenhouse Publishing.

Simpson, C. (2010). Math in the middle institute partnership. *Journal of Educational Research, 94*(8), 40-68.

Singh, K., & Shifflette, L. M. (1996). Teachers' perspectives on professional development. *Journal of Personnel Evaluation in Education, 10,* 145-60.

Small, M. (2009). Good questions: Great ways to differentiate mathematics instruction. New York, NY: Teachers College Press. SMHC (2009). *Principles and Recommendations for the Strategic Management of Human Capital in Public Education*. Retrieved January 2014 from smhc.cpre.org/resources.

Snyder, M. (2014). *Critical thinking: Teaching methods & strategies*. Retrieved March 18, 2016 from Elon University.

Spelman, M. & Rohlwing, R. (2013). The relationship between professional development and teacher learning: Three illustrative case studies of urban teachers. *Journal of Research in Innovative Teaching, 6*(1), 155-171.

Stake, R. E. (1995). *The art of case study research*. Thousand Oaks, CA: Sage.

Stevens, T., Harris, G., Aquirre-Munoz, Z., & Cobbs, L. (2009). A case study approach to increasing teachers' mathematics knowledge for teaching and strategies for building students' mathematics self efficacy. *International Journal of Mathematical Education in Science and Technology, 40*, 903–914.

Subban, P. (2006) Differentiated instruction: A research basis. *Int. Educ. J., 7*, 935–947.

Telese, J. (2012). Middle school mathematics teachers' professional development and student achievement. *Journal of Educational Research, 105*(2), 102-111.

Tobias, S. (1993). Overcoming math anxiety. New York: W.W: Norton Company.

Tomlinson, C. & Allen, S. (2000). *Leadership for differentiating schools and classrooms*. Alexandria, VA: Association for Supervision and Curriculum Development.

Tomlinson, C. & Callahan, M. (1992). Interface between gifted education and general education: Toward communication, cooperation, and collaboration. *Gifted Quarterly, 40*(3), 1-7.

Tomlinson, C. (1999). *The differentiated classroom: Responding to the needs of all learners.* Alexandria, VA: Association for Supervision and Curriculum Development.

Tomlinson, C. (2001). *How to differentiate instruction in mixed-ability classrooms*. Alexandria, VA: Association for Supervision and Curriculum Development.

Tomlinson, C. (2003). *Fulfilling the promise of the differentiated classroom: Strategies and tools for responsive teaching*. Alexandria, VA: Association for Supervision and Curriculum Development.

Tomlinson, C. (2004). Differentiation in diverse settings: A consultant's experience in diverse settings. *The School Administrator, 7*(61), 28-35.

Tomlinson, C. A. (2004b, 2014). *The differentiated classroom: Responding to the needs of all learners.* Upper Saddle River, NJ: Prentice Hall.

Tomlinson, C. A., & McTighe, J. (2006). *Integrating differentiated instruction & understanding by design: Connecting content and kids*. Assoc. for Supervision and Curriculum Development.

Tomlinson, C. (2009). Two schools pursuing learning profiles. *School Administrator, 66*(2), 32-33.

Thompson, G. A. (1984). The relationship of teachers' conceptions of mathematics and mathematics teaching to instructional practice. *Educational Studies in Mathematics, 15*, 105–127.

Timperley & Alton-Lee (2008). Teacher professional learning and development. *Retrieved from* ibe.unesco.org/fileadmin/user_upload/.../EdPractices_18.pdf

Tricarico, K., & Yendol-Hoppey, D. (2012). Teacher learning through self-regulation: An exploratory study of alternatively prepared teachers' ability to plan differentiated instruction in an urban elementary school. *Teacher Education Quarterly, 39*(1), 139-158.

Troia, G., & Graham, S. (2003). Effective writing instruction across the grades: What every educational consultant should know. *Journal of Educational and Psychological Consultation, 14*(1), 75-89.

Trujillo, K.M., & Hadfield, O.D. (1999). Tracing the roots of mathematics anxiety through in-depth interviews with preservice elementary teachings. *College Student Journal, 33*(2), 219–232.

U.S. Department of Education, (2013). Race to the top. Georgia report. Year 2: School

year 2011-2012. *Department of Education, 34,* 1-21.

Usher, L. E., & Pajares, F. (2009). Sources of self-efficacy in mathematics: A validation study. *Contemporary Educational Psychology 34, 89–101.*

Vaughn, S., Mathes, P., Linan-Thompson, S., Cirino, P., Carlson, C., Pollard-Durodola, S., Francis, D. (2006). Effectiveness of an English intervention for first-grade English language learners at risk for reading problems. *The Elementary School Journal, 107*(2), 153-180.

Villa, R., Thousand, J., & Nevin, A. (2004). *A guide to co-teaching: Practical tips for facilitating student learning.* Thousands Oaks, CA: Corwin Press.

Vincent, E. (2005). Foundational skills are key to success in the workplace. *Industrial-organizational psychologist,* 1-28.

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

Vygotsky, L.S. (1978). *Mind in society: the development of higher psychological processes*. (M. Cole, V. John-Steiner, S. Scribner, & E. Souberman, Eds.). Cambridge, MA: Harvard University Press.

Wagner, T. (2010). *The global achievement gap: Why even our best schools don't teach the new survival skills our children need – and what we can do about it*. Basic Books: New York, NY.

Wasburn-Moses, L. (2006). A practical proposal for special education teacher induction.

*mid-western Educational Researcher, 19(*4), 20-23.

Weber, C., Johnson, L., Tripp, S. (2013). Implementing differentiation. *Gifted Child Today*, *36*(3), 179-186.

Wedekind, K. (2011). *Math exchanges: Guided young mathematicians in small group meetings.* Portland, ME: Stenhouse Publishing.

Westphal, L. (2007). *Differentiating instruction with menus: math grades 3-5.* Waco, TX: Prufrock Press, INC.

White, R., & Dinos, S. (2010). Investigating the impact of mediated learning experiences on cooperative peer communication during group initiatives. *Journal of Experimental Education*, *32*(3), 226-238. *Retrieved from* ERIC database. (ED 1008).

White, M., & Mason, C. (2006). Components of a successful mentoring program for beginning special education teachers: Perspectives from new teachers and mentors. *Teacher Education and Special Education, 29*(3), 191-201.

Wilson, T. & Nabors, D. (2012). Small group reading instruction: Lessons from the field. *Dimensions of Early Childhood*, *40*(3), 30-39.

Wirth, D. (2011). *Differentiated math learning centers: 36 Independent centers that keep kids learning while you teach small guided math groups.* New York, NY: Scholastic, INC.

Wood, D., Bruner, J., & Ross, G. (1976). The role of tutoring in problem solving. *Journal of Child Psychology and Child Psychiatry, 17*, 89−100.

Wood, T. (Ed.) (2009). *The balance of teacher knowledge: Mathematics and pedagogy.* In R. Even & D. L. Ball (Eds.), *The professional education and development of teachers of mathematics:* The 15th ICMI study (pp. 211–225). New York: Springer.

Yin, R. K. (2003). *Case study research: Design and methods* (3rd ed.). Thousand Oaks, CA: Sage.

Yin, R.K. (2008). *Case study research: Design and methods* (4th ed.). Thousand Oaks, CA: Sage.

Yin, R. (2009). *Case study research: Design and methods.* Thousand Oaks, CA: Sage Publications.

Appendix A: The Project

Implementing the Project: A Three-Day Professional Development Workshop Training for Educators

The project is a 3-day professional development workshop training focusing on improving differentiated instructional practices for students in regular education classrooms in Grades 3, 4, and 5. The goal of the project is to provide professional development and additional planning time for teachers in order to improve teachers' preparations, practices, and opinions about differentiating mathematics instruction for struggling students. Educators who participate in this project can enroll through eClass and earn six Professional Learning Units (PLUs) for participating in this professional development workshop training.

Purpose

The purpose of this professional development workshop training is to provide educators with a variety of strategies to use for implementing differentiated mathematics instruction. Participants will also learn how to effectively collaborate and plan for instruction as a team in order to implement differentiated mathematics instruction successfully for all students in Grades 3, 4, and 5.

Target Audience

This professional development workshop training is aimed for educators in regular education classrooms working with students in Grades 3, 4, and 5. All teachers in Grades 3, 4, and 5 will be invited to participate in this study, including all support

teachers for these grades. The key to facilitating these changes will be the participation of educators in this professional development workshop, who will also continue to collaborate to discuss and solve educational concerns.

Goals for Workshop Training

- Review and ensure that teachers have understanding of Common Core mathematics standards and help teachers understand the foundations of differentiated instruction by reviewing mathematics standards and differentiation strategies.
- Give opportunity for teachers to gain the necessary knowledge to implement differentiated instruction in their classrooms by providing educators with the time to collaborate and plan for whole group lessons, mini-lessons, small group lessons, and centers that can be used and incorporated in their classrooms to differentiate mathematics instruction.
- Clarify the role of the mathematics coach at the local school and how the coach will continuously support the teachers while they begin to implement differentiated mathematics instruction through mentorship.

Learning Outcomes

The learning outcomes for the professional development workshop training are for educators to gain an in-depth understanding of Common Core Standards, strategies used to differentiate mathematics instruction, and use additional planning time to collaborate and plan for differentiated mathematics instruction. This will help teachers

better understand the mathematics standards that they are teaching, give them an understanding of the foundations of differentiated instruction, and improve their understanding of how differentiated instruction in mathematics is implemented. Providing teachers with time to collaborate with other teachers and math coaches to create and develop lesson plans, mini-lessons, small group lessons, and centers that can be used for differentiating mathematics instruction. Developing these resources will be helpful to teachers because they would be able to use the resources created with the students in their classrooms during the school year.

Timeline

The professional development training workshop will take place over three consecutive days during the summer. The workshop will begin with a one hour introduction for the day with a speaker who would discuss topics that will be focused on in small grade-level groups that day. The participants will be broken down in small groups by grade level and would break into these groups for two hour periods, one before lunch, and one after lunch. During grade-level small groups, educators would discuss the topics discussed that day during the introductory speaker session, concerns, and questions. Additionally, during these grade-level sessions educators would be given time to collaborate and plan for differentiated mathematics lessons. On the last day of the three day training, participants will be asked to complete evaluations pertaining to the workshop activities. These evaluations will be used to determine in which areas the training can be improved for future workshop implementations.

Three-Day Professional Development Training Workshop for Differentiating Mathematics Instruction in Regular Education Classrooms for grades 3, 4, and 5.

Day 1: *Strategies for Differentiating Mathematics Instruction for grades 3, 4, and 5.*

Introduction 9:00-11:00am

Activity 1: Presenter will introduce herself/himself and speak about strategies for differentiating mathematics instruction for grades 3, 4, and 5.

The strategies discussed will be: - flexible small groups, centers, math journals, interactive math games/math tubs/ math centers, mini-lessons, and independent math work.

Presenter will use a PowerPoint presentation to discuss these strategies with examples.

Activity 2: 11:00am-12:00pm – Participants will be split into small groups based on grade level with an agenda that goes over the goals the participants want to achieve during their small group breakout professional development session.

The agenda for small group break out will include:

- What is the purpose of the professional development workshop training?
- What is differentiated mathematics instruction?
- Why do we need to implement mathematics instruction that is differentiated?
- What would differentiated mathematics instruction look like in your classroom with the grade you teach?
- How can you use peer support and mentorships to help implement differentiated mathematics instruction?

12:00-1:00pm Lunch

1:00-3:00pm

Activity 3: Continue working in small group breakouts to:

- Develop three goals for implementing differentiated mathematics instruction for your grade level
  (Participants will pick one person to write down their goals on chart paper and this paper will remain posted in the room that their grade level is meeting in for the remainder of the week).

- Divide intro groups to begin brainstorming on how to meet these goals, discuss, and write down how to achieve these goals.

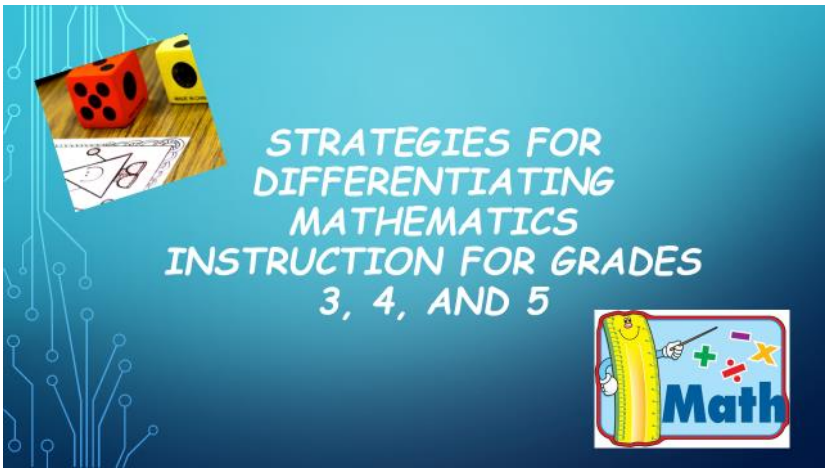
Activity 4:

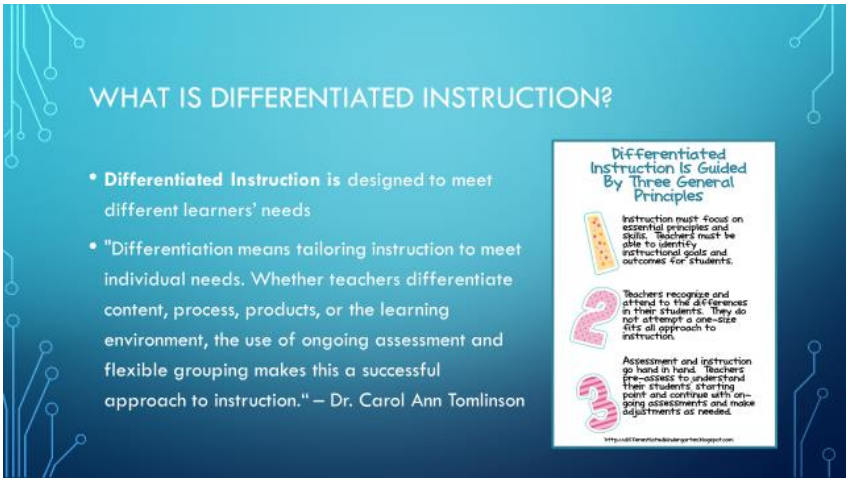
- Begin a list of resources needed to meet these goals with your grade level of students.

Activity 5:

- Begin planning for differentiated instruction using what you have learned today for your grade level of students.

Day 1 PowerPoint for Whole Group Speaker Session:
Differentiating Mathematics Instruction in Regular Education Classrooms for grades 3, 4, and 5.



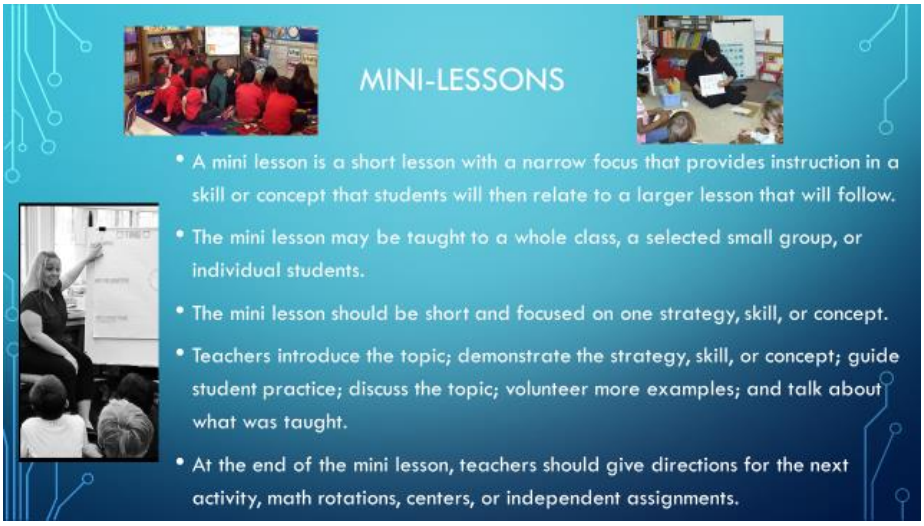


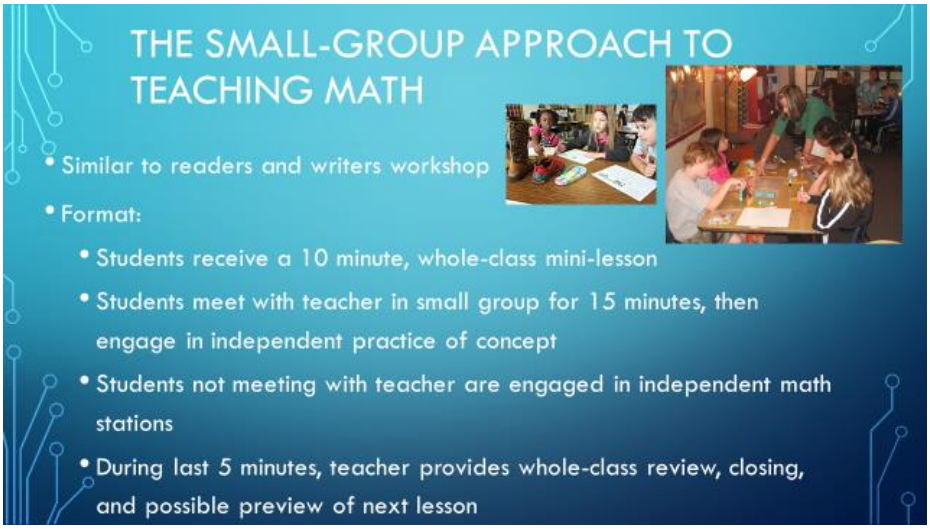
WHAT DOES DIFFERENTIATED INSTRUCTION IN MATHEMATICS LOOKS LIKE?

- Differentiated instruction in mathematics allows the teacher to support each child's development of mathematical proficiency at increasing levels of difficulty, within the context of a small group so that the teacher can reach and teach every student by:
- Creating flexible small groups that allow students to work in their zone of proximal development so they can learn exactly what they need to know at their instructional level
- Creating activities that tap into student's individual learning styles and interests so they stay engaged
- Providing immediate feedback so the student can adjust their work
- Questioning students in small groups so they have an opportunity to talk with their peers, ask questions and justify their mathematical thinking
- Allowing teachers to re-teach, reinforce, expand and compact concepts, strategies and skills
- Providing short lessons that emphasize conceptual understanding, procedural fluency or problem solving
- Scaffolding lessons so that they can be taught at a concrete level, pictorial level or abstract level
- Ultimately providing students with the self confidence they need to become successful mathematicians

BREAKDOWN OF 1 HOUR OF MATH INSTRUCTION

- 10 minute mini-lesson (whole-class)
- 3 (15 minute) small group meetings with teacher (45 minutes total) ☐ Other students doing independent practice or stations
- 5 minute closing


MINI-LESSONS
• A mini lesson is a short lesson with a narrow focus that provides instruction in a skill or concept that students will then relate to a larger lesson that will follow.
• The mini lesson may be taught to a whole class, a selected small group, or individual students.
• The mini lesson should be short and focused on one strategy, skill, or concept.
• Teachers introduce the topic; demonstrate the strategy, skill, or concept; guide student practice; discuss the topic; volunteer more examples; and talk about what was taught.
• At the end of the mini lesson, teachers should give directions for the next activity, math rotations, centers, or independent assignments.


THE SMALL-GROUP APPROACH TO TEACHING MATH
• Similar to readers and writers workshop
• Format:
• Students receive a 10 minute, whole-class mini-lesson
• Students meet with teacher in small group for 15 minutes, then engage in independent practice of concept
• Students not meeting with teacher are engaged in independent math stations
• During last 5 minutes, teacher provides whole-class review, closing, and possible preview of next lesson

SMALL GROUPS

- **Include scaffolding so that students have:**
  - Temporary supports that allow students to accomplish tasks that they otherwise would be unable to complete
- Give teachers an opportunity to closely observe student work and provide strong support for struggling students (Sammons, 2010) because of the small group setting.
- Homogenous, yet fluid
- Analogous to Guided Reading (Fountas & Pinnell, 2001)

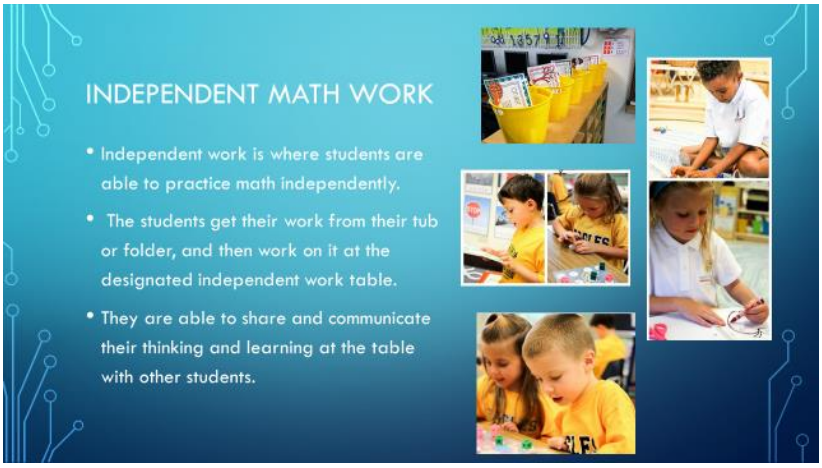
CENTERS

- During math centers students rotate between stations and are able to engage with math, practice what they are learning, review what they have learned, or be challenged through extension activities.
- Math rotations help students to learn how to collaborate and communicate with peers while applying math concepts to the activities they are completing
- The choices for math rotations change weekly so that students can be challenged and stay engaged

Example Group Rotation Schedule

	Group 1	Group 2	Group 3	Group 4
1st Station	Meet with Teacher	Math Games	Math Card Game	Individual Work
2nd Station	Individual Work	Meet with Teacher	Math Games	Math Card Game
3rd Station	Math Card Game	Individual Work	Meet with Teacher	Math Games
4th Station	Math Games	Math Card Game	Individual Work	Meet with Teacher


CENTERS
M.A.T.H. Time
Reading Groups
Math Groups
Reading Groups


INDEPENDENT MATH WORK
• Independent work is where students are able to practice math independently.
• The students get their work from their tub or folder, and then work on it at the designated independent work table.
• They are able to share and communicate their thinking and learning at the table with other students.


MATH JOURNALS
• Math journals are implemented to promote my students' problem solving skills.
• Math journals are a special place where students record and store their math thinking and problem solving skills.
ABOUT MATH JOURNALS

Day 1 Agenda for Small Group Breakout Session:
Differentiating Mathematics Instruction in Regular Education Classrooms for grades 3, 4, and 5.

11:00am-12:00pm – *Setting Goals as a Group and Having a Discussion*

Use chart paper to make goals of what all of you want to achieve during this professional development workshop training. Pick one person to write down the goals that are shared on the chart paper. Post the chart paper in the room assigned for your grade level. The goals for your group will stay posted during the entire three day professional development training.

Next have a discussion as a group. Consider the grade level that you teach for all of the topics for discussion found below.

Topics for Discussion:

- What is the purpose of the professional development workshop training?
- What is differentiated mathematics instruction?
- Why do we need to implement mathematics instruction that is differentiated?
- What would differentiated mathematics instruction look like in your classroom with the grade you teach?
- How can you use peer support and mentorships to help implement differentiated mathematics instruction?

12:00-1:00pm Lunch

1:00-3:00pm Focusing on Implementing Differentiated Instruction

As a group, choose one person to record your responses on chart paper and develop three goals for implementing differentiated mathematics instruction for students on the grade level you teach. These goals will remain posted in the room you are assigned to the remainder of this professional development training.
Next, meet in small groups or pairs to brainstorm on how to meet these goals. Also, discuss and write down ideas on how to achieve these goals. Consider the strategies for differentiating mathematics instruction discussed earlier as you plan for your grade level goals and outcomes. In addition, list resources that you believe you will need to meet these goals with your grade level of students at your current school.

As a whole group, share and discuss what you came up with in small groups. If time, begin planning for differentiated instruction using what you have learned today for your grade level of students. Consider the goals you set, the strategies you learned, and how you set out and plan to implement differentiated mathematics instruction with your students as you plan your lessons as a team.

Three-Day Professional Development Training Workshop for Differentiating Mathematics Instruction in Regular Education Classrooms for grades 3, 4, and 5.

Day 2: Session: *A Look at Common Core Mathematics Standards*

Introduction 9:00-11:00am

Activity 1: Presenter will introduce herself/himself and speak about Common Core Mathematics Standards for grades 3, 4, and 5 using a PowerPoint presentation.
In addition the speaker will use the PowerPoint presentation to discuss resources teachers can use, such as: blogs, websites, books, and how to use Common Core mathematics standards to create lesson plans to plan and implement differentiated instruction in mathematics.

Activity 2: 11:00am-12:00pm – Participants will be split into small groups based on grade level with an agenda that goes over the goals the participants want to achieve during their small group breakout professional development session for day 2.

The agenda for small group break out will include:

- Analyze Common Core mathematics standards for your grade level and discuss them
- Next, choose 2-3 standards that you cover at the beginning of the school year that you would like to use to begin planning today.

12:00-1:00pm Lunch

1:00-3:00pm Activity 3: Continue working in small group breakouts to:

- Using the Common Core mathematics standards chosen (before lunch) for your grade level, share and discuss lesson plan ideas

Activity 4:

- Share, look up, and make a list of resources that would be helpful when planning differentiated mathematics instruction using these Common Core mathematics standards

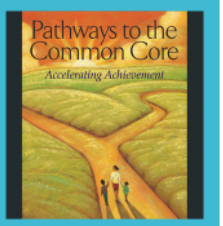
Activity 5:

- Begin planning for differentiated instruction using what you have learned today for your grade level of students using the Common Core mathematics standards chosen.

Resources: Computer with internet access, projector, agendas (paper and ink that will be created prior to professional development), chart paper, dry erase markers, paper, and pencils.

Day 2 PowerPoint for Whole Group Speaker Session: Differentiating Mathematics Instruction in Regular Education Classrooms for grades 3, 4, and 5.

Common Core Mathematics Standards for grades 3, 4, and 5



"As challenging as it must have been to write and finesse the adoption of the Common Core Standards, that accomplishment is nothing compare to the work of teaching in ways that bring all students to these ambitious expectations." – Lucy Calkins

Pathways to Common Core

Common Core Math Standards by Grade Level

Grade	Required Fluency
K	Add/subtract within 5
1	Add/subtract within 10
2	Add/subtract within 20 Add/subtract within 100 (pencil and paper)
3	Multiply/divide within 100 Add/subtract within 1,000
4	Add/subtract within 1,000,000
5	Multi-digit multiplication
6	Multi-digit division Multi-digit decimal operations
7	Solve px+q=r, p(x+q)=r
8	Solve simple 2x2 systems by inspection

A necessary link:

http://www.corestandards.org/Math/

Grade	K	1	2	3	4	5	6	7	8
Domains	Counting & Cardinality						Ratios & Proportional Relationships		Functions
	Operations and Algebraic Thinking						Expression and Equations		
	Number and Operations in Base Ten						The Number System		
					Fractions				
	Measurement and Data						Statistics and Probability		
	Geometry								

WHAT DO THESE SHIFTS MEAN FOR TEACHERS?

- We cannot rely on simply teaching students a formula to answer math problems anymore.
- Students will often need to learn these concepts at varying paces, as not all students will master a deep understanding at the same time.

Common Core Math Shift

- Greater focus on fewer topics
- In grades K–2: Concepts, skills, and problem solving related to addition and subtraction
- In grades 3–5: Concepts, skills, and problem solving related to multiplication and division of whole numbers and fractions
- Coherence: Linking topics and thinking across grades http://www.examiner.com/slideshow/required-fluencies#slide=1
- Rigor: Pursue conceptual understanding, procedural skills and fluency, and application with equal intensity (

A SMALL GROUP APPROACH TO TEACHING MATH IS A MUST TO SUCCEED WITH THIS SHIFT

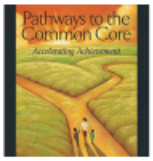
- Format: Students receive a 10 minute, whole-class mini-lesson
- Students meet with teacher in small group for 15 minutes, then engage in independent practice of concept
- Students not meeting with teacher are engaged in independent math stations
- During last 5 minutes, teacher provides whole-class review, closing, and possible preview of next lesson

SMALL GROUP INSTRUCTION IS NEEDED BECAUSE…

- Each student receives small group, need specific instruction, followed by independent worktime
- Allows for students to be rotated/moved to different groups by lesson or unit
- Students are engaged at all times in mathematics practice, and concepts are reinforced daily in stations
- Students are motivated by the rotation, and manage themselves with little need for teacher interruption

Teacher Resources to use when Planning with Common Core Standards for Differentiated Instruction

- A necessary Common Core Mathematics Standards link: http://www.corestandards.org/Math/ - use this link to download/print the standards.
- https://www.khanacademy.org/commoncore - A great resource for lesson plans and differentiated activity ideas.
- http://www.insidemathematics.org/common-core-resources/mathematical-practice-standards - Use this website for amazing lesson plan ideas!
- The book called *Pathways to the Common Core: Accelerating Achievement* by Lucy Calkins is a great additional resource



Day 2 Agenda for Small Group Breakout Session: Differentiating Mathematics Instruction in Regular Education Classrooms for grades 3, 4, and 5.

11:00am-12:00pm – *A Look at Common Core Mathematics Standards*

Look at the Common Core standards for your grade level. Use your computer to access the standards online using the link: http://www.corestandards.org/Math/Practice/

Use chart paper to write down five standards that your grade level teaches at the beginning of the school year (August – October). Pick one person to write down the standards shared on the chart paper. Post the chart paper in the room assigned for your grade level.

Next have a discussion as a group. Consider the grade level that you teach for all of the topics for discussion found below.

- Analyze the Common Core mathematics standards listed that you teach at the beginning of the school year and discuss them
- During your discussion consider: What resources you will need to differentiate these mathematics standards and how you can differentiate these standards using the strategies learned and discussed on Day 1 of the professional development

12:00-1:00pm Lunch

1:00-3:00pm Focusing on Planning for the Five Selected Standards

Using your chart paper responses from this morning, split into five groups. Each group will choose one of the five standards to analyze, and discuss in depth. Next, in your small groups you will begin planning lesson plans for your grade level using the mathematics standard chosen by your group. Use the strategies and resources shared and discussed during Day 1 and Day 2 of the professional development.

Three-Day Professional Development Training Workshop for Differentiating Mathematics Instruction in Regular Education Classrooms for grades 3, 4, and 5.

Day 3: Session: *Collaboratively Planning for Effective Differentiated Instruction in Mathematics*

Introduction 9:00-11:00am

Activity 1: Presenter will introduce herself/himself and speak about collaborative planning and the importance of collaborative planning for educators who teach grades 3, 4, and 5 using a PowerPoint presentation.

The topics the speaker will discuss include:

- How to collaborate effectively
- Why collaborative planning is important for teacher and student success

Activity 2: 11:00am-12:00pm – Participants will be split into small groups based on grade level with an agenda that goes over the goals the participants want to achieve during their small group breakout professional development session for day 3.

The agenda for small group break out will include:

- Participants need to reflect and review what was learned earlier during the speaker session
- Discuss how they believe collaborative planning occurs successfully
    - Begin the planning session using the standards chosen yesterday

12:00-1:00pm Lunch

1:00-2:00pm Activity 3: Continue working in small group breakouts to:

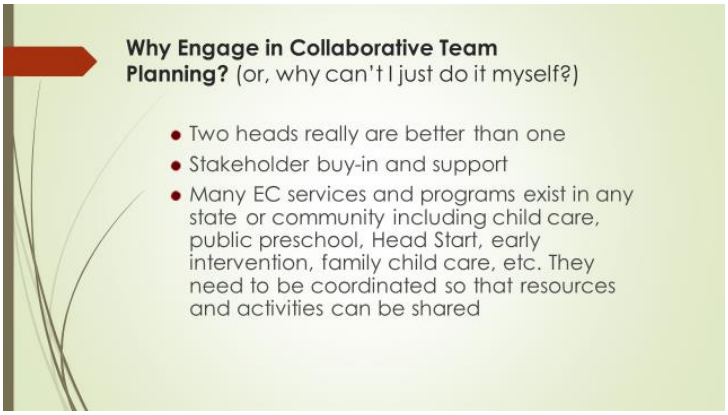
- Begin collaborative planning for their grade level in mathematics (participants should use the lessons they began planning yesterday during day 2 and continue planning them in small groups).

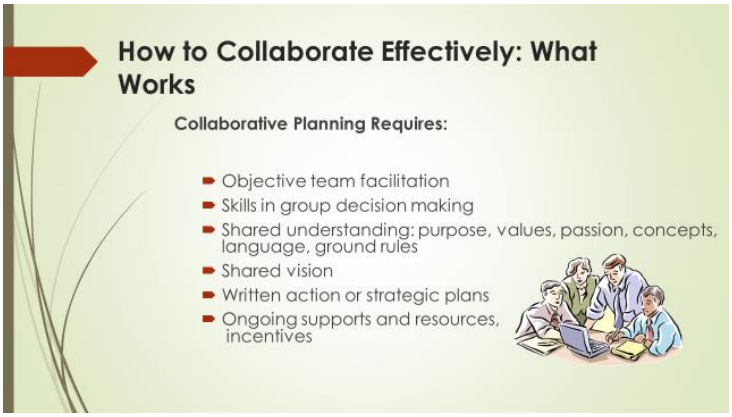
2:00-3:00pm Activity 4: Complete Evaluations

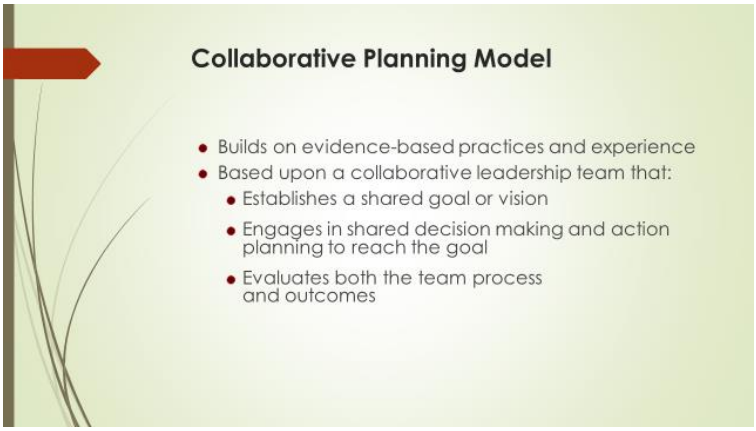
- All participants will meet back in the common area (where the speakers began each day) to complete their evaluations about the entire three-day professional development workshop training.

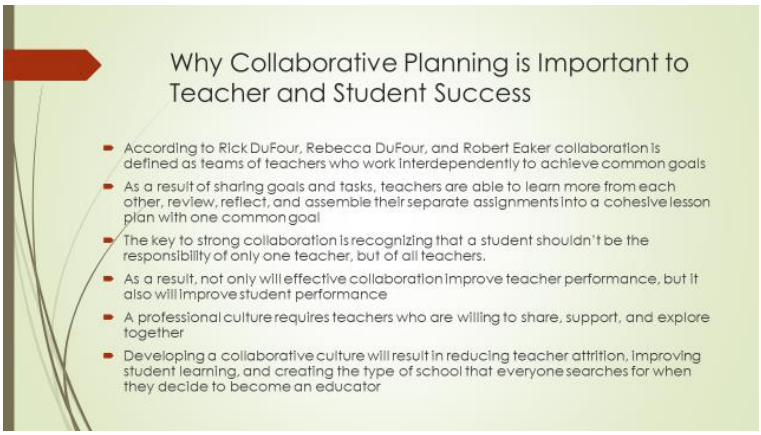
Resources: Computer with internet access, projector, agendas (paper and ink that will be created prior to professional development), chart paper, dry erase markers, paper, pencils, and evaluation sheets.

Day 3 PowerPoint for Whole Group Speaker Session: Differentiating Mathematics Instruction in Regular Education Classrooms for grades 3, 4, and 5.





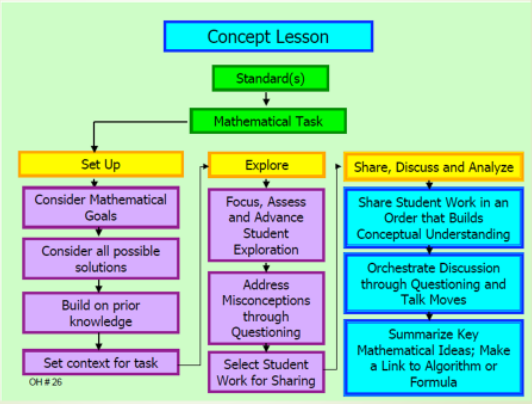

Collaborative Planning Model
Builds on evidence-based practices and experience
Based upon a collaborative leadership team that:
Establishes a shared goal or vision
Engages in shared decision making and action planning to reach the goal
Evaluates both the team process and outcomes

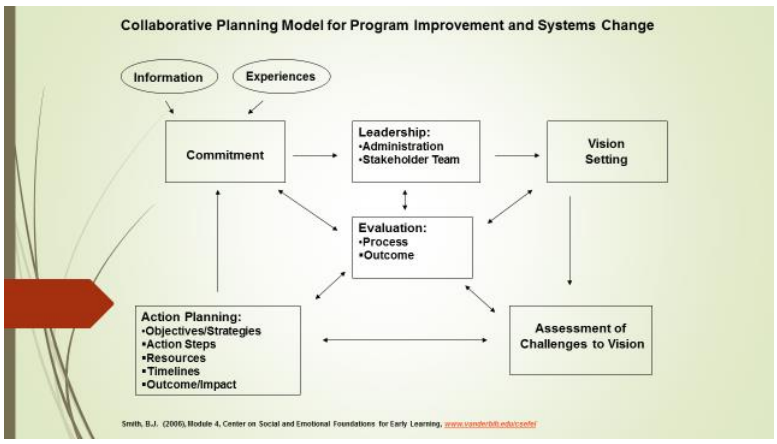

Why Collaborative Planning is Important to Teacher and Student Success
According to Rick DuFour, Rebecca DuFour, and Robert Eaker collaboration is defined as teams of teachers who work interdependently to achieve common goals
As a result of sharing goals and tasks, teachers are able to learn more from each other, review, reflect, and assemble their separate assignments into a cohesive lesson plan with one common goal
The key to strong collaboration is recognizing that a student shouldn't be the responsibility of only one teacher, but of all teachers.
As a result, not only will effective collaboration improve teacher performance, but it also will improve student performance
A professional culture requires teachers who are willing to share, support, and explore together
Developing a collaborative culture will result in reducing teacher attrition, improving student learning, and creating the type of school that everyone searches for when they decide to become an educator

Something to Consider…

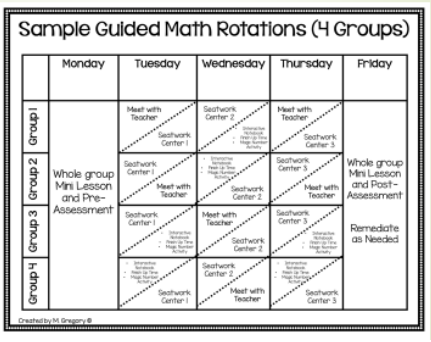
[Common Core State Standards for Mathematics] represent a **significant departure from *what* mathematics is currently taught in most classrooms and *how* it is taught**. Developing teachers' capacity to enact these new standards in ways that support the intended student learning outcomes will require considerable changes in mathematics instruction in our nation's classrooms. Such changes are likely to occur only through **sustained and focused professional development opportunities** for those who teach mathematics.

Sztajn, Marrongelle, & Smith, 2011





Sample Lesson Planning Template

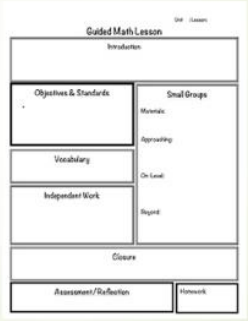


Sample Guided Math Rotations (4 Groups)

	Monday	Tuesday	Wednesday	Thursday	Friday
Group 1	Whole group Mini Lesson and Pre-Assessment	Meet with Teacher / Seatwork Center 1	Seatwork Center 2	Meet with Teacher / Seatwork Center 3	Whole group Mini Lesson and Post-Assessment / Remediate as Needed
Group 2		Seatwork Center 1	Meet with Teacher / Seatwork Center 2	Seatwork Center 3	
Group 3		Seatwork Center 1	Meet with Teacher / Seatwork Center 2	Seatwork Center 3	
Group 4		Seatwork Center 1	Seatwork Center 2	Meet with Teacher / Seatwork Center 3	

Created by M. Gregory ®

Sample Lesson Planning Template



Unit Lesson

Guided Math Lesson

Introduction

Objectives & Standards

Small Groups

Vocabulary

Independent Work

Closure

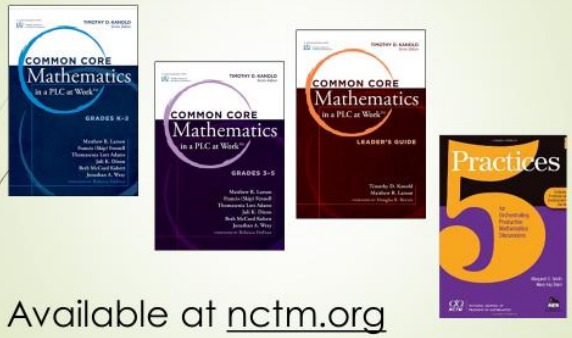
Assessment/Reflection

Homework

Sample Lesson Planning Template

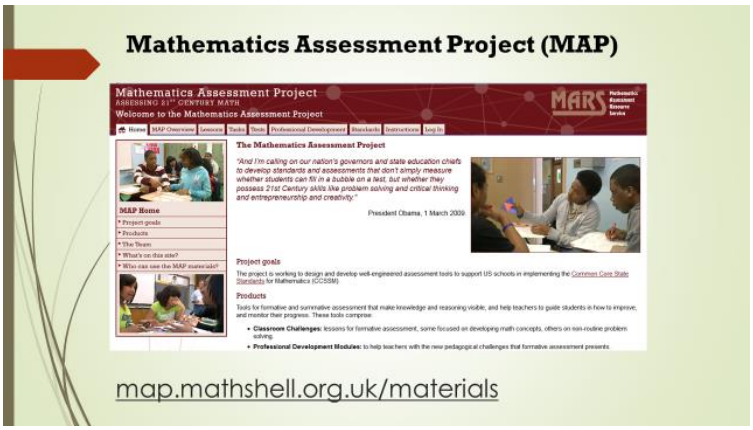
Resources

Collaborative Team Tools



Available at nctm.org


Tools for the Common Core Standards
News about tools that are being developed to support implementation of the Common Core State Standards
Home
About
Tools
Progression on Ratios and Proportional Reasoning
Here is a draft of the Progression on Ratios and Proportional Reasoning. This one took a long time because there is a lot of conflicting and confusing language about ratios and proportional reasoning out in the field, and we struggled with decisions about the extent to which we should try to standardize the language. So comments on this draft would be especially appreciated.
Search
Recent Posts
Progression on Ratios and Proportional Reasoning
Videos about the standards
Essay by Al Cuoco on choosing curriculum aligned to the practices
Drafty draft of
commoncoretools.wordpress.com


Mathematics Assessment Project (MAP)
Mathematics Assessment Project
ASSESSING 21ST CENTURY MATH
Welcome to the Mathematics Assessment Project
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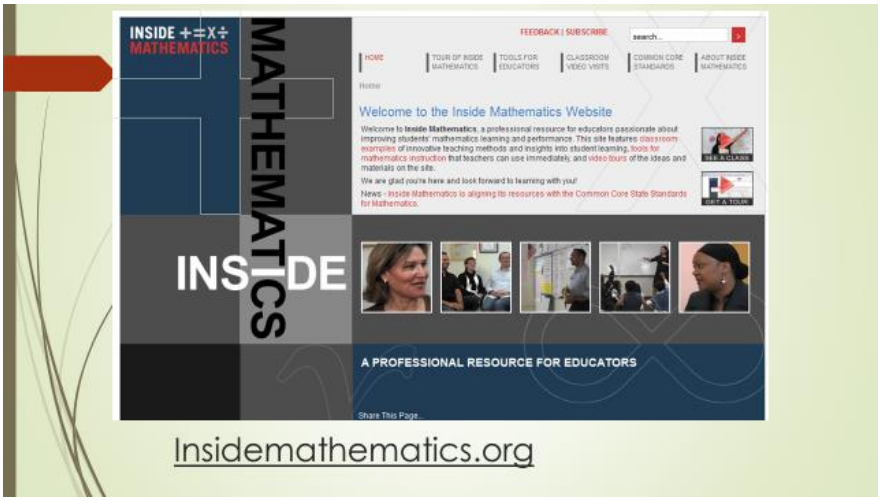
The Mathematics Assessment Project
"And I'm calling on our nation's governors and state education chiefs to develop standards and assessments that don't simply measure whether students can fill in a bubble on a test, but whether they possess 21st Century skills like problem solving and critical thinking and entrepreneurship and creativity."
President Obama, 1 March 2009
Project goals
The project is working to design and develop well-engineered assessment tools to support US schools in implementing the Common Core State Standards for Mathematics (CCSSM).
Products
Tools for formative and summative assessment that make knowledge and reasoning visible, and help teachers to guide students in how to improve, and monitor their progress. These tools comprise:
Classroom Challenges: lessons for formative assessment, some focused on developing math concepts, others on non-routine problem solving.
Professional Development Modules: to help teachers with the new pedagogical challenges that formative assessment presents.
map.mathshell.org.uk/materials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Welcome to Inside Mathematics, a professional resource for educators passionate about improving students' mathematics learning and performance. This site features classroom examples of innovative teaching methods and insights into student learning, tools for mathematics instruction that teachers can use immediately, and video tours of the ideas and materials on the site.
We are glad you're here and look forward to learning with you!
News - Inside Mathematics is aligning its resources with the Common Core State Standards for Mathematics.
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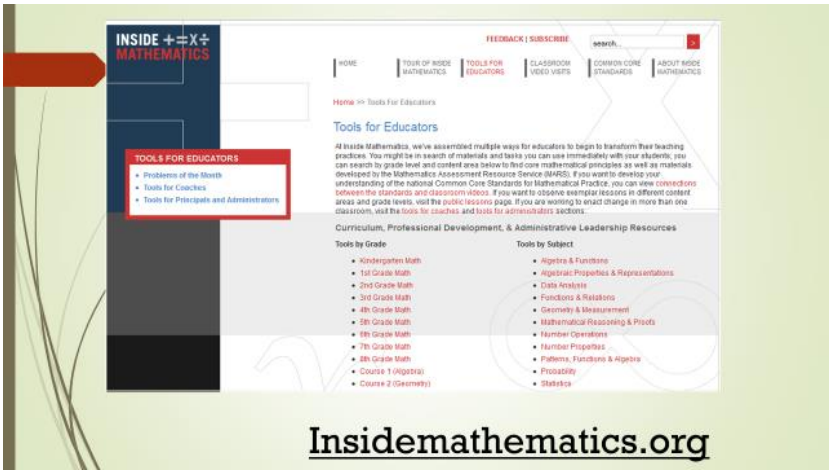
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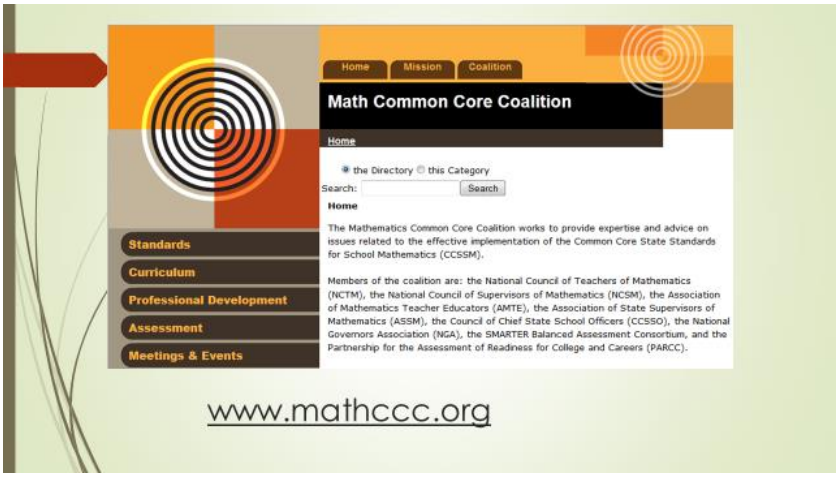
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Day 3 Agenda for Small Group Breakout Session: Differentiating Mathematics Instruction in Regular Education Classrooms for grades 3, 4, and 5.

11:00am-12:00pm – *Collaboratively Planning for Effective Differentiated Instruction in Mathematics*

Look at the templates for planning differentiated instruction collaboratively. Use the chart paper from yesterday to review the mathematics standards to be planned. Discuss how you will split as a group to plan for different parts of the lessons choosing the standard(s) you are planning. Begin planning in small groups using the templates provided.

12:00-1:00pm Lunch

1:00-2:00pm Continue Planning Collaboratively

Using your chart paper responses from yesterday, the standards you have chosen, and the templates given, continue to plan for differentiated mathematics instruction in small groups.

Share what you have planned so far in your small groups. Exchange contact information with one another so you can share lesson plans and resources as you continue to plan together. Next, you will take all of your belongings to the main meeting area to complete evaluations for this three-day professional development workshop training.

2:00-3:00pm Completing Evaluations

In the main meeting area, all of you will be given evaluations to provide feedback about this three-day professional development workshop (NEA, 2017).

Appendix B: Interview Questions

My procedures:

A. I will introduce myself.

B. I will explain my research and ask if the interviewees have questions.

C. I will explain that the interview is being recorded for accuracy with a digital tape recorder.

Interview Questions:

1. Tell me how you have implemented strategies for differentiated instruction in mathematics in your classroom? Research Question # 1
2. Has the way you implement differentiated instructional strategies changed in the last two years as a result of professional development? Please explain. Research Question # 2
3. How would you describe your use of higher level thinking strategies, such as problem solving, synthesizing, analyzing, etc. when you plan your lessons? Research Question #1
4. How does the use of these higher level thinking strategies help facilitate student development of conceptual understanding of mathematical concepts? Research Question #1
5. What professional development, preparation, or training have you had for providing differentiated mathematics instruction for struggling students? Research Question #2

6. What kind of follow through support has been beneficial in teaching mathematics? Please provide examples of support. Research Question #2
7. What areas do you need more support in the mathematics block? (Mini-lessons, centers/stations, mentoring, small group lessons, differentiation strategy ideas, etc.) Please explain how or why. Research Question #2
8. When you are planning instruction in mathematics which strategies for differentiating instruction do you find to be the most effective? Research Question #1 and Research Question # 3
9. What have I not asked you that I should have asked?

    Additional Comments

    Thank you for your time and input!

After the interview is concluded, I will ask each of the four participants who have consented to allow me to watch a lesson for a convenient date and time. I will tell them that the observation will be approximately 45 minutes in length.

Appendix C: Evaluation of Professional Development Session

Evaluation 1: Formative Feedback

Participant Name_____

School:_____

Please answer each question to help maximize the usefulness of this session.

1-Not helpful 2- Somewhat helpful 3- Very helpful

1. Teacher Speakers	1	2	3
2. Peer Collaboration	1	2	3
3. Materials Presented	1	2	3
4. Creating Lesson Plans	1	2	3
5. Tools for DI	1	2	3
6. Overall Experience	1	2	3

7. Any additional information that you wish to share to make this experience more helpful to others:

_____

_____

_____

_____

_____

_____

Appendix D: Evaluation of Professional Development Session

Evaluation of Professional Development Session

Evaluation 2: SurveyMonkey Survey

Name:_____

School:_____

Please provide a thorough answer to each question:

1. Do you feel you had sufficient background knowledge to begin creating lessons in your content area using differentiated instruction in mathematics? Yes or No? Please explain.

2. How did collaboration with your content area peers help you when creating lessons using differentiated instruction in mathematics?

3. How did the materials presented in the professional development session help you create your lessons?

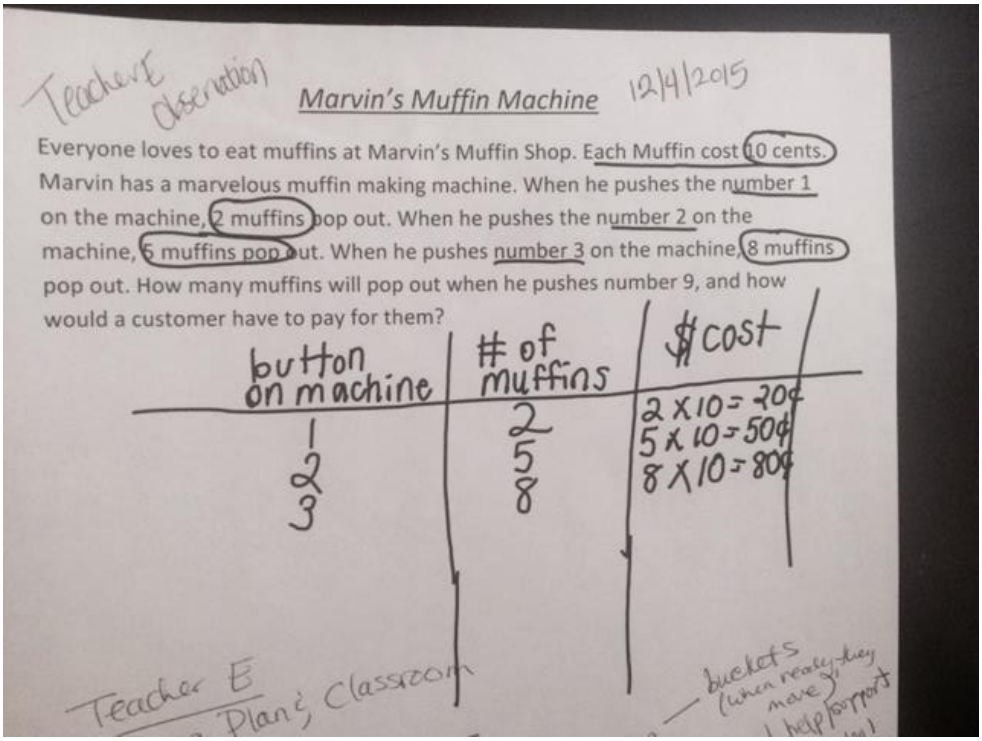
4. Which tools (tools (mini-lessons, small group lessons, centers, technology integration) will you use with your students and how did you change them to meet your individual needs?

5. What do you predict will be successful with your lessons?

6. What inhibitions do you have about implementing differentiated instruction in your classroom?

Appendix E: Lesson Plan Collected from Techer E

Exemplar Lesson



Teacher E observation

Marvin's Muffin Machine 12/4/2015

Everyone loves to eat muffins at Marvin's Muffin Shop. Each Muffin cost 10 cents. Marvin has a marvelous muffin making machine. When he pushes the number 1 on the machine, 2 muffins pop out. When he pushes the number 2 on the machine, 5 muffins pop out. When he pushes number 3 on the machine, 8 muffins pop out. How many muffins will pop out when he pushes number 9, and how would a customer have to pay for them?

button on machine	# of muffins	$ cost
1	2	2 x 10 = 20¢
2	5	5 x 10 = 50¢
3	8	8 x 10 = 80¢

Teacher E Plan; Classroom

buckets (when ready they move) help/support

Appendix F: Lesson Plan Collected from Techer G

Fractions Lesson

Grade/ Level/Course: 5
Lesson/Unit Plan Name: Multiplying Fractions
Rationale/Lesson Abstract: Students will conceptually understand multiplying fractions and using an area model. Students will then be able to apply their understanding of multiplying fractions to solve word problems.
Common Core Standard(s): 5.NF.B.4 Apply and extend previous understandings of multiplication to multiply a fraction or whole number by a fraction. 5. NF.B.6 Solve real world problems involving multiplication of fractions and mixed numbers, e.g., by using visual fraction models or equations to represent the problem.

Background/Connecting Prior Knowledge:
Utilize students' prior knowledge on multiplying whole numbers using an array or area model to introduce multiplying fractions. Remind students that we use multiplication to find 'groups of' something.

2 x 3 is 2 groups of 3

2 x $\frac{1}{2}$ is 2 groups of $\frac{1}{2}$

$\frac{1}{4}$ x $\frac{1}{2}$ is $\frac{1}{4}$ of a group of $\frac{1}{2}$

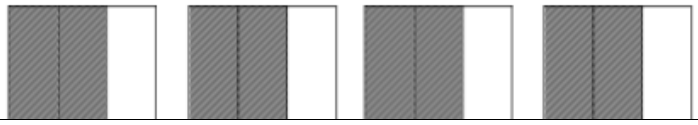
Activity/Lesson:

Multiplying Fraction by a Whole Number

$4 \bullet \frac{2}{3}$ *or* $4 \, of \, \frac{2}{3}$

Draw It

"We will begin by drawing 4 groups of $\frac{2}{3}$"



"How many thirds do we have out of the four groups?" [8]

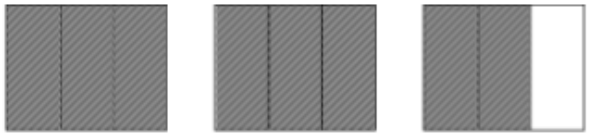
So $4 \bullet \frac{2}{3}$

$= \frac{8}{3}$

"Is there another way I can write $\frac{8}{3}$?" "What do you know about the fraction $\frac{8}{3}$?"

Take this opportunity to review that an improper fraction tells us that there are whole(s) w
the fraction.

"We can combine all the thirds and see how many wholes we have."



Build It and Draw It

Make copies of the Fraction Area Models template on to transparencies. Sets can be made for partner share or individual students.

Remind students when we create an area model for a multiplication problem, one term is represented by the height and the other term is represented by the base. Since we are multiplying fractions, which is part of a whole, the area of the model/square will always equal to a one. Therefore, the height will equal to one and the base will equal to one.

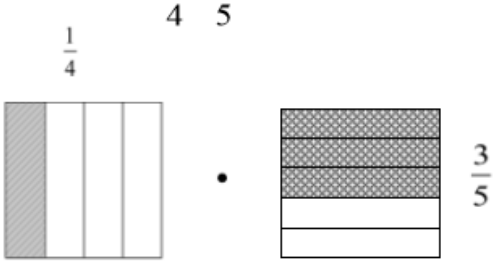
As students build each step to simplify the problem, have them record each step by drawing what they've built.

Tell students to use a striped Fraction Area Model to represent one term and a dotted Fraction Area Model to represent the other term.

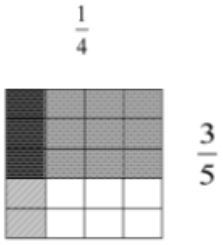
Example #1

Have students pull out the striped Fraction Area Model for $\frac{1}{4}$ and the dotted model for $\frac{3}{5}$ Draw the models.

$\frac{1}{4} \bullet \frac{3}{5}$



Overlay the $\frac{1}{4}$ on top of the $\frac{3}{5}$ model. The over lapping parts show what is $\frac{1}{4}$ of a group of $\frac{3}{5}$. The numerator and the denominator is represented by the amount of pieces that creates the whole which is 20.



$= \frac{3}{20}$