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Differentiating Math Instruction in an Elementary Classroom: Teacher Perspectives

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DIFFERENTIATING MATH INSTRUCTION IN AN ELEMENTARY CLASSROOM:

TEACHER PERSPECTIVES

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ABSTRACT

DIFFERENTIATING MATH INSTRUCTION IN AN ELEMENTARY CLASSROOM:

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Action Research Final Project

Classroom teachers of a diverse group of learners are presented with a conundrum: how can math curriculum be effectively presented to students in order to ensure that all students are meeting required learning targets? Research shows that whole group instructional methods do not meet the needs of struggling and gifted students. So how can teachers change instruction to promote student learning for all?

The purpose of this action research was to discover effective strategies to differentiate math instruction in an elementary classroom. In this qualitative research, data were collected through five structured interviews with classroom teachers. The teachers represented grades K, 1, 2, 3, and 4/5. This research provides perspectives of elementary teachers regarding the planning and execution of differentiation within their mainstream classrooms. It looks at ways to meet the needs of struggling learners, as well as the needs of gifted learners.

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Chapter 1

Introduction

Twenty-three eager first graders sit "crisscross applesauce" on a classroom carpet with whiteboards in their laps and dry erase markers in their hands. They are waiting for the teacher to begin the day's math lesson. The teacher puts the Math Message up on the board to get the kids thinking mathematically. The board reads, "What number is 10 more than 34?" The sound of dry-erase markers scratching against whiteboards quickly takes over the room. Many students begin flashing out finger counts. Some students draw part of a number grid. After giving the students a minute to think independently, the teacher begins to scan the room and the whiteboards. The teacher quickly realizes that three students have yet to even remove the cap from their whiteboard marker, two students are doodling pictures completely unrelated to the task at hand, two students have a puzzled look in their eyes (indicating that they don't even know where to begin) and five additional students have not only answered the problem, but have done so using sophisticated place value understanding. The rest of the class has come to an answer, most of which are correct. The teacher realizes that a handful of students didn't have a chance to solve the problem, but feels compelled to move on since most of the class is now sitting impatiently, waiting for the next challenge. The teacher sighs deeply and wonders how she will ever meet the needs of such a diverse group of learners.

Classroom teachers who instruct mathematics using a whole-group method are often presented with scenarios such as this one as they try to meet the academic needs of a diverse group of learners. Whole-group instruction does not allow

opportunities for struggling learners to receive the remediation necessary for them to understand mathematical concepts. (Gibson, 2013, p. 2). In addition, whole group instruction does not allow gifted learners to extend their knowledge and challenge their thinking. Differentiation is essential to meet the needs of all learners. "Teachers can help students achieve their potential as learners by providing learning and consolidation tasks that are within the student's 'zone of proximal development" (The Literacy and Numeracy Secretariat, 2008, p. 1). If students are being instructed just above their independent level, they will be able to reach their full academic potential. This cannot happen in a whole group instruction only approach.

Purpose

The purpose of this action research was to discover effective ways to differentiate math instruction within an elementary classroom. What are ways in which teachers have effectively differentiated math instruction? How can I implement whole-group and small-group teaching to help students meet the required learning targets? How can I assist my struggling learners by remediating their learning while simultaneously keeping them in the current curriculum? How can I extend the learning of my gifted learners?

Importance of the Study

This study will provide me with insight as to how I can effectively differentiate math instruction within my first grade classroom. The information will also be of value to elementary teachers who teach a diverse group of learners within a mainstream classroom.

Definition of Terms

Differentiation

In this action research, differentiation is used to describe the ways in which curriculum is modified, scaffolded, or extended to meet the needs of different learners.

STEM

STEM is an acronym for Science, Technology, Engineering, and Mathematics. The school that I work for is a STEM magnet school.

UbD

UbD stands for Understanding by Design, a backwards design approach to writing curriculum. A UbD focuses on the desired results of student learning first, then examines how students will demonstrate that learning, and finally looks at how instruction can bring the students to the desired learning targets.

Math Journal

The Math Journal is a component of the Everyday Mathematics resource. It offers a written component for students to use within daily lessons.

Math Boxes

Math Boxes are found in math journals within Everyday Mathematics. Students are given 4-6 opportunities to review mathematical concepts. Math Boxes are a component in every lesson of Everyday Mathematics.

Chapter 2

Literature Review

With the growing diversity of learners in our heterogeneous classrooms, the push for differentiation within American classrooms is becoming increasingly strong. (Moon, 2005, p. 227). "Success for all students is more than a slogan or even a laudable goal: it may be a key to the survival of the American public school as society has come to know it" (George, 2005, p.186). There are an abundant amount of articles that support the use of differentiated instruction within the classroom. Most of these articles stress the importance of differentiation for both the struggling and gifted students.

This chapter will begin by defining what differentiation is and what it looks like in an elementary classroom. It will explain the need for differentiation in the mainstream classroom as well as examine reasons why differentiation may not be utilized. It will demonstrate how formative assessments can be used to identify areas that need differentiation. It will examine whole group vs. small group instruction. This chapter will also examine how differentiation can benefit different types of learners, including gifted learners and struggling learners. Finally, this chapter will discuss different types of mathematical differentiation that could be used in an elementary classroom, including: tiering and scaffolding, offering choices, Differentiated Instruction Planning, Mathematics Investigation Center, Math Workshop and Guided Math.

A definition of differentiation and the need for it in mainstream classrooms

For many years in American schools, teachers used a whole group, lecture-based style of teaching (Sammons, 2010, p. 15). While many of the students in those classrooms still learned, we now know through research that we are leaving out different types of learners through that single-lens approach. George (2005) argues that differentiation is a time sensitive task and it must be done in order to secure the American public school system (p. 186). Differentiated instruction is "based on the belief that all students can learn and succeed" (Broderick, Mehta-Parekh & Reid, 2005, p. 197). It allows students the opportunity to expand a student's knowledge, wherever he/she may be in the learning process. "Teachers can help students achieve their potential as learners by providing learning and consolidation tasks that are within the student's 'zone of proximal development'" (The Literacy and Numeracy Secretariat, 2008, p. 1). Differentiation also allows teachers to meet the needs of a diverse group of students. "Effective differentiating instruction in heterogeneous classrooms is a powerful tool that enables teachers to create inclusive schools and classrooms" (Broderick et al., 2005, p. 200).

The use of differentiated instruction can also have benefits for the social-emotional development of the students within the classroom. "Differentiated thinking empowers teachers to be responsive rather than reactive to the unique and individual personalities, backgrounds, and abilities found within students" (Anderson & Bob, 2007, p. 52). George argues that one of the social benefits to learning among a diverse group of learners is that it inhibits the labels or stigma attached to high and low leveled learners. (George, 2005, p. 187). Everyone is given the opportunity to learn, regardless of ability levels. "Educators must presume, first

and foremost, that their students are competent individuals who are ready for and capable of benefitting from academic curricular content, and then must create the necessary instructional package to ensure students' access to the content" (Broderick et al., 2005, p. 199). It appears as though differentiation has become a "buzz word" in American public schools. Broderick et al. (2005) would argue that it is with good reason. "Only through building on their strengths and acknowledging their experiences can teachers engage students in appropriately challenging classroom activities" (Broderick et al., 2005, p. 196). Differentiating within the mathematics classroom has benefits for how students view themselves. "Students who are taught through differentiated methods not only learn mathematics effectively, but they also become motivated students who view themselves as successful mathematicians" (Grimes & Stevens, 2009, p. 677).

Challenges of differentiating instruction

Differentiating instruction within a heterogeneous elementary classroom is not an easy task to do. Many teachers find it difficult to simultaneously meet the needs of students who demonstrate a range of abilities (Wilkins, Wilkins, & Oliver, 2008, p. 12). "Grouping by age level is not the most effective or equitable way to divide children. Although they have birthdays within the same school year, they can be vastly different in their abilities and needs to learn" (Phillips, 2008, p. 54). With the growing demands on American teachers, there seems to be little time, energy, or support for developing successful differentiation within the classroom. Doing so would require the willingness to change what may have worked in the past (George, 2005, p. 191). "Providing for equity in the classroom- appropriate level of challenge

with the appropriate supports... can become a daunting task when we consider the wide variety of students' readiness levels for important mathematics concepts and skills taught each year" (Williams, 2008, p. 324). To truly have differentiation in one's classroom, deliberate planning must take place. "In a differentiated classroom, informed decision making involves a teacher focusing on what to teach, how best to teach it, and how to assess the students' proficiency with what was taught, while giving attention to students' varying readiness levels, interests, and learning profiles" (Moon, 2005, p. 226).

For many public school teachers, the pressure of students producing quality test scores takes priority over differentiated instruction. "Some individuals in the field of education continue to question whether differentiated instruction can withstand rigorous accountability standards and high-stakes testing" (Anderson & Bob, 2007, p. 51). When the No Child Left Behind act was put into action in 2001, many argued that it inhibited many teachers from successfully differentiating instruction.

> The pressure on elementary teachers to bring as many students up to grade level as needed to pass nationally or state-mandated standardized tests is strong. The No Child Left Behind act may have weakened the pressure to differentiate the curriculum for gifted students (Wilkins et al., 2008, p. 13).

In addition, McAllister and Plourde believe that No Child Left Behind resulted in many school having to put time, energy, and resources into the struggling learners, and left the gifted learners behind (McAllister & Plourde, 2008, p. 41). Phillips argues that "we have sacrificed the learning potential of highly motivated students,

preventing them from breaking away and advancing in selected subjects- especially math and sciences- beyond grade level expectations" (Phillips, 2008, p. 51). While there is plenty of studies that express the benefits of differentiation, it is not an easy task to take on. "Lack of time and expertise for the classroom teacher may keep them from creating challenging curriculum within their classes for those students whose true rate of learning math is often astounding" (Maggio & Sayler, 2013, p. 21). Differentiation on the teacher's part requires deliberate understandings of all types of learners.

Formative assessments to determine differentiation

Determining the need for differentiation and the appropriate instructional steps to take can be determined through formative assessments. "Formative assessment involves a multiplicity of methods that enable students to express what they are thinking and permit teachers to make judgments about student learning to focus their instruction within the students' zone of proximal development" (Heritage & Niemi, 2006, pg. 266). What is formative assessment? "Formative assessments include any activities undertaken by teachers and their students that provide information to be used as feedback to modify teaching and learning" (Aylward, 2010, p. 41). The literature shows that in order to offer efficient differentiation, the teacher must know what knowledge the students possess and what steps can be taken to instruct them to the next level of understanding.

Hertiage and Niemi (2006) make the case that in mathematics, teachers should allow students to show their understandings through visual representations. Using these visual representations, teachers will then have to assess, and determine

which steps must be take in order to offer appropriate instruction to students. This allows teachers to use formative assessments to drive instruction. "Although the overall learning goal with not necessarily change, the pathway to it, including intermediate learning goals, may be altered" (p. 272).

Phelan et. al (2011) conducted a study with 6th grade students and teachers in which a treatment group were given formative assessments throughout the year for teachers periodically check for understandings. Teachers were given access to resources and trainings to know how to differentiate and deal with misunderstandings. Results of the study showed that "students with higher scores on the pretest tended to benefit more from the intervention compared to students with lower pre-test scores" (p. 338). Students who received extensions to their learning made more growth with the use of formative assessment and differentiation than struggling or average students.

Grimes used a method of student self-assessment called *glass, bug, mud. Glass* meant that students had a strong understanding and could "see through the windshield." *Bug* meant that students had an understanding, but it wasn't clear. *Mud* referred to no understanding; the windshield was covered by dirt. Using this method, Grimes taught her fourth graders how to assess their own understanding in the areas of mathematics. After students identified their level of understanding, they were given task cards based on that understanding. Grimes saw academic improvement as well as self-motivation in the students. "Differentiated instruction not only improved test scores for all students, but it also increased students' desire

to do math, their desire to improve in math, and their confidence in their math abilities" (Grimes, 2009, p. 680).

Before teachers can determine how to differentiate instruction, they must first understand what students already know. Building on the knowledge that classroom communities are diverse, the teacher can use carefully collected pre-assessment data to better understand that academic diversity" (Moon, 2005, p. 232). Teachers can then use the data to determine what instruction needs to take place. For example, if students are beginning a math unit on place value, a teacher can administer an assessment to determine what understandings each child already has about place value. The teacher can use that information to drive instruction. If several students aren't able to identify the ones place and tens place in the number 45, the teacher will know that he/she may need to start with visual representations of tens and ones. If several students are able to identify place value in standard and expanded notation, the teacher can move that group on to adding two digit numbers together using decomposition. Formative assessment should be just that: formative. It should be used to drive instruction to the next level of understanding for every child. "In a differentiated classroom, multiple avenues are provided for students to engage with new information, make sense of it, and demonstrate their level of mastery of this new information" (Moon, 2005, p. 231).

Whole group vs. small group instruction

For both veteran and probationary teachers, the idea of managing differentiation can be a daunting task. Teachers have used traditional, whole-group instruction across the country for years. Is that traditional method of instruction

what's best for students? In an effort to differentiate instruction, teachers will often opt for a small group approach. Gibson says that teachers must be careful when beginning to take one small group instruction.

> Simply grouping students for instruction is not necessarily differentiating instruction either. Grouping itself is only a procedural change. In order to differentiate teaching, changes must occur in lesson content and selection of curricula and activities to ensure instruction and practice are aligned to students skills and needs (Gibson, 2013, p. 2).

The literature shows several teachers and researchers who have examined the benefits and struggles of both whole-group and small-group instructional practices.

Tieso (2005) conducted a study in which 31 fourth and fifth grade math students were given a pretest and assigned to different treatment groups. Within these groups, one group of students was taught through a whole group model with no supplementation. The second group was also a whole group model, however, the teacher was allowed to reteach or extend the rigor of different concepts for the whole group. The other two groups included differentiation within-class and between-class. These teachers were given strategies for how to teach students with varying levels of mathematical understandings. All groups were taught the same eight lessons on the interpretation and analysis of graphs, with varying degrees of differentiation. The results of posttest scores demonstrated that students who received revision to their lessons "demonstrated significantly higher post-test scores than comparable students in the comparison groups without adjustment for grade level differences" (Tieso, 2005, p. 77). Furthermore, students who scored the

highest on the pretest made the most gains with revisions made to the whole-group lessons. "Students who were exposed to differentiated curriculum, combined with within- and between- class ability grouping, experienced significantly higher mathematics achievement than students exposed to their regular textbook unit..." (Tieso, 2005, p. 78). According to Tieso (2005), "It is imperative for teachers to examine their current curricular or enrichment practices to assure authentic, original, and challenging learning experiences" (p. 82).

Kobelin, who taught a multi-age first and second grade classroom in Massachusetts, found challenges in trying to differentiate her math instruction for 20 students at different ages and different academic progress. After attempting to tier her instruction in whole-group lessons, she found that her struggling students were unable to work independently. She quickly realized that she wasn't serving her struggling students or her high achieving students well through this whole-group model.

> Instead of differentiating on two levels, I needed to develop a way to meet individual needs. I decided that I would try teaching one brief lesson to the whole group on material that would be new for some and review for others. Then I would allow students who were comfortable to work through problems for independent practice at their own paces. Students who were new to the material or less comfortable with the material could stay with me and would receive extra support in a group (Kobelin, 2009, p. 19).

After her initial instruction, Kobelin asks students if like would like to stay with her or go to the independent work. Students are allowed to make the choice themselves

if they are able to work independently or if they would like to have more direct instruction before taking on tasks by themselves. Kobelin has seen great progress with all learners in her classroom.

Mevarech conducted a study in 1991 in which four classrooms of third-grade classrooms, that were each learning the same mathematical content, were assigned to four treatment groups. In the first classroom, students learned and worked in small cooperative groups. In the second classroom, students learned math with feedback-correctives (formative assessments that informed the teacher of which interventions to put in place). The third classroom had both of the previous strategies combined. In the final room, students were taught through a traditional whole group method. The results of a post-test compared to pre-test scores showed the biggest discrepancy between the classroom that contained both small group learning and feedback-correctives compared with the classroom that had traditional whole-group instruction. The students who were given whole-group instruction made the least amount of mathematical gains for the period of the study. As Mevarech (1991) stated, "It is difficult, and sometimes even impossible, to implement mastery learning in highly heterogeneous classrooms because the good students have to wait too long for the poor students to attain mastery" (p. 225). Mevarech's study suggests that whole-group instruction only doesn't allow students the opportunity to grow in their mathematical understandings.

When using whole-group instruction, teachers can increase student learning by increasing the amount of active participation students have. "Holding other variables constant, those students who make many responses during a lesson learn

more than those students who make few responses" (Christle & Schuster, 2003, p. 148). Christle conducted a study within a fourth grade math classroom, looking to see the effects of response cards vs. hand raising when students answered teacher-led questions. Through the use of data collection, Christle was able to prove that "that response cards were effective in increasing fourth grade students' active participation, academic achievement, and on-task behavior during whole-class, math instruction." In this study, students were writing with dry erase markers on manila folders inside of sheet protectors. Response cards could also include the use of individual whiteboards. The information shown on response cards could be of valuable information to the teacher. "During the response card method a teacher can quickly see all of the students' responses and assess each student's performance. This enables the teacher to give frequent feedback to students, a critical element for self-evaluation of their level of understanding" (Christle & Schuster, 2003, p. 161). The use of response cards is one way that whole-group instruction can be effective.

Differentiation for gifted learners

The literature supports the notion that gifted learners must be given opportunities to extend their learning or problems can occur. "They make connections that others do not make and are capable of thinking abstractly at a younger age. They tend to be more curious and often are fascinated with the process of learning something new" (Nevitt, 2000, p. 24). Typically, gifted learners do not benefit from a one size fits all curriculum in mathematics. George believes that, when they are not challenged, gifted learners can often become uninterested in

school, believing that real learning comes from places other than the classroom. High achieving students can also become behavior concerns, as they are not given opportunities for challenge and growth. (George, 2005, p. 189). "Academically, gifted students may gain little benefit from the regular classroom unless the program has been differentiated to meet their needs" (Nevitt, 2000, p. 26). Without the proper instruction and curriculum differentiation, gifted learners are not given what they need to reach their highest potential.

There is a debate within the literature on whether a pullout method is appropriate for gifted learners. George (2005) argues "students in a pullout gifted program may suffer from a constant comparison of themselves to only the most able learners in the school" (p. 188). He goes on to say that students should be placed in heterogeneous learning environments in order to grow. "An effectively differentiated classroom offers consistent opportunities for advanced learners to extend their knowledge, thought, and skill in exactly the same way that such a class offers other students to advance from their point of entry" (George, 2005, p. 188). A strategy for differentiating instruction for gifted learners within the classroom is to modify content, process, or product for those students. This is a common practice among teachers. In this model, students have the same learning targets as their peers, but are expected to solve more involved problems with advanced strategies. Students can also demonstrate their learning in more creative ways than tests. (Nevitt, 2000, p. 25).

McAllister and Plourde (2008) disagree with George's thoughts on pulling gifted students out of their classroom to offer extension opportunities. McAllister

and Plourde describe a pullout opportunity that was given to a group of high achieving students in mathematics in which they completed a project about taking a trip to Disney World. Students took the concept of time, distance, and money to extend their learning to a real world situation. "Students are able to work on a project that meets their specific needs and learning styles, which includes inquiry-based, discovery learning approaches emphasizing open-ended problem solving with multiple solutions or multiple paths to solutions" (McAllister & Plourde, 2008, p. 46).

Maggio and Sayler describe how a school district in Texas piloted a math curriculum for gifted learners. Students were identified for the program based on standardized test scores and teacher recommendation. Students chosen for the study were pulled daily for 1 hour a day. During this hour, they received accelerated instruction in math. Four of the five fifth grade students who participated in the program not only enjoyed their time, but also were able to skip grade 6 math courses. "Students spoke openly about their excitement about the opportunity to accelerate and be challenged in mathematics" (Maggio & Sayler, 2013, p. 24). During year three of the pilot, an additional 184 students joined the program. Programs like this one allow gifted learners to accelerate their learning and reach their highest potential.

Whether through pullout or inclusion, the literature demonstrates the need for gifted learners to extend their learning through the differentiation of curriculum.

Differentiation for struggling learners

In addition to the gifted learners, struggling learners certainly benefit from the presence of differentiated instruction. Teachers must not assume that students with special needs are not capable of higher order thinking. According to Broderick, Mehta-Parekh and Reid, teachers often believe that struggling learners need teacher-driven lessons and activities. For students with attention issues, this is not the case. These teacher-driven activities have been found to teach our struggling students to be passive learners (Broderick et al., 2005, p. 198). Broderick et al. argue that struggling students should be actively involved in their education. All students need to have options for how they can demonstrate what they know and are able to do. Students should also have multiple opportunities to demonstrate their learning, not just through one project (or assessment) per unit (Broderick et al., 2005, p. 199). Lawrence-Brown adds, "if students with disabilities are to reach higher general curriculum standards, they need to learn in classrooms where they can both access the general curriculum, and reap the benefits of high expectations" (Lawrence-Brown, 2004, p. 37).

Hoover and Patton describe the four areas in which teachers of students with special needs must differentiate instruction in order for students of all abilities to experience success. These elements include: knowledge of content, flexible instructional strategies, flexible instructional settings, and management of student behaviors. (Hoover & Patton, 2004, p. 76). In addition to these elements, the teacher must have a level of competency when it comes to curriculum differentiation. "Teacher competence and flexibility increase the potential success for all students, providing the students with sufficient opportunities to meet the current demands

placed upon them in regards to the mandated standards-based curriculum" (Hoover & Patton, 2004, p. 76). Similarly, teachers of English Language Learners (ELL) with special needs also have several components to consider before differentiation can be effective. Hoover and Patton (2005) list the curricular factors that teacher much take into account as: language function, acculturation, conceptual knowledge, thinking abilities, cultural norms, and learning styles (p. 233). "Educators must differentiate curriculum and instruction to successfully meet the diverse educational needs of ELLs" (Hoover & Patton, 2005, p. 234). While the needs of *all* learners must be considered when developing differentiated instruction, the needs of struggling learners (or those with special needs) require additional attention and competency on the part of the teacher.

Types of Differentiation for the Elementary Math Classroom

The literature offered many different types of mathematical differentiation that can take place in an elementary classroom. Some of these include (but are not limited to): tiering and scaffolding, offering choice, Differentiated Instruction Planning, Mathematics Investigation Center, and Guided Math.

Tiering and Scaffolding

In her article "Tiering and Scaffolding: Two Strategies for Providing Access to Important Mathematics," Williams discussed a third grade teacher, Sally, who tiered a third grade lesson on fractions. Sally first had to think about what she wanted her students to know and be able to do. Sally identified the current understandings of her students by asking two questions, 1. Who will find this task too easy? Why? 2. Who will find this task too difficult? Why? She then she found an activity, which

would allow all students to use high-level thinking, but tiered for different levels. All students were asked to share strategies that they used in their thinking about fractions (Williams, 2008, pp. 326-327).

Williams also gives an example of Kevin, a second grade teacher who is teaching a lesson on geometry. After asking himself the same two questions Sally did, Kevin determined that the students who would struggle with creating a net might need some scaffolds. His struggling learners did the same activity, but were offered larger blocks and graph paper to assist them in the task (Williams, 2008, pp. 328-329). Williams argues, "strategies such as tiering and scaffolding allow teachers to design a variety of paths to understandings that, in turn, create a more equitable mathematics classroom" (Williams, 2008, p. 329).

Offering Choice

Bray uses a method of "choice" within her mathematics classroom. She first begins by having students recognize that their learning needs are different from each other. Bray believes that "choice can be a powerful strategy for differentiation instruction while also helping students invest more deeply in their own learning" (Bray, 2009, p. 183). She allows her students to make choices by self-differentiating problem content, solution processes, and working conditions (Bray, 2009, p. 179).

Bray will offer students different number choices when solving word problems, so that the task is the same, but the difficulty is not. Students are allowed to solve problems using a strategy that is just right from them, whether it is through direct modeling or a sophisticated counting strategy. Students in Bray's class are also given the opportunity to choice the conditions in which they work: by

themselves, with a partner, or with adults. Students are given a menu of choices and must decide for themselves which activity they will do. According to Bray, "offering opportunities for students to make instructional choices has a positive effect on students' motivation and learning" (Bray, 2009, p. 183).

Teachers in Ontario, Canada have begun to offer open, parallel tasks, which allow each learner to focus on the same learning target, but demonstrate learning at appropriate level of mathematical sophistication. "With the revised open number task, students have a choice in the numbers they use, choice in the strategies they use and a choice in how they interpret the meaning of the problem" (Secretariat, 2008, p. 5). It is believed, then, that regardless of the numbers or strategy used, all students to contribute to the learner of the larger group.

Anderson uses a similar method where students may complete a choice board, in which the end goal is the same for all students, but how they each got there is different (Anderson & Bob, 2007, p. 51). Students all complete projects that help them reach the same learning target, but do so in varying ways. Anderson believes that "differentiated products challenge students at all levels to make decisions, be responsible for their own learning, as well as affording them opportunities to demonstrate what they know through products that are representative of their unique learning preferences, interests, and strengths (Anderson & Bob, 2007, p. 51).

Differentiated Instruction Planning

Differentiated Instruction Planning begins with high quality lessons as its core base. Additional Supports are given to the students who struggle with the general lessons. This can be done through the uses of offering manipulatives, visual

aids, charts, outlines, picture cues, and audio taped instructions. Struggling students can also be given personal assistance, as long as it is the least restrictive assistance possible. Struggling students may also be offered Additional Structure, which allows the students to focus on the important main ideas of a concept in a way that is appropriate for them. A Prioritized Curriculum is made available to students with severe disabilities. (Lawrence-Brown, 2004, pp. 39-46). "Prioritized Curriculum includes material that falls within the general curriculum sphere, but also includes goals such as functional daily living skills that fall outside of it" (Lawrence-Brown, 2004, p. 49). For students who are successful in the general lessons, enrichment opportunities should also be available. This can be done through collaborative projects or independent activities that involve higher-level concepts and skills. (Lawrence-Brown, 2004, p. 46).

Mathematics Investigation Center

Wilkins, Wilkins, and Oliver (2006) suggest a Mathematics Investigation Center for the gifted learners, in which 9 activities (displayed in Susan Winebrenner's format) and manipulatives would be available as an extension to do at the teacher's discretion (p.7). Four of the activities are cross-curricular connections (science, writing, social studies, literature), four questions offer opportunities for logical thinking and problem solving skills (game, logic problem, building project, problem solving), and the last question offers a chance to collect data (Wilkins et al., 2006, p. 8). Winebrenner's format for extension activities is based on the idea that students are extend their learning from the general lessons, rather than perform unrelated challenge tasks. "Using the same mathematical theme

that the rest of the class was studying, the activities provided depth for the gifted students by shifting from a computation level to a problem solving level" (Wilkins et al., 2006, p. 9). The Mathematics Investigation Center offers students the opportunity to use different types of thinking.

Math Workshop

Heuser (2006) makes the case for the addition of math and science workshops within the elementary classroom. He states that, just like writer's workshop, students will experience success when they can independently discover mathematical concepts through choice and discovery. "The format of the math and science workshop is similar to that of the writing workshop, consisting of a mini-lesson, an activity period, and reflection" (p. 36). Workshops can be designed as teacher-led or student-led. In the student-led activity period, students are allowed to explore with concepts that are of interest to them. "During the activity period, children can follow their abilities and interests. Each period is self-differentiated inquiry session in which students choose objects that appeal to them and work at their own unique levels of development" (Heuser, 2006, p. 36). The math workshop allows students to obtain knowledge of their mathematical world through exploration.

Guided Math

Guided Math is a program that is growing in popularity among elementary classrooms. Just like Guided Reading, Guided Math allows the teacher to differentiate instruction for a diverse group of learners. According to Sammons, the first thing that must be done in beginning Guided Math is to create a classroom

environment of numeracy. "The creation of a community of learners is inherent within a classroom supporting the learning of mathematics" (Sammons, 2010, p. 19). Students participate in math warm-ups in the morning, which may include calendar board activities. Lessons may begin as a whole group (or a math huddle) and move into small group activities. "Guided Math instruction is a method of teaching in which teachers assess their students formally or informally, and then group them according to their proficiencies at a given skill" (Sammons, 2010, p. 21). While small groups are meeting with the teacher, the other students are engaged in meaningful mathematical work through the Math Workshop (p. 21). Teachers determine appropriate differentiation through assessments. "Formative and summative assessments... all give valuable perspectives on [student] capabilities and needs" (Sammons, 2010, p. 24). Guided Math offers an additional option for effective mathematical differentiation in the elementary classroom.

The literature has provided many different supports for the use of differentiated instruction as well as some challenges that can be face when one attempts to take on differentiation. The literature offers information on the effects that differentiation can have on different types of learners, including both struggling and gifted learners. Finally, the literature provides examples of how differentiation could be used to teach mathematics in an elementary classroom.

Chapter 3

Research Methodology

In order to gain the perspectives of experienced teachers on the topic of differentiation in the math classroom, I interviewed five different teachers at the elementary school in which I teach.

Participants

In order to protect the identity of my participants, I have used pseudonyms.

Joy

Joy is a kindergarten teacher. She has 8 years experience as a classroom teacher and 6 year experience as a Special Education Teacher. She is a 36-year-old white female with a master's +60 education.

Beth

Beth is a fellow first grade teacher. She has been teaching in the classroom for 22 years. Prior to being a first grade teacher, she spent several years as a third grade math teacher. She also has a year of experience as a preschool teacher. She is a 43-year-old white female with a master's +60 education.

Ben

Ben is a second grade teacher who has 5 years experience in the classroom. Prior to that, he spent 6 years in the before/after school program within our district. He is a 27-year-old white male with a master's degree.

John

John is a third grade teacher with 10 years experience in the classroom and 2 years experience as a Sunday School Teacher. He is a 32-year-old white male with a master's degree in Curriculum & Integration.

Mary

Mary is a fourth/fifth grade math, science, and engineering teacher. Prior to this year, she taught only 5th grade math. She has the unique job of teaching two different grade levels this year, which have all new math, science, and engineering curriculum. She has 9 years experience as a classroom teacher. Prior to that, she spent 6 years as a Special Education and ESL Para. She is a 53-year-old white female with a master's +60 education.

Williams Elementary (a pseudonym for the school I work at) is a K-5 STEM (Science, Technology, Engineering, Mathematics) magnet school located just north of Minneapolis. Our specialty is science, mathematics, and children's engineering. Along with having a STEM focus, we are also a part of an Integration District, allowing students from seven other surrounding districts to open enroll into our school. Approximately 40% of our families are on free or reduced lunch. As a result, we offer all day, every day kindergarten for no cost to families. We have a culturally diverse group of students, with 44% of students being white. In 2012, Williams was recognized by the Minnesota Department of Education as a Reward School for its work on proficiency, growth and reducing the achievement gap (Department of Ed). There has been a significant push by the district for each building to create and maintain effective Professional Learning Communities (PLCs). Grade level teams are expected to pace instruction and collaborate on a consistent basis.

Being a STEM magnet school, we have access to a plethora of technology to assist in our instruction. Each classroom houses a Promethean Board, an iPad and a desktop computer for the teacher. There are approximately three student computers in each classroom. We also teach with a voice enhancement system, allowing us to wear microphones around our neck and have our voice evenly distributed within the four corners of the classroom. We have two computer labs, a laptop cart, and an iPad cart, which are all available for student learning.

Materials

My research involved interviewing five teachers at Williams Elementary. These teachers represent the following grades: Kindergarten, 1st, 2nd, 3rd, and 4th/5th. We use the district approved math resource of Everyday Mathematics, a product of McGraw-Hill Education. Each grade level in the district has a UbD (Understanding by Design) document for every unit in Everyday Mathematics, which was written by selected teachers from schools within the district. The district approved UbDs are considered our curriculum. Within a UbD, there are three stages. Stage one considers what students need to know and be able to do. This is where state standards in mathematics are written and described. Stage two shows ways that we can assess student learning throughout the unit, considering both formative and summative assessments. Stage three offers a menu of choices for *how* teachers may deliver instruction. We are given freedom to deliver mathematical instruction in a way that we see fit, given that we are moving students towards the required learning targets.

Procedures

My action research took place over a two-month period. Along with exploring ways of differentiating instruction within my own classroom, I used the qualitative data collection method of one-on-one interviews with five teachers from my building. Teachers were chosen based on the presence of differentiation within their math classrooms. During the month of January, I asked each teacher in person if they would be willing to participate in my action research. All of these interviews took place between the dates of January 16 to January 31, either before or after the school day. Each interview lasted approximately 20-30 minutes and took place in a classroom within our school. Interviews were scheduled ahead of time and each teacher was given a copy of my interview questions, so that he/she could know what to expect. Interview questions were as follows:

1. How do you differentiate instruction in your math classroom (what does it look like)?
2. What does planning for your math lessons entail?
3. How does your differentiation assist you in responding to PLC questions 3 & 4? (Question 3: What do we do for students who don't meet learning targets? Question 4: What do we do for students who already know it?)
4. Do you feel that your math instruction is effectively reaching all of your students? Why or why not?
5. How can you prove that students in your math classroom are reaching the required learning targets?
6. What advice would you give a first year teacher regarding the use of differentiation in the classroom?

I audio recorded each interview, using Audacity on my Mac Laptop. While the interviews were taking place, I also took anecdotal notes of the answers each teacher gave. After the interviews were completed, the audio recordings were exported to mp3 files. I then listened to each interview and transcribed the dialogue, word-for-word in a Word document.

Analysis

Once I transcribed all of the interviews, I was able to organize and analyze the data. I carefully read each transcription, looking for any emerging themes. "This in-depth, intimate knowledge and examination of the data allows teacher researchers to categorize themes and ideas that will contribute to their understanding of the phenomenon under investigation" (Mills, 2011, p. 131). As I read each interview, I kept a list going in a writing notebook of any themes that I recognized as being important. I continued to add to these notes as I read each interview. According to Glaser and Straus (1967), "In discovering theory, one generates conceptual categories or their properties from evidence; then the evidence from which the category emerged is used to illustrate the concept" (p. 23). After reading the transcriptions of my interviews several times, I organized the different themes that I had identified in my notebook and placed a "star" near the one that had become reoccurring themes. Using this qualitative method of data collection allowed me to recognize themes within the differentiation perspectives of these five teachers and develop my theory. I used that information to draw conclusions as to how I can most effectively differentiate instruction within my own math classroom.

Chapter 4

Findings

Throughout my action research, I have been asking the following question: How can I effectively differentiate instruction in my first grade classroom? The data collected from my teacher interviews shed some light on possible answers. While teachers experience struggles in trying to effectively differentiate instruction, four major themes emerged from the interview transcriptions. This chapter will examine those themes. The first theme focuses on the use of formative assessment to drive differentiation. The second theme was the use of a combination of whole group and small group instruction. The third theme involves the steps taken to remediate instruction and keep struggling learners in the curriculum. Finally, the fourth theme demonstrated the possible mathematical extensions for gifted learners.

All of the teachers whom were interviewed claimed to do some type of mathematical differentiation within their classroom. Several of them found difficulty in trying to manage the differentiation within the whole group. As Joy said, "It's not as easy as it looks to do... to keep all those balls in the air juggling." Beth expressed a similar frustration in helping her struggling students keep current in the curriculum. "I feel like there's a rope and my struggling students, I'm always pulling them along in this particular curriculum... I feel like they are a hamster on a wheel, those wheels are always turning and I'm trying to get them where they need to be." Mary's frustration comes from a lack of planning time. "I don't feel like I'm meeting the needs of all my students this year. I feel like I am being stretched too thin and

I'm being asked to plan and take on and prep for an unreasonable amount of things." While many classroom teachers are feeling the frustration of trying to meet student needs within a diverse group of learners, some type of differentiation is happening in the classrooms of those I interviewed.

The use of formative assessments to group students

The data show how formative assessments can be used to group students and determine the need for differentiation. The district that these teachers work for provides diagnostic and summative assessments for each math unit. The diagnostic assessment requires students to demonstrate their understandings of the learning targets for the upcoming unit. For example, if the learning target is: "Students will tell time to the hour and half hour", the diagnostic will provide students an opportunity to demonstrate their understandings of reading times. The diagnostic assessments mirror the tasks found on the summative assessments, but the teachers use the information from the diagnostic assessment to *drive instruction* rather than simply to determine student learning. Ben describes how grade 2 uses those diagnostic assessments.

> We structure our math time so that we work with differentiated groups the unit. We put the students into three groups and we see each of those three groups every day. One is a lower group of students who need extra support to meet the learning objectives of the unit. The middle group of students is the group that just needs more practice with the objectives until they can be considered mastered. And the higher group is a group of kids that

have already met the goals before the unit begins so that we can spend time with them extending their learning in other areas.

In 4th and 5th grade, Mary is using her diagnostic assessments to pull out the gifted learners and allow them opportunities for extension. "If a student passed my diagnostic with 95% or higher, I immediately give them the end of the unit test the next day. Without any of the instruction in that unit they are taking the test." Mary then explains what she does to extend the learning of her students who already know the content before the lessons have been taught.

> If they pass that with 95% or higher, I have a set of middle school algebra books that are self paced, self guided. I set them up with an algebra notebook. The students sit at the back table. There's usually 3-5, it's usually different every single math unit. It's possible that the same student sits at the back table the whole year or it's possible that a student be at the back table once in the entire year. It changes with every unit because I do this with every single unit.

John uses different types of formative assessments throughout a unit to group students. He scores students at a 3-2-1 for their ability to demonstrate understanding through Math Boxes.

> Something that I like that we've done this year is we take the standards, break them into targets and I'm constantly giving kids a score of a 3- they've got the skill, 2- they kind of have the skill, 1- they need help with the skill. Probably, throughout a unit, 10-12 times and then based on those skills I can pull groups while we're doing kind of like a guided math instruction almost.

Joy teaches kindergarten and, as a result, her curriculum resources look different than the rest of the grades. Kindergarten data is based on the Concepts of Math assessment and AVMR (Advantage Math Recovery) assessment data. Joy feels that having access to data allows her to meet student needs. "I feel like I've been using data more and more every year, especially since I've been here... really collecting a lot of data. I know exactly where the kids are. Then, pulling little groups and working accordingly on that... has been huge." Prior to giving students differentiated instruction, these teachers are administering formative assessment to determine student needs, to groups students accordingly, and to drive future instruction.

Using a combination of whole-group and small-group instruction

Each of the teacher interviewed described their math instruction as a combination of both whole-group and small-group instruction. Ben uses small groups to scaffold, provide additional practice and/or extend the lesson for students. He begins his lessons by introducing the mathematical concepts to the whole group. He then breaks the students into three groups: struggling, on grade level, and high achieving. Ben described the importance of grouping students instead of using a whole-group only approach in his room.

> In the past, when you teach a whole group lesson, you know that you're missing the kids who are addressed in question 3, the lower kids who need more support. They are missing the lesson and the kids from question 4 are missing the lesson because you are teaching to just the middle kids who are at grade level. So this structure has given us time to work with kids on scaffolds and time to work with kids on extensions where we never really

had it before so it makes for a more purposeful use of time rather than keeping the whole group together and trying to get the same this accomplished.

When asked if he felt that he was effectively reaching all of his students with this structure, Ben answered:

> I would say that it is more effectively reaching all students compared to the way we did it in the past. With whole group instruction, there just wasn't- you could just tell that it wasn't effective in the assessment data that you collected. The same kids were always were always doing well and the same kids were always not and then the same group of kids was always bored so um, this way, I can respond even in the moment better than I could before because it's a smaller group of kids I'm working with so if I notice that its something that's boring to the high group, I can instantly add some rigor to it to make it more purposeful for them and if I'm working with the lower group that needs more scaffold and, in the moment, I see that they are really struggling, I can make that change right there. Where as, if I'm teaching the whole group all at once, you can't do that simultaneously- it doesn't work. So it's definitely more effective than it was.

John's sentiments mirror that of Ben's. When John was asked if he felt his instruction was effectively reaching all of his students, he responded:

> Much more so now than when I first started teaching where it's 'everyone sit down, I'm going to talk from the front of the room and we're going to do that for 50 minutes.' So, even though I'm talking to the whole group for a shorter

amount of time, I feel like I'm getting everybody acclimated at their level better.

Similarly, Beth teaches first grade lessons as a whole group, then breaks students into ability groups on station days and differentiates as needed.

I teach the lesson whole group and then I differentiate as needed, especially on station days. Station days have about once a week. That's where I find most of my differentiation taking place. For example, when we did the base 10 blocks, I put the kids into- I guess what you'd call, ability grouping. I took my high flyers, so to speak, and they were doing much more advanced things than the kids that were struggling. For example, some of the kids were just making 13- one ten and three ones. I wanted them to show me that- those were my struggling learners. But my high flyers were adding and subtracting using those base 10 blocks and bringing in hundreds numbers. So, I differentiate especially during stations days right now.

Joy is flexible is the decisions she makes regarding whole group versus small group instruction. She reviews her lessons ahead of time and makes decision based on the material and on the students in her room.

Some of the activities I know right away 'this is not going to work whole group. I'm going to have three groups and we're going to rotate around. I'm going to be at this center.' Sometimes I do that. Some of the activities are where they are just exploring and doing individually, something I can just put at math workshop and they can play with, explore, experiment on their own. Then, some of them work better whole group. I just kind of go through and

> decide how best it's going to work with the kids I have. Obviously, it all depends on your class and where they're at and behaviors.

Joy reported that this year, she isn't able to give the students as much independent time because of their behaviors. Regarding her differentiation, Joy said, "It changes every single day... and every year."

In the intermediate grades, small groups are being pulled while students are working independently. In third grade, John takes formative assessments and

> based on those skills I can pull groups while we're doing kind of like a guided math instruction almost. So I'll teach a lesson for 10 minutes and then we have math groups, somewhat like a Daily 5 so some kids are working on reading math books, some kids are doing tangram puzzles, some kids are working on math games, and then while that's going on, I'm pulling a group of kids that needs help or I'm working with a group of kids that is already getting it and pushing them a little farther.

John begins every lesson by teaching whole group, but then determines if the whole-group lesson should be sustained or if students should break into independent/group activities.

> I'll teach whatever the math lesson is for 10-15 minutes and it doesn't always work out like this every day. Some lessons, for some reason, it just feels like its got to be whole group and you've got to go step by step and maybe that 's just me needing to release a little bit, but we'll start with the 10 minutes and then we'll get into the group session and kids are pretty good about making choices.

In 4th/5th grade, Mary is running her math lesson similarly. After correctly Math Boxes, a component of the Everyday Math resource, Mary uses that information to create small groups.

> I have a list of three or four students who are still consistently missing those problems. Those are the kids who, after I finish the initial instruction, I do math groups- "guided math" I guess they're called- but I have done small math groups for five or six years now where I do set it up like guided reading many years ago. I grab those kids, maybe I have three kids on place value for five minutes and then I send them back and maybe pull over four kids on multiplication facts or whatever. It's really effective. It sounds like five minutes isn't much, but when you really sit with a student one-on-one for five minutes, you can really see what their thinking is; you can really help some of those situations.

Like the other teachers, Mary's math groups consist of student of all ability levels. "I pull middle kids and high kids too so it's not the same five kids coming to me. Those five kids are coming to me more often but in the mix of things, they're not the only ones sitting alone with me at a table." Mary said that the need of her students "shows itself through their Math Boxes and assessments. It's like, it's finding those holes and trying to fill them and those holes are different for every group."

Regardless of the grade level taught, all five of the teachers I interviewed used a combination of whole-group and small-group instruction to meet the needs of *all* of their learners, regardless of the students' ability levels.

Providing remediation and intervention for struggling learners

When I think of differentiating instruction, I immediately think of meeting the needs of struggling learners. In my own classroom, these are the students who struggle through whole-group lessons. They may have some holes in their learning and need appropriate remediation or they may have misunderstandings about the current concepts that I am teaching and need intervention. Each of the teachers interviewed provide some type of remediation or intervention for their struggling learners.

Beth described how the Everyday Math curriculum resource addresses the need of struggling learners and how she can respond.

> I feel like I'm always... I feel like there's a rope and my struggling students I'm always pulling them along in this particular curriculum. Yet, we're expecting more out of them than we ever have before. So, I do feel like I'm constantly pulling those kids along. Those struggling students are higher than they've ever been even though I've always... I don't know. I feel like they are a hamster on a wheel, those wheels are always turning and I'm trying to get them where they need to be. That's kind of the way I feel most days too.

In 4th/5th grades, Mary identifies the holes of her struggling learners through correcting Math Boxes, a component of repeated practice in the Everyday Math resource.

> What I do for my struggling students, I pretty much intensively correct math boxes- probably more than I need to but toward the end of the year, it's specific students who I really dive into them with because that's where I find

their holes. The math boxes are wonderful because they have the previously learned materials, they have the current materials, and they have some future things in them and I'm able to go back and say, 'wow, this- we are half way through the year- and they are still not getting place value,' which they should have had even in fourth grade. So as I correct math boxes, I make my small group math lists. I have a list of three or four students who are still consistently missing those problems. Those are the kids who, after I finish the initial instruction, I do math groups.

In 3rd grade, John is also pulling small groups of students who need intervention and providing additional instruction. "I won't meet with a group for more than 10 minutes, but I'm able to help kids that are struggling with a concept."

Ben, who structures his lessons with three groups working at stations, makes sure to see his struggling learners first. This allows him to set them up for the independent work.

We structure it so that we can see the lowest group first because when we're not seeing a group they are working on independent seat work or a math game. So if we don't see the lower group first, they are not going to be ready to do the seatwork independently, so we see them first.

Having changed the way that he delivers instruction, Ben has seen academic gains on summative assessments with his struggling learners. This has justified the differentiation that is taking place in his second grade classroom.

I've seen the biggest difference in the lowest group of students and that's because, well, I *think* that's because they're more well prepared to use the

vocabulary, to do the skills where before they could sit back and let everybody else do it for them in the whole group. When they're in a group where they are the only ones to do it, they're more involved and when it comes to the assessment they're better equipped to show what they know and they are doing a better job of it.

Joy described how she differentiates for struggling learners within her own classroom and how the kindergarten team uses GEARS time to meet the needs of all learners. (OC: At this school, GEARS stands for Getting Excellent Academic Results for all Students. It is thirty minutes of time given to each grade level to provide intervention, remediation, and extensions to all learners. Each grade level has supplemental staff push in during this time. There can be up to nine licensed teachers providing support to students during this intervention block).

So, students that didn't learn, I'm pulling small groups and working on those specific skills, either during math workshop time or GEARS. GEARS in kindergarten has been a beloved time. We really cherish it. I'm not the only teacher, the kids cherish it and we really think that it has been effective. Our scores, especially in the area of math, the growth from fall to spring last year was the best in the entire district. Out of 25 schools or whatever. So something we're doing is working and that is super exciting.

Each of the teachers interviewed described the success that was taking place because they were meeting the needs of struggling learners within a small group setting.

Providing enrichment for high achieving students

All of the teachers interviewed made a distinction between the remediation and intervention provided to students and the extensions that we provided to high achieving students. Ben commented on the need to start extending the learning of his high achieving learners based on what wasn't working in the whole-group model he previously used.

> The same kids were always were always doing well and the same kids were always not and then the same group of kids was always bored so um, this way, I can respond even in the moment better than I could before because it's a smaller group of kids I'm working with so if I notice that its something that's boring to the high group, I can instantly add some rigor to it to make it more purposeful for them.

Beth had a similar sentiment to how differentiation can benefit the high achieving students.

> ...with the high achieving students, they can easily be bored and I'm challenging them. So they are more excited about learning, for sure, when I differentiate the instruction. I'm pushing them, so it's not always easy for them.

Beth explained how she might quickly differentiate problems for students that need an extension to their learning.

> One of the things that I've done, other than station day, when my kids are working on math boxes, those kids that are really strong, I'll add an additional problem or two to enhance their learning. If they are just doing

> fact problems with 9+6 then I'll give them 29+38 to see if they can add two digit numbers.

When asked what he does to challenge his high achievers, John responded, "For the ones that are already getting it, I supplement a little bit with- the district created some unit resources. Then, I'll pull those groups and we can change numbers and make it more digits and place values and stuff like that."

Joy finds ease in differentiated instruction for her high achieving learners.

> I'm not just looking at who can't do something; I'm also looking at who can do this and how strong are they. I think because there isn't that- so much of what we're doing in math in kindergarten is hands on and it's verbal. There isn't a strong written component, so it's pretty easy to challenge those kids that need to be challenged with bigger numbers or harder questions.

To extend the learning of her high achieving students in 4th/5th grade, Mary has students who have met the learning targets of a unit prior to the teaching of that unit sit at a back table and work in a middle school algebra book. She has seen this as a great opportunity for students who don't qualify for Talented Development to have the chance to challenge themselves.

> There is also students who have never had access to extended math who are constantly at the back table. ... it's been a really rich adventure and it gets a little better every year. Their notebooks are amazing and they're able to take those with them to middle school... it's been a really good experience for those higher kids.

Despite the increase in classroom noise, Mary describes the justification in having students work at a table within the classroom, instead of working out of the room.

> These high flyers are usually able to connect to both things, so quite often their hands are up in the back of the room. They are still part of the conversation. They are still getting what's going on in the classroom, but they're not bored with 'oh, we're doing it for the tenth time now...'

In kindergarten, teachers are ensuring that not all of their time is spent on providing interventions for struggling students. Students who have met district benchmarks are being moved beyond those expectations to the next level. As Joy said:

> We feel as a grade level some of those benchmarks are low so we're really pushing those kids. During GEARS, even though it's an intervention time, it's not just for those low kids. We will run a high math group; we will run some science experiment groups. We're trying hard to look at everybody and not just the low kids that always get all of my time, and all of my attention. It's really not fair.

When asked what she does for those high achieving students, Joy responded:

> Some of those benchmarks are low and I know that so I'm extending that. If we can count to 100, we just up that ante. If we, for instance, there is really nowhere they are tested on skip counting, but all of us teachers have agreed that we're going to count by 2s, by 5s, by 10s by the end of kindergarten. We just know that's going to help them in the long run but nowhere is that written or expected.

All of the teachers I interviewed have found productive ways to not only differentiate for struggling learners, but also to offer enrichment to their high achieving learners. Being a STEM specialty school, it was clear to me that students within each grade level are receiving extensions in their mathematical understandings, wherever they may be in the process.

The four themes that emerged from the data and were discussed in this chapter included: using formative assessments to identify where differentiation was needed, providing a combination of whole-group and small-group instruction, providing remediation/intervention for the struggling learners, and providing extensions for high achieving students. This can all be a daunting task for new teachers to take on. As John stated, "I think that makes it easier when you're not the only one that wants to jump on board." Several teachers commented on the benefits of collaborating with a team to make the work more reasonable. Beth suggested that teachers observe others who have made differentiation work in their classrooms. Ben commented that once the structure for his differentiated lessons was put it place, "it is really as easy as it was to plan a whole group lesson in the past." The five teachers that I interviewed have proven to me that differentiation is possible in an elementary classroom and beneficial for *all* learners.

Chapter 5

Discussions

Overview of the Study

The purpose of this study was to identify effective strategies for differentiating math instruction in an elementary classroom. In order to obtain data, I personally interviewed five different elementary teachers from my building on the use of differentiation in their math classrooms. These teachers represented grades K, 1, 2, 3 and 4/5.

Summary of Findings

The data collected from teacher interviews provided four general themes of differentiation. These themes included: using formative assessment to determine the needs for differentiation, using a combination of whole-group and small-group instruction, providing remediation/intervention for struggling learners, and providing enrichment opportunities for high achieving students.

Conclusions

The results of this data prove that differentiation is possible and beneficial for all learners. Of the five teachers who were interviewed, each one represented a different grade level. Whether it was a kindergarten or fifth grade teacher, all of these teachers were providing math differentiation within their classroom. Several of the teachers interviewed came to a point in their teaching career where they felt frustrated with the lack of academic success of students who were being taught through a whole-group instruction strategy. Once they became comfortable with their understandings of how the curriculum supported required students learning

targets, they each made a change in the way they delivered instruction and began to offer differentiated instruction for all learners.

The differentiations in these classrooms were taking place through small-group instruction based on formative assessments. If elementary teachers are willing to take on the task of differentiating instruction, they can do so by determining student needs through diagnostic and formative assessments. Teachers may have to be flexible in the way that they deliver instruction. The teachers interviewed found value is using a combination of whole group and small group instruction. Teachers must also consider how they can differentiate for *all* learners, not just the struggling students. The goal of differentiation should be to extend the learning of all students, wherever they are in their mathematical understandings.

Recommendations

The results of my action research have provided an action plan for me within my own classroom. I currently have 23 first graders in my classroom. These students demonstrate a wide range of abilities. I have three students who can add double-digit numbers and solve algebraic equations. I also have three students who cannot consistently identify the number "13." I have a group of six students who speak English as a second language. I also have four students identified with special needs. My frustrations with not meeting the needs of my diverse group of learners through my whole-group instruction do not need to exist any longer.

Taking the advice of my colleagues, I have begun to use the information provided by the unit diagnostic assessments to determine where differentiation needs to take place with my students. I map out the unit and determine how small

groups could be created so that I can provide interventions or extensions within a small group of 6-8 students at a time. I know that I need to improve on the use of formative assessments within each unit to determine the growing needs of my learners. This is a goal of mine as a look towards the future in my classroom.

I have begun to change the way in which I deliver instruction. Several days a week, I begin my lesson with a whole group "warm up." This allows students with different mathematical understandings to share ideas with each other and, ultimately, learn mathematical strategies from their peers. I then break the students into three groups: students who need intense remediation/intervention, students who are where the curriculum expects them to be, and students who have already met the required learning targets prior to the teaching of the lessons.

When I use this method of small group instruction, I always see my struggling students first, so that I can set them up for success in the independent activities. I then see my "middle" group and extend their knowledge. Finally, I end with my high achieving group where I can offer age-appropriate challenges and extensions. When students are not with me, they are working on seatwork (often Math Boxes or pages in their math journal) or playing an Everyday Math game.

Through my interviews, I was reminded of the importance of seeing all students every day. My struggling learners need my time, but so do all of my students. My action research has energized me to differentiate instruction and push each of my students to the point of their highest mathematical potential. I know that I still have learning to do and my instruction will improve throughout the years, but my research has offered a starting point. My passion for providing appropriate and

differentiated instruction for all learners has been realized and put into action. My hope is that my research can inspire other classroom teachers to do the same.

Limitations of the Study

The teachers that who were interviewed were hand chosen by myself as teachers who differentiate instruction within their classroom. I determined that through personal conversations that I have had with each teacher and through the recommendation of my instructional coach. I did not consider asking teachers who have current hesitations regarding differentiation. Those who were interviewed find differentiation to be a priority within their classrooms. This may have led to an assumption that math differentiation is happening in every classroom within my school. This is not the case. Every teacher is at a different place in how they feel they can most effectively instruct students. I, however, wanted a representation of teachers who support differentiation.

My first interview took place after school on January 16. I had a set of questions ready to go and was a little nervous about getting the data I was looking for. As I was interviewing the first teacher, I was thinking of additional questions that would be pertinent to my research. After the first interview, I changed/added questions that allowed me to collect more data.

This study took place as a STEM magnet school in a suburb located just north of Minneapolis. The population of students is diverse with approximately 25% of the students speaking English as a second language and 40% of students being on free and reduced lunch. There is a certainly a diverse group of learners within this school, which may not be representative of other schools in the district, or other

schools in the state of Minnesota. The experiences of differentiation may be different in schools whose populations are not made of such a diverse group of learners. It would be interesting to understand the teacher perspectives of mathematical differentiation among teachers in more affluent areas, as well as those in truly urban communities.

My research focused on the teacher perspectives of differentiation. What about the student perspectives? How does differentiation affect their learning experience? Do they feel more or less successful in small-group instruction as opposed to whole group? How does it affect their self-esteem and self-efficacy in the area of mathematics?

Once I have "mastered" differentiation in my mathematics classroom, the next areas to look at are how effective differentiation can take place in my writing and science lessons. Like most teachers, I am always asking questions and striving to meet my students' needs with the most efficiency as possible.

Chapter 6

Self-Reflection

When I was asked to choose a topic for my action research thesis, I knew exactly where I wanted to go with my research. For the past three years, I have been a classroom teacher of mainstream classrooms. I spent two years teaching math as whole group lessons, even though I knew (through summative assessments) that not all of my students were meeting the required learning targets. This has been a growing frustration for me. I knew that I was not meeting the learning needs of all my students. For the past few years, I've been trying to think of ways in which I could begin to differentiate the math instruction in my classroom; but I've never known where to start.

Through my research I was able to ask (and answer) a question that has been in my mind for years: how can I effectively differentiate math instruction in my first grade classroom? I chose to collect data by interviewing five of my colleagues. This allowed me to sit down with my mentors and discuss how differentiation is happening in their classrooms. The conversations that I had with my colleagues were rich and informative. It was truly a gift as a 3rd year teacher to gain the insights of my more experienced colleagues.

This action research also allowed me to dive deep into current literature regarding differentiation. Through published articles and books, I was able to identify the global need for differentiation as well as discover instructional strategies for differentiating math instruction.

Taking all that I have learned through my research, I have been able to put an action plan into place. My own first graders have been able to benefit from the presence of effective differentiation in our classroom. I have organized students into flexible groups each unit, determined by their performance on a diagnostic assessment. I am then able to teach the core of each day's lesson in small groups and focus in the needs of each of my student groups. In the three months in which I have begun to differentiate math instruction in my classroom, I have already seen great progress with my first graders. My struggling learners are experiencing success and less frustration, my high achieving learners are enjoying their daily challenges and my students on grade level are being pushed further than they ever were before. As one first grader told me this year, "Mrs. Hoff, math is so much more fun now!" In addition, I enjoy teaching mathematics more now than ever before. I feel like I'm making a difference for *all* of my students, regardless of their academic abilities.

It is my belief that all students deserve to have a quality education that challenges their thinking on a daily basis. By choosing differentiation, a topic close to my heart, I feel that I have been able to make an impact through my research. I have shared my findings with colleagues and assisted them in adapting their instruction. My own students have benefited through my research. As an educator, my hope is that other teachers will recognize the need for differentiation in their math classrooms and learn from the research and experiences that I have been through in this journey that is my action research.

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