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The Impact of Differentiated Instruction on Student Accomplishment Through Mathematics Stations

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THE IMPACT OF DIFFERENTIATED INSTRUCTION ON STUDENT ACCOMPLISHMENT THROUGH MATHEMATICS STATIONS

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DEDICATION

This dissertation is dedicated to my family, friends, and colleagues who have stood by my side for these last three tumultuous years while I have pursued my doctorate degree. You picked me up when I was down, listened to me cry and voice my doubts, helped with picking up the pieces I dropped, and never let me stop in this adventure.

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ABSTRACT

The aim of this action research study is to determine how differentiated mathematics stations effect student learning. The research question that guided this study is as follows: How does the implementation of differentiated instruction using math stations impact individual student learning progression on the Student Learning Objective (SLO) posttest, unit pretests and posttests, and end of the year state assessment?

The research question is answered through an action research study where students completed mathematics stations designed to meet the individual needs of each student. Research theorists, instructional strategies, and policies effecting education support the focus of this study on differentiated instruction. Research focused on educational theorists also provided background information on how students learn, thus aiding in the development of materials used in the mathematics stations.

The methodology of this action research study focused on differentiated instruction over a traditional whole group instructional model. Lessons and materials were designed and organized to provide instruction to fill gaps, to deliver grade-level instruction, and offer additional practice for students who had previously shown mastery of the skill. The researcher was involved in the daily instructional progress, allowing modifications to be made immediately when necessary.

The overall achievement of the students who participated in the action research study portrayed growth in mastery of mathematic skills.

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LIST OF ABBREVIATIONS

Differentiated Instruction.....DI

English Language Learners.....ELL

Elementary and Secondary Education Act.....ESEA

English as a Second Language.....ESOL

Family Educational Rights and Privacy Act.....FERPA

Gifted and Talented.....GT

Inquiry Based Learning.....IBL

Individuals with Disabilities Act.....IDEA

Individualized Education Plan.....IEP

Normal Curve Equivalent.....NCE

No Child Left Behind.....NCLB

Professional Learning Communities.....PLCs

Research Question.....RQ

Response to Intervention.....RTI

South Carolina Department of Education.....SCDE

Student Learning Objectives.....SLO

Scholastic Math Inventory.....SMI

Science Technology Engineering and Math.....STEM

CHAPTER 1: INTRODUCTION

Everyone worked hard to make sure that I was engaged.
I mean, they knew I was different,
DIFFERENT, BUT NOT LESS
I knew I had a gift
I could see the world in a NEW way.
~Temple Grandin

INTRODUCTION

The impact of high-stakes testing on education finds teachers losing the ability to teach in a manner that allows for creativity and individuality. On one hand, teachers hear they must meet the needs of the individual student, but on the other hand, students must master test-taking skills and be able to show mastery of grade-level skills. Additionally, we must teach a plethora of standards and are strongly encouraged to assist students to help improve scoring on standardized tests (Reich & Bally, 2010). Standardized testing often has a negative connotation with students, teachers, administrators, and the overall education community which has led to teachers teaching to the test, giving explicit instructions on how to answer different types of questions, and narrowing the curriculum being covered instead of encouraging students to think critically (Gorlewski, 2012, p. 225).

The teachers who use data, observations, and analysis of student work to help drive instruction are the ones in the best place to make decisions pertaining to the instruction that would best meet individual student needs. Some may say to follow the textbook for instruction, but textbooks offer one method of instruction at one level of instruction. A textbook cannot take the place of an educated teacher who has a surplus of strategies, skills,

activities, and resources available to create an appropriate method of instruction that would best meet the individual needs of all students.

The goal of action research is to improve instruction, meet the needs of all students, and implement instructional strategies, which will influence the learning goals. Implementing new instructional strategies is just the beginning for the researcher as action research occurs in a learning cycle of planning, implementing, observing, and reflecting (Aas, 2014). The cycle creates new and evolving educational practices, which are continually monitored and adjusted in order to promote success.

The final step in the action research process, reflection, is a vital step. This is where the researcher focuses on the learning road traveled, mastered skills, and leads to new roads to travel. Mertler (2014) states, "researchers should not only reflect on expected outcomes, but also unexpected outcomes, as well as, the methodology used in the study" (p. 220). Reflecting on both the expected and unexpected can lead to a new perspective for future teaching and action research. Thinking about the next cycle of research allows the researcher to reflect on whether the outcomes answered the desired questions, plan for different implementation methods, as well as, revise the overall goal of the action research study (Mertler, 2014, p. 215).

With the goal of action research being the improvement of education, or a specific educational issue, the researcher's analysis of the study should include new learning and may include questions formed because of the study. Knowing that nothing is perfect, approaching the reflection process with an open mind is important. Questioning the methodologies to determine if the implementation of best strategies for the study occurred. Are there different sources, which would better support the research? Was the collected

data the best option for the study? Mertler (2014) suggests the answers to these questions can help to improve the action research study.

Using the four-step action research cycle, this action research study focuses on individual student gains in mathematics based on the implementation of differentiated instruction designed to motivate and encourage students to reach their full potential. The Chinese proverb, "Tell me and I forget, show me and I remember, involve me and I understand," encompasses the mindset for this research study (Unzip, 2016).

My action research project began as I reflected on the progress students were making towards their math goals for my SLO teacher evaluation. Using multiple data points and both formal and informal evaluations allows for daily reflection-in-action for me, the teacher, to make immediate adjustments in my delivery making instruction more significant (Giaimo-Ballard & Hyatt, 2012). Flexible differentiated groups evolve, as new standards become part of the daily lesson. This provides students the opportunity to work in groups with multiple students, work at various paces, and reach their highest potential on all levels. Reflecting on the data to show the effects of differentiated instruction then sharing with colleagues can encourage others to assist their students in reaching their true potential. Since the data is gathered and shared by a colleague, the resistance to change will optimistically be less, compared to a mandate handed down through education channels (Webb and Scoular, 2011).

Implementing the action research study requires students to be included in the decisions and conversations about their learning and insure it aligns with the constructionist theory. In *Reflection-in-Action: Teaching Strategies Used by Faculty to Enhance Teaching and Learning* by Giaimo-Ballard and Hyatt (2012), they quote Dewey about using

reflection as a way to include students in their learning because "it enables us to know what we are about when we act," (p. 1). Having conversations with each student during their learning, about their learning, allows each child to voice their opinions. Understanding the students' thoughts about learning provides insight into learning styles and helps to assist in choosing individualized diverse lessons that will have the most impact on learning. Lee Anne Bell (2013) maintains that social justice where everyone participates equally, develops to their fullest potential, and are interdependent is a continuing process. My action research project enhanced my students' learning but also my teaching through reflection.

PROBLEM OF PRACTICE STATEMENT

According to the South Carolina Department of Education (2016) regarding the implementation of the Elementary and Secondary Education Act (ESEA), educators are finding themselves with the additional task of designing and implementing a curriculum, which meets the needs of a diverse classroom while using a district, adopted textbook. To meet the requirements of the teacher evaluation system, the Student Learning Objectives (SLO), based on student academic growth, researching and evaluating additional resources to be included in the instruction for the units of study within the math curriculum is necessary. To measure teacher accountability the use SLO assessments designed by the South Carolina Department of Education's Office of Educator Effectiveness for the math strand, evaluation occurs based on individual student growth. Based upon the pretest results, each student had individual growth targets set for the overall math content and the math standards, which make up the area of mathematics content.

The school of study opened its door to students nine years ago, in a rural area, on the outskirts of a continually growing town. The school was built to house 850 students, but on the first day of school, attendance was pushing 1,000 students. Since opening, enrollment has grown to over 1,250 students.

Prior to opening the doors for students, a motto was developed by teachers, administration, and parents to create an atmosphere conducive to building a family-like community, designed to set high standards of learning for all students, as well as, allowing for all students to push their limits. This led to students exceeding the grade-level expectations. The motto "ROCK and ROLL" showed a belief in the educators and students who made up the school community. For teachers, the "ROCK stood for Responsible educators who create an Organized environment that models Character and values while providing opportunities to expand Knowledge. "ROLL" translated to Respecting One and all while Learning and Leading. This same motto for students, "ROCK" stands for: Responsible students who work to the best of their ability always, who Organize materials while modeling Character skills, which support a positive community where Knowledge is valued and success is expected. "ROLL" for students became Respecting One and all such as classmates and adults within the school by treating others as you want to be treated. Learning how to behave appropriately in social situations and Learning content material by actively listening with eyes, ears, and heart. Leaders set goals in class and became positive role models within the school.

The student body is as diverse as is the community surrounding the school. Within the school's population, 53% of students identified as being within the poverty index, including students who are homeless, in the foster care system, migrant, and receiving

Medicaid or SNAP benefits. Recently the school saw an influx of multi-cultural students. Nine percent of the school's population identified as having a disability, which included ESOL (English as a Second Language), speech disorders, learning disabilities, attention disability resulting in 504 plans, behavioral disorders, cognitive delays, and/or hearing issues. On the other side of the spectrum, the Gifted and Talented program served 10% of the school population in self -contained class settings (William Reeves Elementary, 2016).

One area in which administration and teachers are aware of which needs improvement is the attention to diversity pertaining to educational knowledge and gains. For students to reach mastery of the curriculum, this teacher received support from her administration to implement this Action Research study.

The South Carolina Department of Education issues a yearly report card for each school in the state. The report card for this school showed students in the third grade were not meeting the levels required to indicate adequate preparation for the next school year. In third grade, students participate in the SC READY assessment in the areas of English Language Arts and Mathematics, for the first time. With the state assessment given on the computer, students do not consistently use the strategies and skills applied to pencil-paper assessments. Students had not been exposed to transferring information from the computer to paper, solve the problem, then go back to find the correct answer on the computer. Using data from the South Carolina Department of Education's website, the conclusion drawn reveals approximately 57% of the state's student population have not been meeting or exceeding the expectation for the SC Ready mathematics assessment. Whether this shows an accurate representation of student preparedness, or not, one must realize a problem does

exist. If students are entering the next grade without mastering the necessary skills in previous grades, students are not set-up for success.

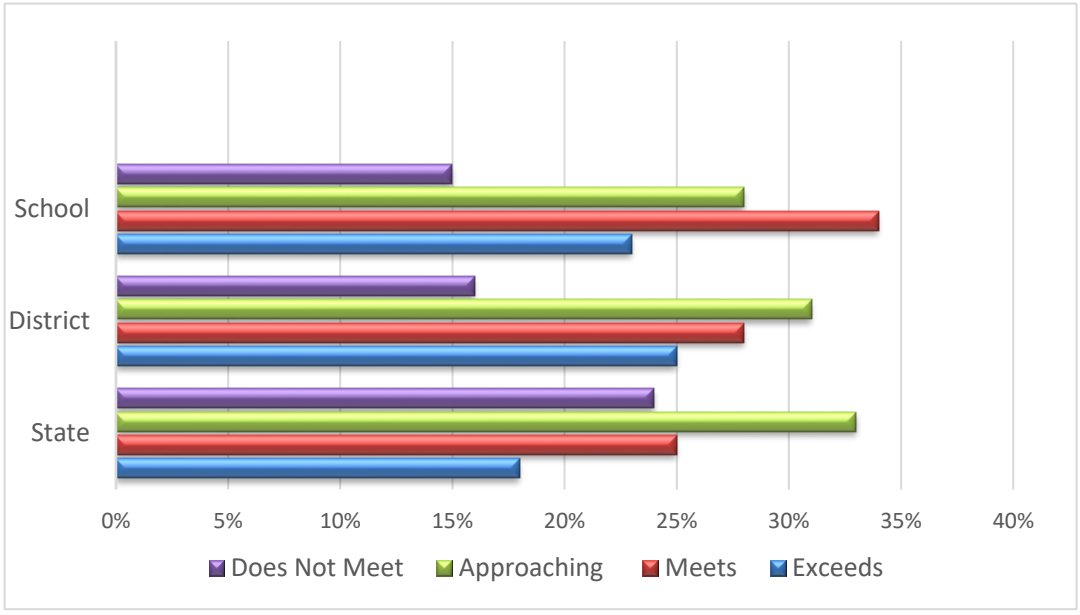


Figure 1.1 State Testing Mathematics Results 2016-2017

A further breakdown of the state data to the school level shows approximately 44% of third grade students fall in the "does not meet" category or in the "approaching" category. As a teacher of third grade math, the goal of the action research study is to implement instruction designed to meet the needs of each child and decrease the number of students not meeting or approaching the grade-level expectations and increase the number of students who meet or exceed grade-level requirements.

The researcher combined the requirements for teacher evaluation along with the goal of improving student performance. The SLO achievement goal is different for each child, but the minimum increase of mastery is two levels. Starting with the data from the SLO pretest of adding and subtracting whole numbers with place value standards, students are grouped based on their mastery of standards. For example, the groups may be addition working at the concrete level, mastery of regrouping in addition, using place value blocks,

and mastery of abstract addition problems, and math reasoning with real-life problems. If the pretest revealed a lack of place value knowledge, a group formed to move back a step before moving forward with the third grade standard. A similar process took place with the subtraction pretest.

As a team teacher, the teacher was responsible for providing two classes mathematics instruction totaling 38 students. Based on second grade end of the year testing scores, my teaching partner and I flexibly grouped the students to create a group of students performing closer to the same instructional level. Within the two flexible groups, observations made during whole group instruction quickly revealed some students struggling, some working diligently, and others completely done with the work. These findings promoted the need to implement differentiated instruction to meet the needs of students various levels of the learning progression within specific standards. Narrowing down the larger group to pinpoint students who need additional help with basic addition with base ten blocks, students who are able to work multi-digit addition problems with base ten blocks, students who are able to solve multi-digit addition problems using master place value strategies, and students who are ready to use all the mastered skills in the learning progression to solve real-world addition problems. As a step in the learning progression is mastered, students move to the next step. Students move at their own pace based on their individual rate of mastery of skills within the standard.

Rather than teaching to the test with focus on the mechanics of test taking, which was not evident in the classroom structure, the students learned multiple techniques to problem solve, compute, and explain mathematical equations. The purpose of teaching multiple strategies of solving equations helps to ensure a higher percentage of students who

will score in the "meets" and "exceeds" range on the state evaluation, thus preparing students for future learning. This occurs with curriculum compacting, integrating curriculum, using technology, and self-correcting partner or small group activities.

THE NATURE OF THE STUDY

The teacher-researcher believes providing a student with multiple learning strategies, engaging in varied learning styles and activities, and providing comfort in a welcoming, safe classroom environment, success is within reach. Understanding not all students are the same, all have different strengths and weaknesses and learning styles results in a classroom atmosphere in which students are not sitting in desks doing worksheets during instruction.

Reviewing the state, district, and school performance on SC READY, South Carolina's end-of-grade assessments, support the need for differentiated instruction to move a larger percentage of the student population to the "meets or exceeds" performance levels. Past teaching experiences, professional development on differentiated instruction, and research have led to the following research question:

> RQ: How does the implementation of differentiated instruction using math stations, students' surveys, and exit slips impact individual student learning progression on the SLO posttest, unit pretests and posttests, and the end of the year state assessment?

During the 2017-2018 school year, the organization of math instruction groups in the researcher's class appeared different with the implementation of differentiated lessons designed to meet the individual needs of each student. During weekly grade level meetings, collaboration was key to successful implementation (Webb & Scoular, 2011) while

enhancing the quality and depth of knowledge for each student (Giaimo-Ballard & Hyatt, 2012). Collaborating with other math teachers assisted in designing individualized assignments for students performing on various levels within the same standard. This collaboration assisted students in staying engaged and prevented them from shutting down (Giaimo-Ballard & Hyatt, 2012). During implementation, student feedback on the different activities assisted in deciding to whether to continue, remove, or revise the lessons.

THE PURPOSE OF THE STUDY

Mertler (2014) states, the first step in action research is the planning, which includes identifying and limiting the topic (p. 39). The researcher is a mathematics, science, and social studies teacher, but her SLO focused on mathematics standards. The SLO focuses on the individual growth of third grade mathematics students assigned to two specific mathematics classes on addition and subtraction of numbers and operation standards. Within the focus group, three students received mathematics support from the special education teacher for 30 minutes daily. The remaining students entered the third grade ranging from emergent mathematicians to ready to learn at the third grade level. The group of students this researcher used during the action research consisted of the following: 22 males and 16 females, 26 of the students identify Caucasian and 12 minority, 16 students are on the free/reduced lunch program, seven students are identified special education, and four students are English language learners (ESOL).

To meet the needs of all students, the researcher identified differentiated learning groups and designed mathematics stations as a primary instructional method for this study; therefore, the classroom arrangement allowed for a minimum of four math stations in

which students rotated daily. These stations included a technology station, a self-correcting activity, a teacher guided lesson, an independent station, and various other stations that allowed students to work on activities to either reinforce instruction or extend instruction. All stations aligned with a piece to show daily on task engagement and progressing learning for each station visited. Each mathematics station had an accountability piece relevant to the students' activity. At the computer, the teacher was able to pull daily or weekly activity reports specific to each student. In the independent station, students had an activity to complete and turn in for evaluation. Exit slips used for the self-correcting games to gather information on individual student progress and on the students, they played against. Teacher observations and other formal and informal evaluations occurred throughout the action research study.

Mertler (2014) states, gathering information relative to the plan of action is next in the process (p. 39). The purpose of this action research study was to provide mathematic instruction designed to meet the diverse needs of all the students in the class by accommodating learning styles, providing varied instructional strategies, and promoting problem-solving methods. Through systematic exploration of existing curriculum, collaboration with fellow teachers, and investigating other resources, the educator provided individual students with appropriate instruction on their achievement level designed to remediate, support, and expand existing knowledge (Dana & Yendol-Hoppey, 2014). As part of the class schedule, there was a 40-minute daily computer lab time. During this time, the teacher pulled individual students or a very small group to provide additional support. The decision of who to work with and what skills to be remediated, supported, or expanded were a result of the prior day's work. The teacher hoped to affect educational change and

promote social justice by gathering evidence that would support the study and generate data to show individual student achievement/growth based on the diverse teaching methods designed to promote success and demonstrate gains on the SLO post-assessment, Scholastic Math Inventory, district benchmarks, and unit posttests.

Based on the SLO pre-assessment, students began receiving instruction at different points in the units of study based on performance. This alleviated wasted instructional time by allowing students to avoid repeating already mastered skills, which in turn reduced behavior problems due to students having to wait for others to finish or receive additional instruction. The goal was for all students to benefit from the differentiated approach to instruction.

Ultimately, teachers are the ones who find themselves responsible for implementing differentiated instruction, spending their time and energy to locate resources, and then organizing everything into a usable format (Reis & Renzulli, 1995). The attention and detail shown in creating, assigning, and finding differentiated materials typically led to higher students engagement, minimizing boredom, and/or showing signs of underachievement due to lack of focus from inappropriate curriculum pacing (Rogers & Kimpston, 1992).

Accommodating students who have reached mastery included extending their learning to broaden the depth and breadth of instruction while requiring students to put forth more effort to be successful without reaching the point of exasperation and giving up on themselves (Kapusnick & Hauslein, 2001). Students who reached mastery, completed computer assignments at a more advanced level, played different self-correcting games,

and worked with the teacher to provide an extension of the learning that include some fourth grade standards.

Successful implementation required students to be able to self-monitor, ensuring progress on the timeline for the designed learning experiences. Established learning centers provided the opportunity to implement higher order thinking skills, research a topic beyond the given grade level material, use technology to produce products, and incorporate multiple intelligences (Kapusnick & Hauslein, 2001). Individual student's self-esteem increased as they saw a purpose for the work they were doing in the classroom (Stamps, 2004).

A middle aged, white, female with 25 years of teaching experience led the action research study. She has seen the education pendulum swing back and forth throughout her education as a student in the school district and then when hired within the same district. To ensure her students reached their highest potential, this teacher continually monitored, adjusted, and researched proven practices to implement during instruction. The researcher provided a classroom environment in which all students were encouraged to think for themselves, ask questions, and engaged in learning activities to further their potential.

RELATED LITERATURE REVIEW

Imagine being a teacher at the beginning of the school year, trying to prepare a classroom, organize curriculum materials, and check off a few items on a to do list. During this time, you are required to attend staff development focused on curriculum and planning where you found out changes continuously made to the mandated curriculum. You look around in astonishment at the stunned, frustrated faces of your colleagues wanting to ask the question, "When enough is going to be enough?" (Buoncristiani, 2012, p. 136).

CURRICULUM REVIEW

South Carolina has changed the curriculum standards from state developed and mandated standards, to Common Core Standards, and now back to South Carolina State Standards. Curriculum consists of the courses, lessons, and learning activities students participate in, as well as the knowledge and skills educators intentionally teach to students (Hidden Curriculum, 2014).

A free and appropriate education is all about meeting the needs of each child. Districts and schools operate to accomplish meeting these individual needs; however, the implementation is often difficult to attain due to the various ability levels of student performance within a classroom. Textbooks adopted by states and districts incorporate a large percentage of repetition and are written at a lower readability level (Reis & Renzulli, 1995). Funding, curriculum materials, and specifically trained teachers are available for students who need remediation or special services (Stamps, 2004). However, the same amount of attention is missing for the average and higher achieving students in the school community. The average student does not have access to the same resources as their classmates.

HIGH STAKES TESTING

Teachers work to provide a safe, welcoming environment where students go to learn, explore, question, and become critical thinkers. To provide the best education for every child, teachers must use various teaching materials, implement multiple levels of instruction, and constantly look at new and improved activities students will enjoy while learning. All the while, the ever-present standardized tests hover in the background, in the world of education, waiting to apply pressure to both teachers and students. The term high-

stakes testing can change the morale in a classroom of teachers quicker than a planning period in any given school day. The results of one test used to evaluate student-learning affects everyone involved in education (Minarechova, 2012).

ACTION RESEARCH DESIGN

The action research design included a pretest and posttest to evaluate individual student growth on math learning objectives in place value including addition and subtraction. Quantitative data gathered on four math learning skills and the overarching math learning objective aided in decisions made. A growth goal generated for each student per skill based upon each student's pretest results. Using a Student Growth Target Excel Spreadsheet, the researcher recorded pre-assessment scores as well as growth target goals.

Based upon the baseline/pretest, grouping students by individual needs for each skill occurred. These groups allowed the researcher to meet the needs of the individual student in all areas, as the groups were not stagnant. Instruction provided the opportunity for interventions, reinforcement, and extension when appropriate. The method of instruction included manipulatives, teacher groups, available technology, and outside support. The formation of each individual group based on the mastery level of the skill and the level of instruction provided varied based on the needs of the group at each mathematics station.

The researcher gained parental permission before beginning the action research. Students who did not have parental permission received the same instruction; however, their specific data was not included in this study. Revealing the identity of the student participants to outside audiences before, during, or after the implementation of the action

research study will not occur. Individual student data gathered existed solely for instructional purposes, site-based data for placement, and district data collection as needed.

For this action research study, students assigned to two math classes for the 2017-2018 school year created the pool of participants. Administration specifically assigned students to each class, trying to group similar students together to enable the teachers to provide a well-balanced education to everyone including male to female ratio and ethnicity equality in each class. With 38 students, there were 22 males and 16 females. In 2017-2018, the students needing support through the special education department and the English Learners existed in one of two groups. The special education teacher provided services to seven students in reading and four students in mathematics and a reading interventionist served an additional eight students during their computer lab time. The beginning of the year the Scholastic Math Inventory (SMI), a district mandated assessment, identified 18 students as needing intensive math instruction due to scoring below the 10th percentile, 16 students identified as needing strategic instruction due to scoring between the 11th and 35th percentile, and four students identified as being on a third grade instructional level.

ETHICAL CONSIDERATIONS

Family Educational Rights Protection Act (FERBA), created by Congress, designed to protect students and their family's privacy in respect to educational records (Hlavac & Easterly, 2015). As a teacher who is, also a researcher the protection of each student's privacy is a vital part of action research. The ethical standards implemented pertained to evaluating student work, analyzing student mastery, implementing engaging

questioning techniques, and observing student behaviors during instruction. (Dana & Yendell-Hoppey, 2014).

Following the development of the action research plan, parents received information of the research taking place and the role of student participation, giving them the option to opt out of participating in the research study, guaranteeing confidentiality, and asking them to sign an informed consent form (Mertler, 2014, p.108). Providing parents with information pertinent to the action research allows questions about the process to be answered, uneasiness to be alleviated, and explained the reason for the action research was to enhance each child's education, as well as, improve daily instruction.

Diversity incorporates various elements composing a single group (Webster, 2016). For educators to be successful in the classroom, understanding how social diversity impacts education empowers teachers with knowledge not constrained to academics alone. The perception of social identify, social justice, oppression, and privilege influences all individuals in different ways. An individual's social identity merges a person's self-perception with roles in society based on preconceived thoughts and actions. This relationship with others is visible within classroom structures based on achievement levels, which aids in the decision and basis for instructional materials.

Within the framework of social identity is social inequality. Historically, social inequality refers to the dominant or privileged having power over the subordinate or oppressed. Privilege affects individuals daily on both a conscious and unconscious level (Adams et al., 2013, p.45). Patterns of inequality exist in the funding of schools, in sports, in gender restrictions, and access to resources (Weber, 2013, p.28).

Social justice affect everyone either in a positive or negative manner. Lee Anne Bell (2013) maintains social justice where everyone participates equally, develops to their fullest potential, and are interdependent is a continuing process. Social identity occurs on preconceived notions; whereas, social justice is a process in which individuals can have a voice and impact. In 1892, Francis Bellamy wrote the Pledge of Allegiance including "with Liberty and Justice for all" (Martin, 2008).

Even though our students come from various backgrounds, either privileged or oppressed, within the classroom, the teacher's job is to level the playing field by ensuring all students receive an equal, quality education. Whether we are filling in the gaps, redirecting, or expanding a student's knowledge, within the classroom, children should all feel equally safe, secure, and capable of achieving.

OVERVIEW OF DISSERTATION IN PRACTICE

This researcher completed a five-chapter dissertation based upon an action research study implemented during classroom instruction focusing on the impact of differentiated instruction through rotating mathematics stations. Chapter One: Introduction provides an overview of the action research study. Chapter Two: Review of Related Literature, provides support to the action research study citing previous studies and theories in education related to the topic. Chapter Three: Action Research Methodology defines the plan of action for the action research study. Chapter Four: Findings, Discoveries, Reflections, and Analyses, provides a summary of the data and conclusions reached from the action research study. Chapter Five: Summary of the Major Points/Conclusions and Suggestions for Future Research provides detailed highlights of the study, as well as, suggestions for future studies.

Knowing teachers are not all comfortable with new approaches, one way to encourage the use of action research methods within the classroom is through the creation of Professional Learning Communities (PLCs) in a school or across a school district with participants from various schools (Dana & Yendol-Hoppey, 2014). Participation in a PLC places the teacher in a situation similar to what students face during a typical day. By providing teachers the opportunity to learn through practice, collaboration through dialogue, and engagement in activities, teachers learn first-hand what the process should look, sound, and feel like during implementation. Implementing PLCs for teachers and generating action research methods in the classroom all while providing the best education possible allows change from just an ordinary school to a school filled with various learning components (Dana & Yendol-Hoppey, 2014). Sharing findings from the action research study with grade-level teachers and other educators within the school who are implementing differentiated instruction through mathematic stations is a goal of the researcher. During district staff-development, the possibility exists for sharing the action-research study including background information, the process for the study implementation, and the resulting outcomes.

CHAPTER 2: A LOOK AT DIFFERENTIATED MATH INSTRUCTION IN PRACTICE

Differentiated instruction is an important element in elementary classrooms designed to provide each student with the skills necessary to be successful in the learning process. Using different strategies to teach standards allows the opportunity to integrate learning styles. Students work in groups, rotating through various activities, and experience different instruction styles while maintaining the instructional goal.

Response to Intervention (RTI) came as part of the Individuals with Disability Act (IDEA) in 2004 (Watts-Taffe, 2012/2013). Although the accommodations happen for all students, not just students identified with specific learning disabilities, the resources and support often remains limited to the number of students that benefit based on software licenses. Differentiation and intervention both occur because of a response to student performance. Teacher evaluation incorporates using the Student Learning Objectives (SLOs), measurable objectives to evaluate student academic growth (Thomas, 2015). SLOs require teachers to develop individual student growth goals for each student in focused areas based on a specific set of measured standards. To meet SLOs, teachers must effectively incorporate differentiated instruction within the classroom, designed to move students up the learning ladder.

In order to meet individual student goals set by the teacher and to improve future classroom instruction, the researcher decided to implement an action research study focused on the numbers and operations standards, as well as, algebraic thinking and operations pertaining to addition and subtraction. Preparing for the action research study

allowed the researcher to organize, plan, schedule, and start with a general plan of study even though changes were expected to occur throughout the eight-week time span.

With the goal of action research, that being the improvement of learning, or another specific educational issue, the researcher's analysis of the study had to include new learning, material learned stemming from prior learning, analysis of mastery, and typically include questions formed because of the study. Knowing nothing is perfect; approaching the reflection process with an open mind is important for everyone involved. Questioning if the methodologies used were best for the study is part of the reflection process. Are there different sources, which would better support the research? Was the collected data the best option for the study? Mertler (2014) suggests the answers to these questions can help to improve the action research study (p. 215).

In the case of this action research study, the researcher used data, focused on specific math skills, and designed instruction with specific growth goals for individual students. The students measured impact using SLO assessments designed by the district's math interventionist for the math strand, district benchmarks, pre and posttests for each standard, and journal writing. Based upon the pretest results, each student had individual growth targets set for the overall mathematics content and the math standards within the area of mathematics content. The teacher kept documentation of evaluations, journal entries, interviews, and student work as part of the final evaluation of student mastery of each skill.

Educators believe providing a student with multiple learning strategies, a welcoming safe classroom environment, and engagement in varied learning styles and activities, success is within reach. Offering all students the opportunity to learn differently,

at their own pace, results in a classroom atmosphere where students are not sitting in desks doing worksheets during instruction, rather students are active, completing activities, and excited about learning.

Past teaching experience, professional development on differentiated instruction and research have led to the following research question:

> RQ: How does the implementation of differentiated instruction using math stations, student surveys, and exits slips during the unit impact individual student learning progression on the SLO posttest, unit pretest and posttest and end of the year state assessment?

Continuing to do the same thing repeatedly without change is not acceptable in education. Through reflection during instruction, allows educators the option to make immediate adjustments to ensure fidelity. In *Reflection-in-Action: Teaching Strategies Used by Faculty to Enhance Teaching and Learning*, Giaimo-Ballard and Hyatt (2012) describe the reflection process by quoting Schon's explanation of reflection-in-action. Schon "suggests not only that we can think about doing, but we can think about doing something while doing it" (Giaimo & Hyatt, 2012, p. 2). Reflection is a continuous process occurring during the action and after the action completion (Peters, 2009).

The school of study includes a diverse student body reflecting the community surrounding the school. The school identifies approximately 53% of the student population as being within the poverty index including students on Medicaid, SNAP, homeless, foster care, and belonging to migrant families. Recently the school has seen an influx of multi-cultural students. The school itself is comprised of a population where approximately 50% of the students qualify free or reduced lunch. Nine percent of the school's population

identified as having a disability, which includes speech disorders, learning disabilities, attention disability resulting in 504 plans, behavioral disorders, anxiety disorders, students on the Autism spectrum, cognitive delays, and/or hearing issues. On the other side of the spectrum, 10 percent of students make up the Gifted and Talented (GT) program (William Reeves Elementary, 2016).

Within the classroom, the teacher's job is to level the playing field by ensuring all students receive a quality education. Whether instructional lessons are designed to fill in gaps, redirect or reinforce instruction or expand a student's knowledge, within the classroom, children should feel safe, secure, and capable of success. Students will not learn in an environment where the preconceived notion makes the believe success is not possible.

This action research study included two groups of third grade students assigned to the researcher. In the daily school schedule, 100 minutes earmarked for math instruction provides for sufficient time for differentiated instruction. Now, the district mandates 10 minutes of instruction for a program called FASTT Math, where students practice on improving their fact fluency, specifically multiplication in third grade. Thirty minutes of the math instructional time is for computer-driven Compass instruction. Compass is a district purchased program in which students complete an assessment at the beginning of the year and work is based on the preassessment. However, teachers have the autonomy to assign work based on instruction in the classroom and individual student performance when appropriate. For this action research study, students completed work based on the pretest. Instruction intended to reinstruct previous learning, reinforce and practice current learning, and extend learning when reaching mastery. The goal of differentiating the instruction through mathematics stations was to provide engaging, appropriate instruction.

Each station had similar activities; however, the level of difficulty depended on the group of students and their needs. Computer assignments ranged from a second grade level to provide reinforcement, a third-grade level for application practice, and a fourth grade level to challenge those who had reached mastery.

The 2017-2018 class consisted of 38 students of which there are 22 males and 16 females. One student diagnosed with Tourette's syndrome, eight students were on medication for ADHD, and two students had visual challenges even with their glasses. Additionally, seven students received services via special education teachers, and six students identified as English Language Learners (ESOL). The family structures were varied and constantly changing during the school year for various reasons. Eleven students lived in two parent households, 17 students lived with one parent, three students had stepparents, one student was in a foster home situation awaiting adoption, one student lived with her grandmother, and three students lived in a family unit with cousins and other extended family members. The Department of Social Services visited five of our students' families, one resulted in the child removed from the home and another had the parents looking to move away. There were multiple legal convictions for drug use and drug manufacturing with some of these students' parents. The classes did not have any gifted students, as these students were designated to one classroom within the third grade.

ORGANIZATION OF THE CHAPTER

The organization of this chapter aims to provide background information to support using differentiated instruction techniques and the history behind differentiated instruction. The purpose of differentiated instruction lies in meeting the needs of individual children. Followed by how professional development and in-service trainings can prepare teachers

to be successful even though factors exist to make the implementation difficult. Then suggestions for meeting the diverse needs of the individual students within the school day to provide a solid mathematical base for future learning while at the same time preparing for the high stakes test students must take each year.

The history of education encompasses many changes in the methods used to provide instruction in the classroom to prepare students for the future. Star (2016) indicates, "Past educational reforms have failed because they didn't meet teachers where they were. They expected major changes in practices that may have been unrealistic for many teachers even under ideal professional conditions," (p. 59). Whether educators are researching curriculum theory or the theorists, the past or the present, or curriculum instruction ideas, a connectivity should exist between them all.

The literature is organized to demonstrate researched theories, history behind differentiated instruction, and procedures for use in differentiated instruction. In the development of the action research study, the methods chosen to implement were curriculum compacting, integrating curriculum, using technology, self-correcting partners or small group activities aligned with the standard, and instruction on strategies students can use in various mathematical situations. These strategies incorporated in mathematics stations within the classroom with instructional materials and activities changing to keep students' attention and avoid redundancy.

Reviewed literature provided the reader with terms associated with differentiated instruction, methods for improving instruction, and materials to enhance instruction. Each suggested how the varied methods affects student achievement. In the search for literature to support the action research project, consulting books from present and past graduate

classes provided support for various topics. Current research and supportive articles were located using the campus library and ERIC, saved on the computer, and then dissected for information meeting the topics discussed. Not being near campus and a larger collection of published books, district employees with a focus in math instructions provided additional research both current and past.

The purpose of the literature review was to provide support and documentation for the use of differentiated instruction in an elementary math classroom to meet the needs of all students. Mertler (2014) proposed reviewing related literature to provide the opportunity to narrow the topics, as well as, gather data to aid in forming an action research study. Information gathered through research prior to the implementation of this study provided support as to the need of differentiated instruction within the classroom to produce 21st Century learners.

Mertler (2014) states gathering information relative to the plan of action is the next step in designing an action research plan (p. 39). The purpose of this action research study was to provide mathematic instruction designed to meet the diverse needs of students in the class through accommodating learning styles, providing varied instructional strategies, and problem-solving methods. Through systematic exploration of existing curriculum, collaborating with fellow teachers, and investigating other resources, the researcher provided individual students with instruction on their current achievement level designed to remediate, support, and expand existing knowledge (Dana & Yendol-Hoppey, 2014, p. 39). The researcher effected educational change, promoted social justice by gathering evidence to support the study, and generated data to document individual student

achievement growth by using diverse teaching methods. This ultimately resulted in gains on the SLO assessment, Scholastic Math Inventory, district benchmarks, and unit posttests.

The materials chosen for this literature review included various articles on similar studies, graduate books, and published books on math instruction. Research provided a background of knowledge to prepare for future events in the action research both positive and negative. Part of the research provided information, which assisted in the organization of lessons and activities prior to implementation.

EDUCATIONAL THEORIES INFLUENCING INSTRUCTION

The theoretical perspectives aligned with the action research study included constructivism, sociocultural theory, and essentialism theories. Constructivists believe learners achieve their own learning when new learning combines with knowledge constructs through active involvement in the process (Walle et. al, 2014). By providing a variety of experiences, students showed their knowledge in a way they felt most comfortable. The principles of constructivism focus on student learning through combining prior learning with action-based learning either independently or with a group setting (Drake, 2012). Inquiry Based Learning (IBL) actively engages students using student interests and incorporating higher level questioning from Bloom's Taxonomy (Marks, 2013). During the cycle on an IBL lesson, students gain a deeper understanding of the information through continuing to ask questions and gather data. Individual student's self-esteem and confidence increases as they see a purpose for the work they are doing in the classroom (Stamps, 2004; Keller, 1987).

The sociocultural theorist believes learning enhances by working in tandem with individuals of different ability levels (Walle et. al, 2014, p. 6). Socio-culturalists believe

individuals can learn from those around them. Classroom culture can either help or hinder the learning taking place. Classroom personalities occasionally do not allow for as much interaction among students and opportunities to learn from one another. Interacting with others allows students to hear other viewpoints, explanations, and thoughts, which may translate into additional learning or an alternate way to approach a problem (Walle et. al, 2014).

Essentialists believe upon leaving school students should be ready for the real world; they should have obtained basic skills, knowledge to build upon, and the ability to apply learning to real life situations (Null, 2007). Essentialism centers on standardized testing for teachers and students, the state and national standards, and strict discipline within the classroom to hold all parties accountable. In an essentialist's classroom, William Bagley (1939) states, teachers are the authority figure dispensing knowledge and essential skills students need to learn; whereas, students are in school to learn ways to improve the world. His followers did not think students should be worried about changing the world; rather they should become model citizens to function.

Essentialism learning focus on the outcome where progressivism considers the child's engagement in learning. Within the progressivist movement, students are encouraged to be active while learning through creativity. Using the interdisciplinary approach to planning focuses on the concepts of the curriculum, student interest, and problems of society to provide fluidity within the lesson. Teachers are not the center of the students' attention; rather they serve as monitors through the learning experience offering explanations, redirection, and encouragement, when needed.

John Dewey, a prominent figure in the progressivism movement, wanted children to learn through activities, to learn how to cooperate with other students within the class to achieve a common goal, all while promoting individual growth of all students. Under Dewey's theory, teachers are engaged in the learning taking place within their classroom.

History of Differentiated Instruction

While these theories have shaped education, practices related to differentiated instruction often credited to the one room schoolhouse with all ages attending one school, with one teacher instructing everyone at their level necessitated its use. Further research into the background of differentiated instruction revealed aspects of individualized instruction as early as 1889, ability grouping in 1890, followed by the introduction of high stakes testing in 1912 (Washburne, 1953).

Tomlinson (2001) provided research into the many needs of diverse learner's methods then broke down what differentiated instruction was in non-technical language. DI defined as the process, the product, the demonstration by teachers and students, the engaging environment, and the content taught (Watts-Taffe et al., 2012/2013). The learning process of individual students varied in a quest for learning new content. Acknowledging the fact students do not learn the same was as important as acknowledging the individuality of everyone to prepare everyone for the future. Cumulating projects needed to reflect the learning styles of the individuals for students to provide proof of understanding, mastery, and extension of the content learned. The final projects extend to act as a review for classmates when presented.

Gardner's theory of multiple intelligences focuses on various learning styles in which students' show mastery of learning (Kapusnick & Hauslein, 2001). Using Gardner's

Theory of Multiple Intelligences to plan lessons, activities, and assessments, provides the opportunity for students to use their strengths to prove their knowledge. Verbal-linguistic learners like to speak and write to convey their message. Logical-mathematical learners look for patterns, analyze the problem, and tend to see connections. Musically inclined students look for rhythms in what they are learning, thus may choose to create chants or raps to enhance learning. Bodily-kinesthetic students like to move, so incorporating hand movements, dances, and other opportunities to engage learners will help all learners, not just a group. Gardner's diverse methods helped to meet the needs of students by engaging the individual and encouraging independent thinking (Bender, 2012).

DIFFERENTIATED INSTRUCTION STRENGTHENED BY PROFESSIONAL DEVELOPMENT

Top administrators and leaders reach beyond the normal, allowing individuals working for them to make relevant decisions, and act as a catalyst for everyone (Murphy, 2013). Murphy (2013) quotes Ronald Heifetz and Riley Sinder, "A leader is a guide, interpreter, and stimulus of engagement." A leader's vision is "the grain of sand in the oyster, not the pearl" (Murphy, p. 31). Leaders come in all different shapes and sizes, with different beliefs and methods of leading, and with different attitudes affecting the relationships built.

Top administrators and leaders differ themselves from the rest of the group through their actions, thoughts, and words. They walk the walk with their teachers sharing a common vision for the school in the present while forming a bond and gaining a commitment for the future (Senge, p. 9). In order for the bond to strengthen, trust must exist between administrator and the teachers. Without trust, lines of communication will not be open.

As a researcher, a third grade classroom teacher, and a member of the district math team, I work to assist teachers in creating a classroom environment in which all children can learn. For teachers to implement differentiated instruction effectively, training through modeling needs to occur with teachers having time to plan and reflect (Cusumano & Mueller, 2007). Training should not be a one and done opportunity. As teachers begin to implement differentiated instruction methods, questions are going to arise, and support services needed. Professional Learning Communities offer an opportunity to sustain learning and focus on methods to provide instruction to a broader group of students instead of just the small group in the action research study.

Curriculum leaders assist in preparing and training teachers to be able to handle the ever-changing education and social issues students encounter in school. Rookie teachers are not the only individuals in need of continued education. All teachers can benefit from staff development tailored to the present-day classroom. For teachers to be prepared to teach, teachers first need to learn.

> Teacher professional learning is a complex process, which requires cognitive and emotional involvement of teachers individually and collectively, the capacity and willingness to examine where each one stands in terms of convictions and beliefs and the perusal and enactment of appropriate alternatives for improvement or change (Avalos, 2011, p. 9).

Providing teachers with specific strategies to reinforce positive interaction, students will in turn learn how to better interact.

Students should collaborate during the school day, just as teachers should collaborate, to develop varied instructional procedures, align with standards, all while

creating successful students. Collaboration may occur during grade level planning, school or district staff development, and even through graduate courses. School-based professional development provides teachers who work together to pull together forming a support network (Bissonnette & Caprino, 2014). The process does not end after each meeting or training, as each teacher should take time to reflect upon the discussions, adjust assignments and activities to meet the needs of the individuals within the specific classroom, and add personal touches. Reflection may raise understanding, create further questions, or lead to additional growth.

When NCLB began part of the requirement of the document focused on the availability of high-quality professional development (Bissonnette & Caprino, 2014). Preparing students to be 21st century learners requires teachers to be trained and educated in all areas of academia, student development, and learning methods. Professional development may exist at the school, district, or state level depending on the scope of need and the subject material. Providing teachers with quality education and continued learning experience strengthens the learning environment existing within the school for students.

In the chapter *My Pedagogic Creed,* John Dewey (1938) raises a question pertaining to the expectations we are setting for our young students while leaving out many of the social interactions, which produce individuals who are able to participate in society. The curriculum standards and objectives leave little to no time for play, interaction, or fun learning as now testing dictates the pace and curriculum being taught. As a curriculum leader, providing examples of diverse mathematical lessons, which offer the opportunity for social interaction, assists teachers in understanding how instruction can exist beyond workbooks and copied papers.

STRATEGIES FOR DIFFERENTIATED INSTRUCTION

Ultimately, teachers are the ones responsible for implementing differentiated instruction, spending time and energy to locate resources, and organizing everything into usable formats (Reis & Renzulli, 1995). Curriculum compacting is an instructional technique in which teachers organize adjusted curriculum materials as a way to provide higher achieving students with a variety of engaging activities (Reis & Renzulli, 1992). Providing more challenging through content including higher-level questioning, alternate readings, and investigations provides students with a positive educational experience (Stamps, 2004). No longer are the students showing signs of underachievement due to the curriculum compacting accelerating their learning (Rogers & Kimpston, 1992).

In the past, accelerated learning for students generally referred to skipping a grade to meet the individual's needs. One of the concerns with this scenario focused on the child's maturity and social skills. Rogers and Kimpston (1992) did not find a negative effect on a child's social well-being at the elementary and secondary level when the academic progress was increased.

Accelerating learning allowed students who have proven mastery on a specific skill the opportunity to add depth and breadth to their learning. Accommodating students who reached mastery included extending their learning, to broaden the depth and breadth of instruction, while requiring students to put forth more effort to be successful while avoiding students reaching the point of exasperation and giving up on themselves (Kapusnick & Hauslein, 2001).

Interdisciplinary curriculum paves the way for connections while looking at things through different lenses, as a curriculum should integrate subjects in various manners to

encourage creativity in teaching and learning (Drake, 2012). The implementation of an integrated curriculum has shown to have a positive effect on student attendance, motivation, and resulted in fewer discipline referrals. This also led to teachers who were happier and more satisfied with their jobs (Drake, 2012).

Even when creating an interdisciplinary curriculum, consideration to accountability is important, including covering specific standards and preparing students for high-stakes testing. When implementing the backwards design process, teachers designing the curriculum are not limited to a state adopted textbook to teach the curriculum. Instead, the process begins with concepts and skills, real world problem solving, and student questions by focusing on the assessment designed for learning (Popham, 2001).

Interdisciplinary curriculum, organized through a backwards design, affects differentiated instruction in a positive manner. Teachers know teaching to the test, as well as teaching item specific skills, is not how a plausible curriculum works. Even though the process of creating a backwards curriculum can be time consuming and labor intensive for a teacher, developing a truly integrated curriculum would help ensure a curriculum study that would positively affect both teachers and students.

MOTIVATING STUDENTS TO LEARN USING MULTIPLE STRATEGIES

To ensure students learning is active and engaging, the teacher used the Attention Relevance Confidence Satisfaction (ARCS) Model of Motivational Design, created by Keller, to influence student motivation in their mathematics curriculum (Keller, 1987). The ARCS model based on Tolman's and Lewin's expectancy-value theory stating, "If an individual is motivated to learn then there is relevance to the knowledge being gained" (Frymier, 2001). Attention and relevance are the bases of the model, which supports the

two remaining components, confidence and satisfaction. If a student understands the relevance of the lesson, a purpose has been set for the student to pay attention to the instruction, thus leading to an individual's confidence growing and facilitating self-satisfaction from the ability to master the content material (Keller, 1987). No longer, are the students bored, unengaged, or show signs of underachievement (Rogers & Kimpston, 1992). Content needs to be relevant to the learner and introduced at a level of understanding which provides a solid starting point. One approach to motivate students at their level is through technology, as programs offer various levels of practice.

Adapting curriculum to meet the needs of individual students is only a starting point to providing each student a free and appropriate education. With all the environmental influences students face today, school may not be the most important part of their life. Students, who struggle with poor social and/or environmental stimuli, and/or lack the most basic of necessities in life, may not understand the importance of education and achieving success. Using ARCS with students provides a rationale for the hours spent at school.

TEACHER'S UPHILL BATTLE

Teachers work to provide a safe, welcoming environment, where students go to learn, explore, question, and become critical thinkers. To provide the best education for each child, teachers must use various teaching materials, implement multi-leveled instruction, and constantly look for new and improved activities students will enjoy while learning. All the while, the ever-present standardized tests hover in the background in the world of education waiting to apply pressure on both teachers and students. The term high-stakes testing can change the morale in a room of teachers quicker than a planning period

goes by during the school day. Gone is the personality, creativity, flexibility, and fun in teaching (Reich & Reich, 2010).

By adjusting the planning approach, the curriculum design developed to include critical pedagogies; students are empowered to learn; and the educators in the program are involved in a heightened learning process. This course of action should not have restrictions to the educators in the program. Teachers who embrace this approach would not have to take the chance of defending their integrity.

The effects of high-stakes testing are an ever-present gray cloud over the education family as legislation uses the mandated assessments to hold teachers, administrators, and school districts accountable. Teachers compared to other teachers, schools compared to comparable schools, and even districts compared to other districts, and occurs all due to a political agenda. At the classroom level, teachers are continuously evaluating data pertaining to student performance and growth while implementing instruction to redirect and eliminate skill gaps. Administrators also use this data to evaluate teacher performance during evaluations. Due to the pressure to advance every student to an acceptable performance level on mandated tests, teachers lose the ability to teach students based on learning styles and ability level (Reich & Reich, 2010).

Successful curriculum implementation requires students to be able to self-progress monitor, ensuring progress stay on track with the timeline for the designed learning experience. Established learning centers provide the opportunity to implement higher order thinking skills, research a topic beyond the given grade level material, use technology to produce products, and incorporate multiple intelligences (Kapusnick & Hauslein,

2001). Individual student's self-esteem increases as they see a purpose for the work they are doing in the classroom (Stamps, 2004).

To combat the stress of high stakes testing, teachers can enlist cohorts to meet, discuss, plan, and support one another. By integrating the curriculum, creating vertical alignment documents, and analyzing curriculum content, teachers can come together, to alleviate some of the stress related to high-stakes testing (Reich & Reich, 2010).

POLICIES EFFECTING CLASSROOM INSTRUCTION

Working together teachers have a voice in policies and restrictions over how instruction occurs within the classroom (Reich and Bally, 2010). Educators should work together and have conversations on how to improve student scores by establishing goals and ideas to incorporate into their teaching. Policies made at the state level, which affect teachers, are often made without teachers' voices being heard and are typically made by people without any educational background. These policies may look good on paper, but without a guide for implementation, the teachers muddle in the trenches to fend for themselves.

Gabriel Reich, teacher in an alternative school, found that although her students could express their knowledge of state standards verbally and in writing, the knowledge did not transfer to the multiple-choice test administered by the state. The results of the test dampen the earlier positive feeling of success (Reich & Bally, 2010). Multiple-choice tests, given on a computer, do not provide an opportunity for students to prove the knowledge gained over one hundred eighty days in the school year. When scoring, only the answer chosen matters, not the rationale or process used to find the solution. Teachers

teach students to become thinkers, problem solvers, and analyzers, not individuals who on any given day can answer an extensive amount of multiple-choice questions.

David Bally is a World History teacher. His instructional plan began with learning the test structure, allowing him to focus on important skills and knowledge. He shared this information with colleagues, which they used to create a document, aligning the curriculum across grade levels. The entire department worked together to teach skills students would need to pass the exam. Bally's (2010) approach to creating his curriculum compares to what researchers call "teaching to the test", even though he was focusing on content, not specific test content. By working with colleagues across grade levels, and creating a vertical content alignment including subject integration, his colleagues worked with the result to create a workable document designed to provide students with integrated curriculum and instruction in an engaging and thought-provoking manner.

All educators are accountable for student performance on the high-stakes tests. Since these educators are taking responsibility for the education of their students, administrators need to have faith in the work the individual teachers are doing. Administrators can help the process continue during the school year, and from year to year, by establishing common planning times, providing guidance and support, and assisting in gathering educational materials and resources to support the goals of the teachers (Reich & Bally, 2010).

DIFFERENTIATED INSTRUCTIONAL METHODS

Educators are aware children come into the classroom with different strengths and weaknesses, different styles of learning, and in need of different accommodations to ensure learning to their potential. Differentiated instruction allows for accommodation through

materials, methods, and outcomes all while focusing on the same standard. Effective differentiation does not come from a basal series or a program adopted by a district or state. Effective differentiated instruction occurs when teachers know their students, provide effective instructional practices, and vary materials used for instruction (Watts-Taffe, 2012/2013). The balance between whole group instruction and small group instruction needs to exist throughout all daily instruction.

Including written and oral communication in math differentiation is a concept not always related to math instruction. However, having students write and talk about the math they are doing strengthens the knowledge base and understanding. Often students memorize steps to complete math problems without understanding the process. Through journaling and discussions, students not only use mathematical vocabulary, but they begin to think through the steps of the math problems (Kostos & Shin, 2010). Math journals also offer a teacher the opportunity to gain a better understanding of the individual thoughts of students, thus opening a two-way communication between the teacher and student.

The implementation of an action research study using math journals helps to enhance math communication. Writing is a natural process, a method of communication between people, and a way to express the thoughts and feelings that occur within a person. Its use as a tool for the teaching and learning of mathematics is a recent development, springing in part from NCTM Standards on Communication. No longer is the exclusive proving of the humanities, writing now in use in mathematics classes at all levels K-12 (Kostos & Shin, 2010).

Integrating writing in mathematics allows students to revise and edit their thought process while completing a math assignment. Writing out the problem-solving process

provides students the opportunity to apply the mathematical vocabulary correctly, revisit their work, and learn from their own mistakes.

Maintaining student attention and engagement is vital for learning to take place in the classroom. Games are a unique way to provide differentiated instruction while preparing for students for standards-based exams (Trinter, Brighton, & Moon, 2015). Games can be obtained from educational stores, the curriculum provider, can be teacher-made, or be a variation of popular children games where the game itself is the same but the game cards or rules are changed. Using a preexisting game design aids in the directions and student knowledge of how to play the game.

Cooperative learning is an instructional technique where students work in groups to achieve a common goal. Within the small group, students must communicate, problem solve, and listen to each other in an appropriate fashion. The opportunity exists for each member of the group to hold a specific job designed to encourage participation and work on social skills within the smaller setting.

Project-based learning is an instructional strategy in which students tackle an assignment to complete with directions, checklists, rubrics, and information on the final presentation (Walle et. al, 2014). Using PBL, students have the advantage of working within a given timeframe but at their own pace. The methods, choices, and final product all must fall within the parameters given; however, the parameters allow for flexibility and independence.

The process known as flipping the classroom is a gradual process in implementation, as the teacher becomes a facilitator. Students learn information at home prior to learning in the classroom, and then the knowledge from the previous night's learning is the lead off

to the lesson of the day (D'addato & Miller, 2016).

To make sure stations run effectively, procedures need to be established. Engaging students in learning through the implementation of educational games, based on mathematic standards, is more effective than traditional based instruction (Trinter, et al., 2015). For the purpose of this study, transitions were performed to short music clips with the volume decreasing as a signal to everyone they should be in place. During stations, students willingly ask a classmate within their group for help, if needed, alleviating the interruptions of the teacher led station.

Successful implementation required students to be able to self-monitor ensuring progress on the timeline for the designed learning experiences. Established learning centers provided the opportunity to implement higher order thinking skills, research a topic beyond the given grade level material, use technology to produce products, and incorporate multiple intelligences (Kapusnick & Hauslein, 2001). Individual student's self-esteem is boosted as the student see a purpose for the work being completed in the classroom and success in individual achievements (Stamps, 2004).

Technology provides a valuable addition to the concept of differentiated instruction; students have access to various apps, programs, and methods to learn. Students in classrooms today live in a world where technology plays a major role in daily life. Technology allows students to interact on several different levels, and advance based on individual mastery of content (Scalise, 2009).

In the technology plan, *Getting America's Children Ready for the 21st Century*, goals were included to ensure teachers received the training needed to assist students in using computers to gain information and to achieve high academic standards (Chen &

Herron, 2014). Training the teacher on effective use of technology prevents the teacher from becoming frustrated with technology resulting in more daily use.

The use of iPads, or devices allow the downloading of multiple apps, allows the opportunity for students to engage in fact fluency practice using engaging methods which are more entertaining than the traditional flashcard and worksheet. The use of a variety of apps provides students with choices to alleviate the monotony of only having one option every day. Today's world is visual, faster paced, and input occurs continuously and simultaneously. Teachers must be willing to adapt to the times to meet students' needs.

The specific district mandated computer program, Compass, was used during this action research study as a data collection tool. Data was given in a percentage of questions answered correctly in quiz format, after students have completed interactive instructional lessons. If students did not pass the quiz with eighty percent accuracy, they were redirected to a similar lesson to review, and then allowed to take the test again.

Traditional assessments require students to memorize information, recall that information for a specific assessment, but do not require students to think, analyze, or apply any newly acquired knowledge. Students are regurgitating, or parroting back, information given to them during instruction. Teachers tend to use traditional assessments based on ease of creating and grading, both of which require less time than creating an assessment that requires a student to think (Chapman & King, 2012, p.24).

For 21st Century Learners to be successful in the present and future, students need to be fluent with critical thinking skills, able to apply knowledge, and know how to self-evaluate one's own performance. Many teachers already use graphic organizers for pre-assessments and during instruction to evaluate individual student progress of the current

content (Struble, 2007). Implementing graphic organizers during assessment would incorporate the process of visual representation in every facet of a student's day actively engaging thinking before, during, and after instruction (Chapman & King, 2012, p.113).

DIFFERENTIATED INSTRUCTION AND ARCS MODEL OF MOTIVATION

Understanding of student learning styles, individual strengths and weaknesses, and motivation towards learning helps a teacher make the instructional materials relevant to the learner. ARCS Model of Motivation relates relevance to the instructional activities to the individual's personal needs in order to meet a goal (Frymier, 2001). Teachers who use data, observations, and analyze student work are the ones in the best place to make decisions pertaining to the instruction individual students need, what type of activities the students are successfully completing, and can observe ways to motivate students in the learning process. Ultimately, teachers are the ones who find themselves responsible for implementing differentiated instruction, spending their time and energy to locate resources, and then organize everything into a usable format (Reis & Renzulli, 1995).

With the instructional method ready to implement, consideration turns to Keller's Model of Motivational Design to assist in making sure students are achieving their fullest potential. Prior to Keller's study of motivation in relationship to student learning, the majority of motivation research was directed at classroom control or reinforcement; however, it did not offer help to the classroom teacher in how to proceed with the actual motivation of students (Keller, 1987).

The shift with the ARCS model finds the expectancy value theory to be very important with respect to the relevancy component. Students who are motivated to perform behaviors, which are personally satisfying, are more likely to positively approach-learning

experiences (Keller, 1987). If students only see one curriculum assignment, and think they are not going to be successful, the goal of engagement is hard to encourage. Making the activity relevant by providing students choices within the assignment, accommodating various ability levels, and modeling during differentiated instruction reinforces the need for individual motivation in learning.

CONCLUSION

Differentiated instruction provides the opportunity for a teacher to reach many students simultaneously. Planning instruction that encompasses various learning modalities and reaches all learning levels, all while maintaining focus on the standards can be time consuming but also rewarding. Classroom instruction exists in many forms, looks different from room to room, but always has a common goal of reaching each student.

Students do not come to us on a level playing field; therefore, it is our job to level the playing field within our classroom using positive approaches to learning. Research has shown differentiated math instruction can be successful. Aligning games, projects, technological instruction, and traditional instruction with given standards, students can use their individual strengths to reach their goal.

Throughout history, starting with the one room schoolhouse, education has undergone changes to meet the needs of students. Whether the goal is teaching a special needs student, challenging a gifted student, or providing a classroom of students with every opportunity possible, differentiated instruction is a way to reach everyone.

CHAPTER 3: METHODOLOGY

"Effective teachers know it is worth their time to gather as much information as possible about each student and not assume anything."
~Chapman and King

INTRODUCTION AND OVERVIEW

This chapter provides an overview of the research methods implemented in this action research study intended to produce a positive increase in student mastery of specific mathematic skills. Due to the parameters of this study, which occurs within a six to eight-week period, the focus was on specific third grade math skills, which represented standards that made up between 20 to 25 questions of a 50-question state assessment according to the blueprint provided by the South Carolina Department of Education.

Instruction was delivered based on the district math instructional model. Explicit Direct Instruction (EDI) consists of starting with a standards-based learning objective, activating prior knowledge, a mini lesson, guided lesson, independent practice, and an active closure. The components are systematic, direct, and engaging which are supported through the differentiated math stations used in the action research study.

As referenced in chapter one, statewide testing drives the overall direction of curriculum instruction occurring in the classroom daily. Teachers must meet the needs of everyone in the class; teach within the given time constraints, while having the constant reminder of state testing looming overhead.

During this action research, the researcher used strategies learned during staff development trainings, shared during team planning, and located during researching differentiated instruction. Strategies used during the study were best suited to each student's learning style, provided different approaches, and provided a framework for further learning.

The researcher chose to implement an action research study based on the method and implications pertaining to educational research for improving classroom instruction through the implementation of differentiated instruction. Adapting differentiated instruction over the traditional whole group instructional method aimed to determine if individual education for all students could exist in a classroom. Using the South Carolina state mandated math standards, lessons and materials were designed and organized to provide instruction to fill gaps in prior instruction, to provide grade level instruction, and allow for additional practice for students who had previously shown mastery of the skill. The researcher was involved in the daily instructional progress, allowing modifications to be made immediately when necessary. The purpose and design of action research allowed the teacher researcher to deal with problems occurring during instruction in the classroom while providing immediate results making it possible for the researcher to understand and improve educational practices (Mertler, 2014, p. 21)

Action research where the teacher is also the researcher, gives power back to the teacher implementing curriculum instruction. The teacher no longer implements a curriculum, designed to be a one size fits all practice; the teacher takes control of the teaching using knowledge gained through practical experience from being in the classroom

(Postholm, 2009). The researcher chooses to be involved in the study, in the development of the instructional materials, and in the actual practice.

Educational practices, materials, research, and experiences are essential components in the careful development of educational philosophy. Dewey (1938) analyzed both the traditional and progressive educational curriculum values and found when evaluated independently neither are sufficient; however, they are essential in creating a connection between the learners' prior knowledge and what is learned (p. 10). The quality of each individual child's education heightened when the educator is reflecting on a continuous basis about the instruction, which previously occurred.

Dewey (1938) focused on the quality of the experience and the continuity of the experience influencing future experiences, which are engaging, enjoyable, and necessary. He stated, "Every experience lives on in further experiences" (p. 27). Thus, the importance of connecting learning experiences for the learner became vital to build a solid learning foundation, which then provides a solid base for many years to come. Quality experiences are wonderful, but in isolation, the full potential of the learning experience is lost. To prevent experiences from occurring in isolation, educators should look at the continuity of the specific experience by referencing prior learning related to the activity, connecting to real life experiences, and foreshadowing of learning to come (Dewey, 1938). The connecting of past, present, and future experiences creates a learning environment which encourages curiosity, stimulates new ways of thinking, and makes learning important to everyday life (Dewey, 1938). Educators who can present learning to individuals in a connected manner, with future intentions stated, enable understanding the reason for

learning the material to the learner. Dewey (1938) goes further when discussing the subject matter:

> One consideration stands out clearly when education is conceived in terms of experience. Anything, which can be called a study, whether arithmetic, history, geography, or one of the natural sciences, must be derived of ordinary life-experiences (p. 73).

As education practitioners are under pressure to improve test scores, differentiate instruction to meet the needs of individual students, and provide an engaging learning experience, reviewing educational research provides teachers with a starting point. Traditionally, research was often conducted by researchers who were somewhat disengaged from the environment. The research was conducted and disseminated to help explain educational issues, answer questions about educational methods of instruction, and processes that occurred during daily student education. With the research removed from the environment being studied, two methods of collecting data were primarily used to provide results. Quantitative research method involved collecting data and the analysis of numerical data (scales, scores, ranking, etc.) (Mertler, 2014, p. 7). The numerical values were then used to draw conclusions about the data collected. Anecdotal records were collected to record findings during small group instruction with the teacher, evaluations of independent work, and responses to exit slips from self-correcting games. These records were used to look for patterns in student learning and common mistakes which occurred.

With changes in education practices came a change in the research method used in the education field. Action research has enabled educators to better manage the task of systematically completing inquires that are directly related to themselves, their classes, and

their schools (Mertler, 2014, p. 4). When a researcher chooses the topic, collects the data, interprets the data, and forms a plan of action, the researcher is empowered with the knowledge and satisfaction of being able to generate action research, which will directly affect future instructional practices thus making the teachers knowledge generators (Dana & Yendol-Hoppey, 2014). Teachers aim to relate classroom experiences with prior knowledge and real-life experiences of their students. Teachers, as researchers choosing to focus on action research topics relating to classroom experiences, makes both experiences even stronger.

ROLE OF THE RESEARCHER

The education of today's children begins behind the scene, long before what is visible in the classroom setting, starting with the education and training of the teachers who are responsible for the day-to-day instructional practices. Teachers who are responsible for curriculum planning and implementation need knowledge of curriculum theory, subject matter expertise, the ability to incorporate instructional practices varied to meet individual need, and be open to support in the form of trainings and workshops (Tjark Huizinga, 2014).

Educators find themselves planning, implementing, and assessing instruction daily while implementing instruction on various subject matters. Becoming a researcher is a natural step for an educator interested in providing the best possible education to all children. The forever-changing methods and teaching strategies introduced to teachers makes mastering or providing consistent instruction difficult. For change to occur in the classroom, the focus can no longer be others evaluating teachers' work, but teachers need

to begin studying their own work with an open mind and willingness to effect change (Postholm, 2009).

For curriculum to be successful, consideration needs to focus all influences that surround the child. Some children come to school equipped with knowledge from life experiences; whereas others may not have had the same opportunities and experiences. In planning curriculum, the one-size fits all method does not work; rather educators need to be open to adapting the chosen curriculum to meet the learning needs of a diverse population. Considerations can include presenting the material in a different order, giving additional explanation of confusing vocabulary or phrases, supplying hands-on materials for investigations, and using available technology for assistance (Corso, 2002). Virtual field trips, classroom speakers and enactors, classroom investigations, historical and cultural artifacts, and photographs can contribute to building a knowledge base for students who otherwise would not be exposed to these experiences.

The role of public schools has changed throughout history starting with the one room schoolhouse. Schools are now responsible for educating the children of the community, providing a safe learning environment, teaching social and coping skills, and developing lifelong learners (Willis, 2016). Effective teachers must take into consideration all aspects effecting students when planning curriculum for the school year.

Through action research, the researcher can validate specific teaching practices by systematically evaluating a singular focus. Using Mertler's four-step action plan for research aided in the research plan development. Choosing the strand in math, which focused on numbers and operations, a variety of activities were organized to meet various levels of student mastery. The organization of activities, computer-based lessons, skill

work, and unit organization was performed ahead of the implementation. Once the pretest was given to all student, the data was collected to aid in the formation of small groups with similar results. When working through the timeline, if a student's placement needed to be altered, the researcher had the option of moving that student. Research and development, which occurs during an action research study, aided the researcher in understanding and better teaching. As a professional, the researcher should be able to plan, develop, assess, and analyze the components of instruction occurring in the classroom (Postholm, 2009).

Action research differs from the research teachers are familiar with by implementing practices while gathering data required at the school, district, and state level. Empowerment came from taking control of the action research, choosing a topic vital to one's own situation, designing a study as an extension of the daily routine in the classroom, sharing the results with colleagues, and in the results achieved through hard work effecting change in student learning (Esposito & Smith, 2006).

During the research process, quantitative data was accessible and easily documented. What happened daily during the instruction needed to be documented in a manner where observations, thoughts, comments, and achievements could be revisited after the study was completed. Taking notes, recording observations and conversations, collecting examples of student work, and reflections on the teaching practices was part of the researcher's responsibility during the study (Postholm, 2009).

PURPOSE OF THE STUDY

As stated in Chapter 1, the purpose of this action research study was to implement mathematic instruction designed to meet the needs of individual students. Yearly classes are formed based on age, similar instruction from the previous year, and when possible the

previous year's test scores. No matter how classes were formed, the students' knowledge levels differed to the point where one size fits all education continuously fails.

Mathematic instructional standards, as well as the methods used to teach the standards, undergo periodic change as to implement reform on how best to teach mathematics. Learning trajectories aligned with specific mathematical domains grouping curriculum, instruction, and developmental appropriateness (Myers, Sztajin, Wilson, & Edgington, 2015). This action research study focused on the domain of numbers and operations including standards under the domain, instructional methods, curriculum, and assessments.

Instead of focusing on memorization, on teaching in a specific order, and maintaining a level of general knowledge; differentiated instruction provided the opportunity to encourage higher order thinking skills. De Jesus (2012) provides the following list of advantages to teaching through differentiation:

- They meet the needs of diverse students with a variety of learning styles.
- They accommodate students with learning disabilities and other types of disabilities.
- It facilitates language learning to student from different cultures such as English Language Learners.
- Differentiated instruction stimulates creativity and helps students understand ideas at high levels of thinking (p. 8).

STATEMENT OF THE PROBLEM OF PRACTICE

Every five years, publishers submit newly designed textbooks to the South Carolina Department of Education for approval. Textbooks approved at the state level are then sent

on to the school districts for the next step in the adoption process. Once a textbook is adopted the strategies observed on the pages within drive instruction.

As established previously in this paper, students do not come to class with the same background knowledge, experiences, or mastery of specific skills. Instead of looking at domain standards in isolation, focusing on learning paths allowed students to build their knowledge base in multiple areas while mastering key concepts (Myers et al., 2015). Learning took place by representing all levels of learning, encompassing the various modalities in learning activities, providing open ended activities, as well as, participating in assessments.

Teachers are responsible for teaching either state or national standards specific to the grade level. The method chosen to reach these goals would be better designed by setting individual learning paths. Individual learning paths set goals for each child instead of one goal for the entire class. This method allowed a child to achieve, and even exceed, goals set versus setting an unobtainable goal.

Implementing differentiated instructional strategies in mathematic instruction provided the opportunity for each child to reach the goal set for the specific domain of study. De Jesus described differentiated instruction as a "philosophy that enables to plan strategically to meet the needs of the diverse learner in today's classroom" (2012). Identification of specific strengths and weaknesses of individual learners provided the researcher with knowledge to modify and adapt instructional materials and methods.

RESEARCH DESIGN

The researcher designed an action research study to cover a six to eight-week time span focusing on the implementation of differentiated instruction to assist third grade

students in mastering specific domain standards or progressing towards mastery at a predetermined rate. The researcher implemented the differentiated instruction with the grade-level place value unit of study leading into addition and subtraction with and without regrouping while problem solving. This is aligned with three of the South Carolina State Standards for third grade math. The first standard includes writing numbers in expanded form to demonstrate an understanding of place value, a building block of mathematics. Once students showed an understanding of place value, this knowledge was used to add and subtract whole numbers fluently. Addition and subtraction were performed using place value blocks, using the traditional method, and through expanded form. Once abstract problems could be solved, students used any of the previous methods to solve one and two-step real world problems using addition and subtraction.

Based on a district baseline assessment, as well as a teacher pretest, four groups were developed within each instructional block. Students were grouped based on the SLO pre-test and math learning progression rubric (Appendixes E and I), which established five performance levels, based on mastery of specific skills related to the place value standards in conjunction with addition and subtraction standards. This grouping was flexible and subject to change as students showed the need for additional instruction, made gains and were ready to move forward, or had shown mastery and were ready to broaden their knowledge base.

The data generated by the SLO pre-test correlated to the math learning progression rubric. Initial groups were formed based on the addition pre-test results. Students scoring at level zero or one on addition began with focusing on decomposing base ten units for addition and subtraction to build a connection between the inverse operations building to

solving addition problems with the base ten blocks. Students scoring a level two on addition began with the base ten blocks in conjunction with written addition problems to make the connection between the concrete and abstract. Students scoring a level three on addition worked with abstract problems using multiple problem-solving strategies. Students scoring level four on addition already mastered multi-digit addition problems and moved on to real-world problems in real-world form. Groups were not set in stone, student mastery in a step in the learning progression (APPENDIX I) move fluidly to the next instruction step. Once mastering the addition learning progression, students moved on to the subtraction learning progression, and once again progressed at their individual rate of mastery.

Differentiated instructional strategies occurred during mathematics stations three days per week for 20 minutes per station (80 minutes within the block of station instruction). Stations included teacher small group instruction, technology, self-correcting activities, and independent practice. Instruction took place as students rotated through different math stations approximately every 20 minutes. The remaining two days were used for assessment and/or school related mandates if necessary, otherwise instructional rotations continued.

During differentiated grouping with the teacher, students received instruction specifically designed to their performance levels on the three mathematics standards being evaluated. The activities included instruction at the conceptual level with manipulatives used to build two-digit numbers with base ten blocks then expanded to practice regrouping and borrowing. Students then illustrated the concept of addition and subtraction through expanded form with base ten blocks and continued to practice with regrouping and

borrowing. For students at the abstract level, the teacher used dry erase boards, number cubes, number lines, and other available resources to provide randomly generated addition and subtraction problems. Once the original problem was solved, students traded boards with another student in the group to check each other's work using the inverse operation. If a disagreement occurred, the two students had to defend their problem solving using mathematical vocabulary to both the other student and the teacher. Students already performing at the instructional level were provided strategies to broaden and extend their knowledge base while solving two-step real-world word problems.

Technology programs and applications offered a broad expanse of resources to use during instruction. Compass Learning, a part of Edgenuity, a mandated program at the district level, had the flexibility for the teacher to assign specific lessons to individual students. The assigned lessons reflected various levels of instruction with oral directions, time for practice, quizzes, and redirecting when quizzes were not passed with an 80% accuracy rate. FASTT Math Next Generation by Scholastic, a second district-mandated program, provided practice for students to have automaticity of mastery addition, subtraction, multiplication, and division facts. Students progressed at individual rates based on their ability to recall facts accurately and quickly. Prodigy was another mathematics program used to encourage students to practice knowledge of addition and subtraction through games and challenging friends. Skill practice on iPads provided games to enhance learning experiences for early finishers.

Independently, students focused on specific skills and strategies to strengthen their progress in the learning progression. During this rotation, student assignments included traditional pencil-paper work, additional practice of skills and strategies work with the

teacher, and/or a multi-day project. Independent assignments were evaluated daily to assess student progress.

Within the small groups, students had the opportunity to interact with other classmates needing additional practice of the same skills. Teacher-made games, self-correcting games, and other activities designed to open channels of communication between students about the learning objectives were used. Students completed exit slips in response to each day's activity, which provided feedback on the experience, as well as, provided an opportunity for students to ask questions in a non-threatening manner.

PARTICIPANTS AND DATA COLLECTION METHODS

Participants in this study include 20 males and 14 females assigned to the researcher's classroom for mathematics instruction, four parents of the original 38 opted out of having their child's data included in this study. Differentiated instruction allowed each student to achieve successfully. Two non-readers were given instruction, quizzes, and assessments orally to ensure the content was being evaluated, not their reading ability. The five ELL students received further explanations, some translations, additional practice, and worked together to help each other when the researcher was not available to provide additional help. The five reading resource students received help in reading and understanding the written questions, specifically when related to mathematical vocabulary. The remaining students were grouped according to their performance on pretests with materials designed for their learning level.

SLO ASSESSMENT

The district requires a baseline assessment for the objectives evaluated using the SLO assessment and unit data. The baseline included questions using concrete items,

concrete items in conjunction with abstract, abstract, and application with word problems. The SLO baseline assessment was given in August per a state mandated timeline of district-mandated assessments for this cohort of students. This assessment was also used as the SLO end-of-year assessment. These assessments included hands-on questions with manipulatives, addition and subtraction problems where manipulatives were available for use, multiple addition and subtraction problems, and a series of word problems and was administered in May at the end of the district timeline before submission of paperwork for teacher evaluation.

The researcher scored the students' SLO pre-assessments using a rubric to determine baseline data for the learning progression. Even though the teacher scored the student work, the SLO excel spreadsheets (APPENDIX E) generated the level at which the student performed at mastery level which was 83%. Students were leveled 0 – 5 with zero being the lowest level and five being the highest. Students who scored a level zero or one were defined as intensive, meaning struggling with the concepts and in need of instruction at the conceptual and abstract stage to move up two levels by the end of the study. Students who scored a level two, performed slightly higher or at a strategic level. These students have basic concepts on the progression chart but are still in need of conceptual based instruction to continue to a level at the abstract level. Level two students needed to move up two levels on the progression chart with the implementation of differentiated instruction. Students who scored a level three on the pre-assessment were considered core, or on grade-level, but struggled with real world problem solving and had a learning progression goal of two levels. Students who scored a four on the pre-assessment were considered at the core level also having mastered an understanding of the concept and were one level from

mastery at the application level. Level five was not given during the pretest but was on the posttest. These performance standards were used to aid in the organizations of groups to provide differentiated instruction to all students.

The researcher analyzed these assessments using descriptive statistics. "Descriptive statistics are simple mathematical procedures that serve to simplify, summarize, and organize relatively large amounts of numerical data" (Mertler, 2014, p. 169). The three categorizes were measures of central tendency, measures of dispersion, and measures of relationship. Measures of central tendency focused on the performance of the whole group using the mean, arithmetic average, of everyone in the research group (Mertler, 2014). Descriptive statistics provided systematic methods for the researcher to communicate findings from the action research study.

The SLO baseline data was collected at the beginning of the study using a district designed pre-assessment focused on the three number and operation standards used for this action research study. Quantitative data was collected throughout the study allowing the researcher to modify and adjust the specific skills, strategies, and lessons to be used with each student. By providing differentiated instruction at the appropriate instructional level, growth targets were obtainable. Using the baseline data growth targets growth goals were determined for each skill in the chosen domain. Differentiation occurred during whole group and small group instruction, during center rotations, and during technology implementation. Anecdotal records and review of completed work assisted in decision making for future lessons.

The SLO post-assessment administered consisted of the four levels given on the pre-test as well as level five. To achieve mastery of a level, the student had to score 83%

or higher as mandated by the district guidelines. The post-assessment was administered at the end of the action-research study and scored by the teacher.

SCHOLASTIC MATH INVENTORY

The Scholastic Math Inventory (SMI) is another district-mandated assessment used to evaluate student progress. This assessment is computer generated in both test items and reports on student learning progression. The math inventory is used to determine readiness for grade level instruction and placement. The assessment has the option for students to hear the questions read aloud in either English or Spanish, which takes reading ability out of the evaluation. Individual student questions adapt to the student response to questions. If a student answers correctly, the questions get progressively harder; whereas, if the student gives an incorrect answer the questions get easier. Once a student incorrectly answers three consecutive questions, the test ends. The adaptability of the program lessens individual student stress while generating a valid and reliable score (Math Inventory, 2014).

SMI generates an instructional planning report, which includes the following information on each student: fact screener, quantile measure, testing time, and normative data including percentile rank, a normal curve equivalent (NCE), and a stanine score. Mertler (2002) explains, NCE is a normalized standardized score with a mean of 50 and a standard deviation of 21.06 to generate a scale score from 0 to 99 (p.3). With a mean of 50 meaning average, the calculation of the NCE provided another source of information to understand student scoring. The stanine scores range from 1 to 9 with a score of 5 representing an average range. The normative data provided a complete picture using three different evaluation methods of the same data.

TEACHER MADE PRE-TEST AND POSTTEST

Due to the fact the SLO pre-test was given at the beginning of the school year and not at the beginning of the research study, a pre-test and posttest for addition and subtraction were developed by the teacher and given prior to the unit of study and at the culmination of the study. Using the same test allowed for the researcher to analyze the changes in the methods students used to solve the problems and improvement in accuracy.

Test items generated for the addition pre-test and posttest were based on the South Carolina state standards for third-grade math. In the support document provided by the State Department of Education to aid in the instructional process, example problems are given. Using the examples, the researcher designed problems parallel to the examples given to ensure the evaluation was appropriate.

INFORMAL AND FORMAL ASSESSMENTS DURING INSTRUCTIONAL PROCESS

The researcher observed the process and took detailed notes during the instructional periods using the mathematics stations. During the action research study, the researcher administered the assessments, scored the assessments, designed the instructional plan for each student, documented instructional strategies and results, and consistently monitored student progression. Daily observations, quizzes, homework, and tests were used to document the progression being made in smaller increments of time.

The researcher looked for themes in the observational note to determine progress toward mastering the standards within the small group. During the station, which students worked with the teacher, notes were taken on the work students turned in with notes about successes and difficulties during the lesson. On the back of the paper, commonalities and differences were recorded once the paper was corrected. Prior to the implementation of

the posttest, the researcher gathered everyone's work together and analyzed the progress. Based on the analysis of the observational notes, students showed improvement in the standards observed with less frequent mistakes and more positive interaction during the small group lesson.

Student Survey and Exit Slips

Understanding the data was vital to determining if students were making progress in their learning. The researcher looked at daily work from the independent station, as well as, the exit slips from the self-correcting games. The researcher evaluated the number of errors made and looked to see if a pattern existed in the errors. Data from the computer program was evaluated either daily or every other day. As the timeline advanced, activities increased in difficulty, based on mastery from the previous day's accomplishments.

Conclusion

Public schools are responsible for educating the children of the community, providing a safe learning environment, teaching social and coping skills, and developing lifelong learners (Willis, 2016). Effective teachers take into consideration all aspects affecting students when planning curriculum for the school year. Differentiated instruction, when well planned and organized prior to the day's instructional time, ensures continuous learning is taking place. In a world where many students are spending large amounts of time playing video games or watching television, the expectation of sitting through continuous whole group stagnant instruction is not likely to be successful. Differentiated mathematics stations allow for movement, changes in stimulation, and helped keep the students' attention, resulting in learning gains.

Mertler (2014) describes that various action research models have similar components even though they may vary slightly during implementation. Researchers begin with an idea or topic in which to focus to generate answers and plans of actions. Whereas in traditional research which found the researcher removed from the natural setting, in action research the researcher may be in the setting or close to observe, monitor, and take notes of the situations occurring. Once the data is collected, the researcher must then analyze and synthesize the information (p. 14). To gain the maximum benefit from the research, researchers may choose to repeat part of the research multiple times with adaptations in the steps and the order of implementation (p.16) where the goal being to use the results to lead to better educational practices and improving the overall education provided (p.23).

This action research study occurred due to the researchers desire to provide each student with a mathematics education strong enough to support future learning. By taking the time to get to know students' prior knowledge, learning style, and depth of prior knowledge, interventions in the form of instructional stations were established. Data was collected continuously throughout the study in the form of teacher observational notes, exit slips completed by students at the end of an activity, correcting of independent work to look for commonalities, and evaluating student performance on computer assignments. Analyzing the data from the action research study provided details supporting the need for differentiated instruction in the classroom.

CHAPTER 4: PRESENTATION AND ANALYSIS OF DATA

OVERVIEW OF STUDY

A free and appropriate education is a benefit of being a citizen of the United States, which sounds amazing as a statement. However, in reality, for the education to be appropriate, educators struggle to meet the individual needs of students placed within their classroom for the school year. In order to meet the needs of each student, educators take the time to learn the strengths and weaknesses of every individual in preparation for instruction and then differentiate the instruction.

This action research project blossomed from this notion. The researcher, in order to reach the needs of the individual students in mathematics, began by researching mathematics instructional strategies designed to provide instruction for each student on their performance level. The result of the researcher's inquiry was the implementation of differentiated instruction during the mathematics instructional block.

As a third grade mathematics teacher, students arrived at the beginning of the year with varying strengths and weaknesses in the area of math. The researcher was part of an instructional team, teaching mathematics to two groups of students during the school day. For this reason, implementing differentiated instruction became the focus of this action research study during the 2017-2018 school year.

The significance of the topic chosen for implementation and study was relevant at the classroom level, the school level, and district level. The school district in which the

research study took place requires differentiated instruction during the Language Arts block of instruction. Teachers have been exposed to multiple professional development sessions focusing on Language Arts. As a mathematics teacher, I felt instruction during the math instructional block would better accommodate students if approached with the same intensity and integrity. Evaluating the growth of students from the beginning of the study to the end when differentiated instruction was taking place. This data was then shared with the site administrator to show the importance of providing the same intense, focused, instruction during mathematics are critical.

INTERVENTION/STRATEGY

During this action research study about the effect of differentiated instruction on the individual student gain, the intervention/strategy was the application of differentiated instruction. The students completed a pretest evaluating their existing knowledge on the three math standards that provide the framework for all number and operation standards. Based on the data collected students were grouped according to their previous knowledge.

Students rotated through four stations either all in one day or in a combination of two days when necessary. Within each station, the activities varied to best meet the needs of each group. Grouping was flexible to acknowledge students mastering skills and allowing individuals to progress at their own pace. The movement of a student from one group to another or a group's movement from one level to a higher level of instruction was based on the researcher's observations, completion of work with an 80% or better accuracy rate, computer assignments completed and passed with an 80% accuracy or better, and on the comments/questions on the exit slips.

On days when mathematics instruction did not start or include rotations, students would immediately begin asking when stations would start, or if we could stop what we were doing and do rotations instead. Explaining to the students the reason for not doing rotations would result in several sad faces.

RESULTS

Using the district pre-test, baseline data was collected on number identification with base ten blocks, basic fact addition, basic fact subtraction, addition and subtraction using base ten blocks, abstract addition and subtraction, and two-step problem solving with addition and subtraction. The action research study began with thirty-nine students. Due to attrition and parental non-consent for their child's data to be used in the study, 34 students' scores and data were used for the remainder of the action research report.

The implementation of the district-mandated assessments occurred within a window of time set by the school district. All assessments must occur within a timeframe for each child. The SMI assessment is completed on the computer where the SLO assessment is traditional completed using pencil and paper. The SLO assessment is designed to evaluate specific standards as mandated by the district; whereas, the other assessment may cover standards from various levels based upon the individual student achievement.

Throughout the intervention, data collection continuously occurred during the implementation of the rotations, during mathematics instruction with exit slips, teacher observations, evaluation of independent work, and completion of computer lessons, quizzes, and tests. Exit slips were given when students were working on self-correcting games or when using task cards. Teacher observation occurred throughout the rotations,

but even more specifically when students were working in direct contact with the teacher in small group. Independent work was collected and checked daily then used to guide instruction the following day based on common misunderstandings and procedures.

SLO ASSESSMENT ANALYSIS

The SLO assessments, which was administered at the beginning and end of the year, allowed the teacher to conference with the individual child after scoring since it is completed in a pencil-paper format. The SLO assessment administered at the beginning of the year provided information for grouping students based on need of reteaching during differentiated instruction that occurred through the math stations.

The improvement within the SLO levels of addition evaluated supported the action research study question that differentiated instruction transfers to student gains in mastery. The subtraction evaluation showed progress, but not as much as within the addition section. Common mistakes in subtraction included subtracting from the bottom up in the ones-column, borrowing from the tens-column incorrectly, and basic subtraction mistakes due to not having an automaticity of basic facts.

The SLO pre-test revealed 68% of the students tested preformed below grade level, or below core, in the area of addition and 97% of the students performed below grade level, or below core, in the area of subtraction. According to the SLO pre-test, students performing at the emerging, intensive, and strategic level were considered to be performing below a third-grade level, otherwise known as the core, at the beginning of the school year. Students performing at core level three were considered to have mastered the necessary skills to be ready to begin instruction at the third-grade instructional level.

After implementing the intervention practice of differentiated instruction, student performance on the posttest showed an increase in both areas, but specifically in the area of addition. Subtraction showed an increase in performance level, but not to the core level for third grade.

The pre-test in addition revealed 68% of the students performed below the core level for third grade. With the implementation of the intervention, there was a 59% decrease of students performing below the expected core instructional level on the posttest. Three students performed at the strategic range after the intervention was in place; two of the students were diagnosed with ADD and not on their medication the day of testing and the remaining student was an ESOL student.

The pre-test in subtraction revealed 97% of the students performed below the core level for third grade before the intervention was implemented. With the implementation of differentiated instruction, 65% of the students were still below the core level, but there was movement within the three levels, and there was a 32% increase in student performing at or above the core level.

TABLE 4.1

SLO PRE-POSTTEST RESULTS

	Addition		Subtraction	
	Pretest Number & Percentage	Posttest Number & Percentage	Pretest Number & Percentage	Posttest Number & Percentage
LEVEL 0: EMERGING	2 - 6%	0 – 0%	10 – 29%	2 – 6%

LEVEL 1: INTENSIVE	6 - 18%	0 – 0%	17 – 50%	13 – 38%
LEVEL 2: STRATEGIC	15 - 14%	3 – 9%	6 – 18%	7 – 21%
LEVEL 3: CORE	10 - 29%	9 – 26%	1 – 3%	4 – 11%
LEVEL 4: CORE	1 - 3%	19 – 56%	0 – 0%	7 – 21%
LEVEL 5: ABOVE AVERAGE	0 – 0%	3 – 9%	0 – 0%	1 – 3%

SCHOLASTIC MATH INVENTORY

The second district-mandated evaluation assessment is the Scholastic Math Inventory (SMI). The SMI is a computer-generated math inventory completed by students throughout the school year. The computer technology allows the assessment to generate questions, which decrease in difficulty when a question is missed, or increase in difficulty when students answer correctly. The third grade goal range is 431-610 by the end of the school year. The test given at the beginning of the year to provide baseline data used in conjunction with other assessments to help group students for differentiated instruction.

The SMI content validity is based on the alignment of the content of the items with specific standards (Houghton Mifflin Harcourt, 2014). Houghton Mifflin Harcourt designed the SMI to evaluate and track student progress over time. The Instructional Planning report places students in performance levels, provides instructional recommendations, and provides a data base teacher can access for suggestions to promote student learning (Houghton Mifflin Harcourt, 2014). Matching the items with the standards in order to measure academic readiness aids in the content validity of using SMI to help in the development of individual learning paths. Since the assessment is computer-adaptive, instead of every student taking the exact same test, the reliability increases.

The SMI computer-based assessment looks at ranges with the ranges increasing as the grade levels increase. Based upon the score generated by the computer, students are rated as above average, core, strategic, and intensive. The initial implementation showed 45% of the students tested scoring below grade level while the second implementation showed 8% performing below grade level. The movement within the areas indicated students made progress with the implementation of differentiated instruction.

TABLE 4.3

SMI – SCHOLASTIC MATH INVENTORY RESULTS

	Fall Implementation		Spring Implementation	
	Number	Percentage	Number	Percentage
INTENSIVE	5	15%	0	0%
STRATEGIC	9	26%	1	3%
CORE	16	47%	19	56%
ABOVE AVERAGE	4	12%	14	41%

The SMI assessment is mathematics skills that build in difficulty and are not grade level specific. The table shows the student growth over all with the core level representing the goal of 431-610, strategic and intensive include below grade level standards while above average includes standards above the third-grade level. This table shows the overall growth which was broken down in more detail in the analysis.

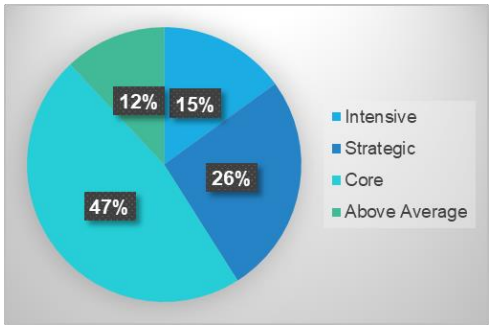
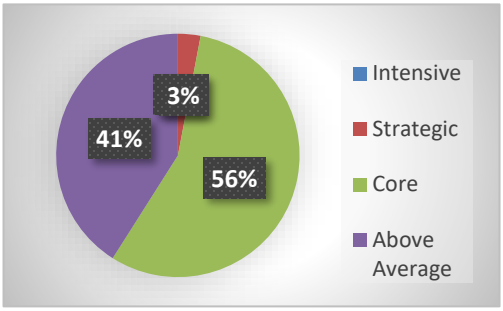
Fall Implementation	Spring Implementation
	

Figure 4.1 SMI Comparison between Fall and Spring Scores

TEACHER MADE PRE-TEST AND POSTTEST

In order to increase the reliability and validity of the teacher made test, the researcher used the third grade math standards and resources available on the South Carolina Department of Education, SCDE, and website. The SCDE website provided examples of test items for the standards as might be seen on the end of year state assessment. The test differs from the SLO assessment as it focuses on the third grade outcome goals in order to prepare for the state assessment.

The researcher constructed the pretest and posttest used during the time of the intervention implementation. One test was created for addition and one for subtraction as was with the SLO assessment. Following the implementation of the intervention and prior to state testing, problems were integrated to allow students time to move fluidly from one action to another.

In order to increase the reliability and validity of the teach made test, the researcher used the third grade math standards and resources available on the South Carolina Department of Education website.

TABLE 4.2

TEACHER MADE PRE-POSTTEST

	Pretest		Posttest	
	Number	Percent	Number	Percent
Addition Vocabulary	14	41%	29	85%
Two-Digit Addition	10	29%	31	91%
Three-Digit Addition	8	24%	28	82%
Real World Problem Solving With Addition	0	0%	11	32%
Two-Digit Subtraction	6	18%	24	71%
Three-Digit Subtraction	0	0%	19	56%
Real World Problem Solving With Subtraction	0	0%	16	47%

STUDENT SURVEY AND EXIT SLIPS DURING UNIT

Student surveys and exit slips that were collected throughout the intervention of the math stations provided insight into the individual students thinking and their continued questions, which may not have been asked during a whole group lesson and discussion.

The engagement survey focused on math engagement, preference of independent or group work, and method of completion of mathematics assignments. In this survey, the options for answering were never, sometimes, usually, and always. Thirty-three students completed the survey in 2017– 2018 along with the question about how to be successful in math.

Table 4.4

MATH ENGAGEMENT SURVEY RESULTS

	Never	Sometimes	Usually	Always
I like problem-solving activities in math.	2	8	6	17
I am good at problem-solving activities in math.	2	9	17	5
I prefer to work in a group for math activities.	1	8	4	20
It is easy for me to complete individual assignments without assistance.	5	13	14	1
I feel comfortable answering questions aloud during math class.	8	6	9	9
I learn best when the teacher uses manipulatives.	0	3	11	19
I enjoy using a computer to practice math.	3	6	10	14

Overall data from student surveys and exit slips revealed students felt they were better mathematics students after the intervention. The few who notated they did not feel as good about their mathematics abilities stated, “Subtraction was much harder than addition,” “the two step word problems were difficult to solve because I didn’t know whether to add or subtract,” and “I needed more help where I was confused about the steps to use.” Students who struggle with math concepts across the board generated these statements. In alignment with the self-evaluation as a mathematician, the enjoyment of

mathematics would rise or fall in relationship with the feelings about themselves as a learner.

Students indicated they preferred to work in groups rather than independently. While talking with one particular child, who tended to choose to work on his own but, indicated he, preferred groups, he clarified with the statement, "Two is a group, and I like working with a partner not a large group." A student who overheard our conversation pipped up with, "It depends on who is in the group because some of our classmates don't take their work seriously." Later in another discussion, another student stated, he preferred to work alone because his classmates just wanted the answers. Manipulatives proved to be the preferred method of solving problems among the students with reasons being, "Manipulatives make it harder to be wrong," "Manipulatives make math fun," and "When I am confused, I can work out the problem with the manipulatives."

Information about technology use, which was gathered through observation and conversation with students, revealed mixed feeling about using computers during the rotations. Since students are always asking to use the computer and iPads, I had to ask for some reasons why. Student responses included, "Compass is a boring program," "I would rather play fun games during the computer rotation than complete assignments where I am graded," and "Prodigy is what we like doing but you don't let us play it enough." After further class discussion, students liked the computer when instruction was given in a game format versus the lesson format.

SUPPLEMENTAL ANALYSIS OF DATA

The difficulty with computer-based assessments occurred because students were not taught test-taking strategies on the computer, teaching takes place with pencil and

paper. The method of delivery on the computer did not allow students to implement the strategies learned in class, even though pencil and paper were provided for the testing. Instead of transferring the problem to the pencil and paper, students look at the answers and choose which one they thought would be best. Questions and answers were not always visible on the same page, the wording of the questions was sometimes confusing, and alternate vocabulary confused the test takers. The most frustrating observation this researcher came across this year pertained to a student going through and clicking answers in a pattern format without taking the time to read or work out any problems. After the implementation, the researcher approached the child and asked for an explanation. "My big brother said to make a pattern on any of the tests and I will do okay," was the response given. Where did this thought process come from with our students?

SUMMARY

Providing individualized instruction to students within the number and operations standard produced data to support the need for differentiated instruction in the classroom. Varying the activities within the rotations helped maintain student focus on the instructional material. Based on the survey and comments about using the computer for practice, the researcher looked for other programs to maintain attention and produce better results.

The action research study generated data that when analyzed provided evidence to support the use of differentiated instruction to meet the needs of the individual students within the classroom. During the spring implementation of the SMI, given after the intervention, only 3% of the students scored strategic with 97% scoring core or above average. On the SLO posttest the addition results revealed 9% of the students scoring in

the intensive range and 91% scoring within core or above average range. The subtraction results for the SLO posttest were not as strong with 44% scoring intensive, 21% scoring strategic, 35% scoring core or above average. On the teacher made test used immediately prior to the intervention and immediately following the implementation, students scored similarly to the SLO posttest with better results in the addition area than in the subtraction.

CHAPTER 5: DISCUSSIONS, CONCLUSIONS, AND RECOMENDATIONS

OVERVIEW OF THE STUDY

The action research study was a result of students not performing up to standard in the number and operations strand on state mandated tests. Students in third grade begin building a framework for math instruction to come as they continue their education. Without a strong base in numbers and operations, future learning and mastery of more complex skills could be jeopardized. For this reason, this action research study was designed to meet the needs of individual students by using various instructional strategies and modalities to increase student mastery at the third grade level.

The significance of this action research study was to reveal the success of using differentiated instruction in mathematics to meet the needs of individual students. Providing instruction using different methods, at various instructional levels, and in smaller groups created an atmosphere in which students were more comfortable, more successful, and more likely to ask questions leading to a stronger understanding of the numbers and operations strands. Differentiated instruction goes against the traditional method of whole group instruction and practice. In whole group instruction, instructors cannot monitor a group of students consistently to be able to pinpoint the time at which mistakes are occurring. This was the point when confusion set in or understanding was completely off base. Through differentiated instruction, the teacher strived to ensure that all students could be successful and make gains.

The theoretical framework for this action research study began with the researcher's belief and philosophy that all children are capable of learning and succeeding when provided with the right opportunities. Students do not enter a classroom with the same backgrounds educationally, emotionally, or physically. Students do not all think the same which means they do not learn the same. Providing an appropriate education required the action researcher to get to know the students on a personal level, gather data to find a beginning point for instruction, and find the best way to motivate each individual to take responsibility for learning. The creation of rotating mathematics stations, which contained varied activities for the different groups, provided the students with the opportunity to feel success, which resulted in further successes during the action research study.

The researcher began instruction at the skill level where students showed success on the pre-test and the point of the skill where success began to fade. The decision to start between these two points focused on providing initial success for the student while challenging and building content knowledge at an appropriate pace.

After the initial evaluation from which the instructional starting point was decided, daily evaluation of successes and struggles occurred through teacher observation, exit slips, independent practice completion, and computer assignment scores. Small groups were not stagnant, but changed periodically, as individual students made gains and were ready to move on. With the constant rotation and movement of students, there was not a feeling in the classroom of failure. Data was analyzed continuously to create a fluid learning environment for all students.

The action research study resulted in 78 percent of the students meeting their goal on the posttest SLO assessment and 94 percent of the students scoring at or above grade

level expectations on the state mandated end of the year test. The overall success of the students suggested that differentiated instruction provided students with the opportunities needed to be successful.

The implementation of the South Carolina Ready Assessment (SC READY) followed the end of the action research study. Scores previously discussed were based on classroom assignments or district mandated assessments. SC READY is the state-mandated, end of the year computer-based assessment. The assessment requires students to be able to manipulate between screens, as well as, scroll up and down to see all possible answers. Students were rated in four categories: exceeding expectations (EE), meeting expectations (ME), approaching expectation (AE), and did not meet expectation (DNME).

The results of the 2017-2018 implementation of the SC Ready assessment became available immediately prior to the submission of this action research study. These support the findings from the assessments, surveys, exit slips, and observations that occurred as part of this study.

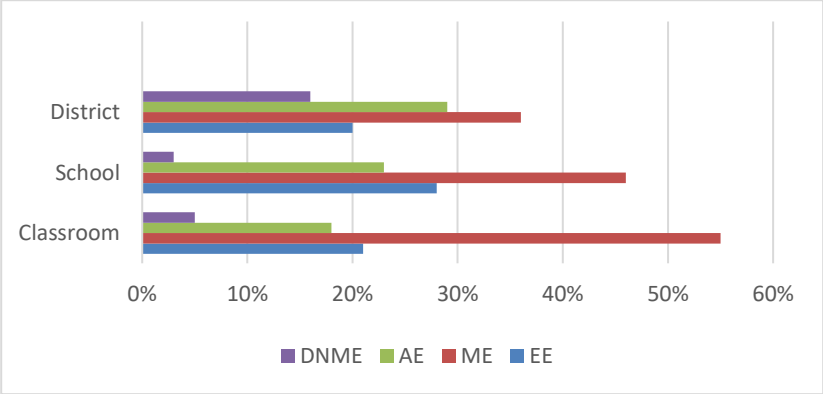


Figure 5.1 2018 State Assessment Results

RESULTS RELATED TO EXISTING LITERATURE

Education theorists and educational theories have shaped the education system into what it is today. Over time, standards changed, methods used to provide instruction adapted, and expectations elevated; however, teachers and researchers continue to refer to the same theorists and theories stated many years ago.

This action research study consisted of blending many of the ideas generated by theorists to create the best possible learning environment for the students. Piaget and the constructivist movement lean toward individuals learning through doing and building upon previous knowledge. To help students master addition and subtraction, the concept of place value was built upon. Adding in the socio-cultural thoughts about learning while working with others, students had the opportunity to work with classmates in at least one of the rotations, if not two. Learning to work together in an appropriate manner prepares students to be responsible engaged citizens within the community. Dewey and the progressive movement provided support for teachers to allow students to be creative. Not all students learn alike, therefore the chances of them demonstrating the mastery of new knowledge in the same way are minimal. In the differentiated rotations, students were taught multiple methods to solve addition and subtraction problems then given the opportunity to solve problems using creative approaches. Students were more receptive to the assignments when they had some say in the decision-making.

Thomlinson (2001) and Gardner (2014) both approached learning in respect to individuality through the process and products. Gardner's theory of multiple intelligences opened up opportunities for students to demonstrate their knowledge in a meaningful way. Differentiated instruction is an education method used to allow this to happen.

PRACTICE RECOMMENDATIONS

The information garnered from the action research study indicated the positive effect differentiated instruction had on student success. Using various data points, all students improved in some aspect during the action research study. The inclusion of differing evaluation points allowed the researcher to comprehend how each student progressed.

This researcher would suggest lengthening the time of the study implementation and expanding the execution of differentiated instruction to include all aspects of mathematical instruction. Based on the concise study and positive results, the researcher inferred additional progress would be made in both classes and additional third grade classrooms. Presentation of the findings to colleagues and administration should encourage everyone to implement differentiated instruction. Encouraging staff to attend professional development opportunities at the school, district, and state levels, as well as, opportunities through national organizations would allow teachers to understand the impact of differentiated instruction in a larger capacity.

Transferability to other classrooms and content areas is possible with teacher focus being student improvement. The subject content would affect the methods and procedures for implementation; however, construction of the building levels of instructional content is available. Teachers need to consider the learning styles of students in both their presentation of the content material and student methods of proving content mastery. PLCs would offer teachers the opportunity to immerse themselves in differentiated instruction with a support base for ideas and implementation. This would also allow for the sharing of materials, and would lessen the stress aligned to finding or creating activities.

Differentiated instruction does not occur in one form for all areas but is limited only by teachers' willingness to step outside of the traditional teaching methods using a designed curriculum.

LIMITATIONS OR SUGGESTIONS

Although the results of the study were positive, the number of students affected was limited as was the timeframe in which the study occurred. The researcher's suggestion would be to conduct the research with a larger scale of students. The students within this study did not include any students identified as gifted learners or any students receiving self-contained instruction in mathematics. The effect on the highest and lowest performing students within the grade level would strengthen the importance of the study and provide support as to the transferability of the teaching strategy. Widening the scope of students and number of teachers included in the study would provide additional information. Additionally, the researcher would include additional mathematics standards in the study over a longer course of time. Broadening the focus of the research would allow for further opportunities to support the use of differentiated instruction in the classroom.

The time of year (Spring 2018) in which the study occurred was not the prime time of the school year to implement a new instructional strategy. Preparing for and beginning the year with differentiated methods of instruction in place, would allow for a continuous evaluation of the process and product.

RECOMMENDATIONS FOR FUTURE RESEARCH

The findings of this action research study provided enough positive results to lend itself to be implemented with future students, a larger group of students, and in various classroom settings. As stated in the recommendation section, the increased instructional

time devoted to the use of differentiated instruction, the use of differentiated instruction for all mathematics standards, and increasing the number of students impacted would be the priority of the researcher. Continuing the method of research in the future would provide opportunity for the sustained development of instructional materials, the identification of available software, and the strengthening of the researcher's data collection methods.

SUMMARY

This action research study was the first completed by this researcher. The overall experience and results were enlightening and encouraging enough for this researcher to continue using differentiated instructional methods within the classroom for the benefit of present and future students. The results of the implementation of differentiated mathematics instruction had a positive effect on student performance and teacher satisfaction with instruction.

Reflecting upon the outcome of the action-research study brought forth questions about individual student movement within the learning progression for the standards. The present study did not document individual student movement other than the results. To strengthen classroom instruction in the number and operation standards as well as other mathematic standards, a chart(s) will be created showing each standard broken down with the levels of the learning progression. As students master a certain level, the date of mastery will be recorded on the chart. Mastery of the skill can be gleaned through teacher observations, quick checks, or quizzes and the final assessment. The chart ultimately becomes the basis for each days lesson and who is served in each group reducing the planning and documentation frustrations often occurred by teachers when implementing differentiated instruction.

REFERENCES

Adams, M., Blumenfeld, W., Castañeda, C., Hackman, H., Peters, M., & Zúñiga, X. (Eds). (3rd ed). (year). *Readings for Diversity and Social Justice: An Anthology on Racism, Antisemitism, Sexism, Heterosexism, Ableism, and Classism* (pp. 21-35). New York, NY: Routledge.

Aas, Marit. (2014). Towards a reflection repertoire: using a thinking tool to understand tensions in an action research project. *Educational Action Research*, 22(3), 441-454.

Avalos, B. (2011). Teacher professional development in teaching and teacher education over ten years. *Teacher and Teacher Education,* 27, 10-20.

Bagley, W. (1939). The significance of the essentialist movement in educational theory. *The Classical Journal, 34*(6), 326-344. Retrieved from http://www.jstor.org.pallas2.tcl.sc.edu/stable/3290875

Bakar, K. A., Ayub, A. F. M, Luan, W. S., & Tarmizi, R. A. (2009) Exploring secondary school students' motivation using technologies in teaching and learning mathematics. *Procedia Social and Behavioral Sciences, 2*, 4650-4654.

Bell, L.A. (2013). Theoretical foundations. In Adams, M., Blumenfeld, W., Castañeda, C., Hackman, H., Peters, M., & Zúñiga, X. (Eds). (3rd ed). *Readings for Diversity and Social Justice: An Anthology on Racism, Antisemitism, Sexism, Heterosexism, Ableism, and Classism* (pp. 21-35). New York, NY: Routledge.

Bender, W. (2012). *Differentiating instruction for students with learning disabilities.* Thousand Oaks, CA: Corwin.

Buoncristiani, M., & Buoncristiani, P. E. (2012). *Developing mindful students, skillful thinkers, thoughtful schools*. Thousand Oaks, California: Corwin Press.

Chen, S., & Herron, S., (2014). Going against the grain: Should differentiated instruction be a normal component of professional development. *International Journal of Technology in Teaching and Learning,* 10(1), 14-34.

Corso, R. M. (2002, Jan-Feb) Honoring diversity in early childhood educational materials. *Teaching Exceptional Children,* 30-36. Retrieved from http://www.ced.sped.org/Content/NavigationMenu/Publlications2/TEACHING ExceptionalChildren/default.htm

D'addato, T. & Miller, L. (2016). An inquiry into flipped learning in fourth grade math instruction. *Canadian Journal of Action Research,* 17(2), 33-55.

Dana, N.F. & Yendol-Hoppey, D. (2014). *The Reflective educator's guide to classroom research.* Thousand Oaks, CA: Corwin.

De Jesus, O. N. (2012) Differentiated instruction: Can differentiated instruction provide success for all learners? *National Teacher Education Journal,* 5(3), 5-11.

Dewey, J. (1938). *Experience and education.* New York, NY: Free Press.

Diversity. (n.d.). In *Merriam-Webster Dictionary online*. Retrieved March 20, 2016, from http://www.merriam-webster.com/dictionary/diversity

Drake, S.M. *(2012) Creating standards-based integrated curriculum.* Thousand Oaks, California: Corwin.

Esposito, J., & Smith, S. (2006). From reluctant teacher to empowered researcher: One teacher's journey toward action research. *Teacher Education Quarterly*, *33*(3), 45-60.

Ford, J. [TEDxEMU]. (2012, April 11). *Pedagogy of privilege*. [Video File]. Retrieved from http://www.youtube.com/watch?v=JW9eyN924Q

Galvan, M. E., & Coronado, J. M. (2014). Problem-based and project-based learning: Promoting differentiated instruction. *National Teacher Education Journal*, *7*(4), 39-42.

Giaimo-Ballard, C. & Hyatt, L. (2012). Reflection-in-action teaching strategies used by faculty to enhance teaching and learning, *Networks*, 14(2), 1-11.

Gorlewski, J. A, Porfilio, B. J, & Gorlewski, D. A. (2012) *Using standards and high stakes testing for students: exploiting power with critical pedagogy.* New York:

PETER LANG. Hidden curriculum (2014, August 26). In S. Abbott (ED.), The glossary of education reform.

Hlavac, Esq., George C. & Easterly, Esq., Edward J. (2015, April). FERPA primer: the basics and beyond. *NACE Journal.*

Kapusnick, R. A. &Hauslein, C. M. (2001) The 'silver cup' of differentiated instruction. *Kappa Delta Pi Record,* 37(4), 156-159. http://doi.org/10.1080/0228958.2001.10518493

Keller, J. M. (1987). Development and use of the ARCS model of motivational design. *Journal of Instructional Development,* 10(3), 2-9.

Kostos, K., & Shin, E. (2010) Using math journals to enhance second graders' communication of mathematical thinking. *Early Childhood Education Journal,* 38(3), 223-231.

Marks, D. B. (2013). Inquiry based learning: What's your question? *National Teacher Education Journal,* 6(2), 21-25.

Martin, L.A. (2008). Examining the pledge of allegiance. *Social Studies.* 99(3). 127-131.

Mertler, C. A. (2002). *Using standardized test data to guide instruction and intervention.* College Park, MD: ERIC Clearinghouse on Assessment and Evaluation. (ERIC Document Reproduction Service No. ED470589)

Mertler, C. A. (2014). *Action research: Improving schools and empowering educators.* Thousand Oaks, CA: Corwin. Minarechova', M. (2012). Negative impacts of high-stakes testing. *Journal of Pedagogy, 3*(1), 82-100. doi:http://dx.doi.org/10.2478/v10159-012-0004-x

Murphy, J. T . (2013). The unheroic side of leadership. In M. Grogan (Ed.), *The Jossey-Bass Leader on Educational leadership* (pp. 28-39). San Francisco: Jossey-Bass, A Wiley Imprint.

Myers, M., Sztajn, P., Wilson, P. H., & Edgington, C. (2015). From implicit to explicit: Articulating equitable learning trajectories based instruction. *Journal of Urban Mathematics Education*, 8(2), 11-22.

Null, J. W. (2007). William C. Bagley and the founding of essentialism: An untold story in American educational history. *Teachers College Record, 109*(4), 1013-1055.

Peters, J. (2009). Reflective practice and a process called "Levelising", *The International Journal of Learning,* 16(5), 79-89.

Popham, W. J. (2001, March). Teaching to the test? *Educational Leadership, 58*(6), 16-20. Retrieved from http://www.ascd.org/publications/educational-leadership/mar01/vol58/num06/toc.aspx

Postholm, M. B. (2009). Research and development work: developing teachers as researchers or just teachers? *Educational Action Research, 17*(4), 551-565. doi:10.1080/09650790903309425

Reich, G. A. & Bally, D. (2010). Get smart: Facing high-stakes testing together. *Social Studies, 101*(4), 179-184. doi:10.1080/00377990903493838

Reis, S. M., & Renzulli, J. S. (1995). Curriculum compacting: A systematic procedure for modifying the curriculum for above average ability students. *The Journal of the California Association for the Gifted*, *26*(2), 27-32. http://gifted.uconn.edu/schoolwide-enrichment-model/curriculum_compacting/

Reis, S. M., & Renzulli, J. S. (1992). Using curriculum compacting to challenge the above- average. *Educational Leadership*, *50*(2), 51-57.

Rogers, K. B., & Kimpston, R. D. (1992). Acceleration: What we do vs. what we know. *Educational Leadership*, *50*(2), 58-61.

Stamps, L. S. (2004). The effectiveness of curriculum compacting in first grade classrooms. *Roeper Review,* 27(1), 31-41. DOI: 10.1080//02783190409554286 Student Learning Objectives. (2016, June 19). Retrieved from: http://ed.sc.gov/educators/educator-effectiveness/measuring-student-growth/slo/

Star, J.R. (2016). Improve math teaching with incremental improvements. *Phi Delta Kappan,* 97(7), 58-62.

Tjark Huizinga, A. H. (2014) Teacher involvement in curriculum design: Need for support to enhance teachers' design expertise. *J. Curriculum Studies,* 33-57. DOI:10.1080/00220272.2013.83407

Thomlinson, C. (2001). *How to differentiate instruction in mixed ability classrooms* (2nd ed.). Alexandria, VA: Association for Supervision and Curriculum Development.

Trinter, C. P., Brighton, C. C., & Moon, T. R. (2015). Designing differentiated mathematics games. *Gifted Child Today,* 38(2), 88-94. doi: 10.1177/1076217514568560

Van de Walle, J., Karp, K., Lovin, L., & Bay-Williams, J. (2014). *Teaching Student-Centered Mathematics*. Upper Saddle River, NJ: Pearson Education, Inc.

Washburne, C. (1953). Adjusting the program to the child. *Educational Leadership,* 138-147. Retrieved from http://www.ascd.org/ASCD/pdf/journals/ed_lead/el_195312_washburne.pdf

Watts-Taffe, S., Laster, B. P., Broach, L., Marinak, B., Connor, C., & Walker-Dalhouse, D. (2012). Differentiated instruction: Making informed teacher decisions. *The Reading Teacher,* 66(4), 303-314.

Webb, L. & Scoular, T. (2011). Reflection on reflection: Collaboration in action research, *Educational Action Research,* 19(4), 469-487.

Weber, L. (2010) (2nd ed). *Understanding race, class, gender, and sexuality*. New York, NY: Oxford University Press.

Willis, B. C. (2016). Using the criticism of public schools for constructive purposes. *Elementary School Journal,* 13-23. Retrieved from http://www.jstor.org/stable/999043

Young, I.M. (2013). Five faces of oppression. In Adams, M., Blumenfeld, W., Castañeda, C., Hackman, H., Peters, M., & Zúñiga, X. (Eds). (3rd ed). *Readings for Diversity and Social Justice: An Anthology on Racism, Antisemitism, Sexism, Heterosexism, Ableism, and Classism* (pp. 35-45). New York, NY: Routledge.

Xunzi. (n.d.) AZQuotes.com. Retrieved January 18, 2016, from AZQuotes.com Web site: hppt://www.azquotes.com/author/3026-Xunzi

APPENDIX A – SLO PRE-TEST

Third Grade
SLO Pre-Assessment
Adding Whole #s with Place Value Strategies

Name: _____

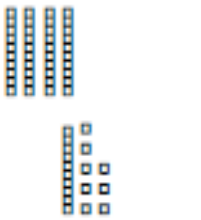
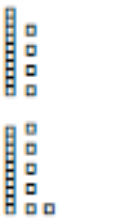
Level 1
Write the number represented by each picture.

1.)  ____	2.)  ____	3.)  ____

Provide the answer for the following.

4.) 8 +5	5.) 7 +4	6.) 6 +3
7.) 3 +4	8.) 9 +8	9.) 7 +6

Level 2
Solve.

1.) 	2.) 	3.) 
4.) 	5.) 	6.) 

Level 3

Solve.

1.) 325 + 428	2.) 127 + 302	3.) 123 + 321
4.) 119 + 221	5.) 819 + 481	6.) 154 + 432

Level 4

Solve.

1.) Marcus had 45 Pokemon cards. Ahem gave Marcus 17 new Pokemon cards. How many Pokemon cards does Marcus have now?

2.) Mike has 912 marbles. Nancy gives him 143 more marbles. How many marbles does he now have ?

3.) Frances had 780 quarters in his bank. She received 125 quarters from her grandmother. How many quarters does she have now ?

4.) There are 27 pine trees in the park. Park workers will plant 18 more pine trees today and 31 more pine trees tomorrow. How many pine trees will the park have when the workers are finished ?

Third Grade
SLO Pre-Assessment
Subtracting Whole #s with Place Value Strategies

Name: _____

Level 1
Represent the following numbers using base ten blocks.

Draw a  to represent 10. Draw a ◘ to represent a unit.

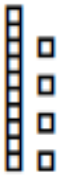
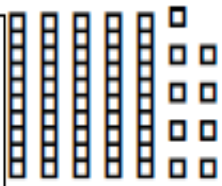
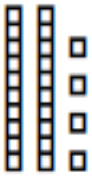
1.)	2.)	3.)
34	15	28

Provide the answer for the following.

4.)	5.)	6.)
15 - 8	11 - 5	13 - 7
7.)	**8.)**	**9.)**
16 - 8	12 - 4	19 - 9

Level 2

Solve.

1.) 49 - 15 	2.) 32 - 24 	3.) 47 - 10 
4.) 14 - 8 	5.) 59 - 32 	6.) 24 - 17 

Level 3

Solve.

1.) 806 - 704	2.) 906 - 328	3.) 685 - 214
4.) 555 - 456	5.) 1,321 - 408	6.) 2,988 - 809

Level 4

Solve.

1.) Carter's high school played 47 basketball games this year. He attended 17 games. How many basketball games did Carter miss?

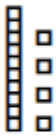
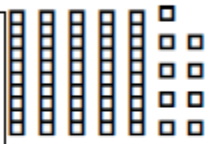
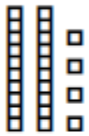
2.) Richard's apple orchard grew 884 apples in the past two months. 399 of those apples were grown this month. How many apples were grown last month?

3.) The school library bought 1,004 new books in the last two years. 170 of those books were bought this year. How many new books did the library buy last year?

4.) Vanessa's coffee shop sold 1,620 cups of coffee on Monday and Tuesday combined. 897 of the cups were sold on Tuesday. How many cups did the shop sell on Monday alone?

Level 2

Solve.

1.) 49 - 15 	2.) 32 - 24 	3.) 47 - 10 
4.) 14 - 8 	5.) 59 - 32 	6.) 24 - 17 

Level 3

Solve.

1.) 806 - 704	2.) 906 - 328	3.) 685 - 214
4.) 555 - 456	5.) 1,321 - 408	6.) 2,988 - 809

Level 4

Solve.

1.) Carter's high school played 47 basketball games this year. He attended 17 games. How many basketball games did Carter miss?

2.) Richard's apple orchard grew 884 apples in the past two months. 399 of those apples were grown this month. How many apples were grown last month?

3.) The school library bought 1,004 new books in the last two years. 170 of those books were bought this year. How many new books did the library buy last year?

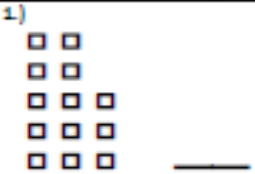
4.) Vanessa's coffee shop sold 1,620 cups of coffee on Monday and Tuesday combined. 897 of the cups were sold on Tuesday. How many cups did the shop sell on Monday alone?

APPENDIX B – SLO POST-TEST

Third Grade
SLO Post-Assessment
Adding Whole #s with Place Value Strategies

Name: _____

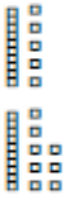
Level 1
Write the number represented by each picture.

1.)  _____	2.)  _____	3.)  _____

Provide the answer for the following.

4.) 7 +3	5.) 9 +4	6.) 5 +4
7.) 4 +4	8.) 9 +9	9.) 7 +7

Level 2
Solve.

1.)  + _____	2.)  + _____	3.)  + _____
4.)  + _____	5.)  + _____	6.)  + _____

Level 3
Solve.

1.) 215 + 509	2.) 297 + 304	3.) 324 + 453
4.) 329 + 271	5.) 427 + 361	6.) 144 + 333

Level 4
Solve.

1.) Ron had 35 marbles. Blaine gave Ron 17 new marbles. How many marbles does Ron have now?

2.) Joey has 312 baseball cards. Fred gives him 236 more baseball cards. How many baseball does Joey now have?

3.) Abbott had 521 dimes in her bank. She received 329 more dimes from her grandfather. How many dimes does she have now?

4.) There are 38 pear trees in the park. Park workers will plant 27 more pear trees today and 65 more pear trees tomorrow. How many pear trees will the park have when the workers are finished?

Level 5

Solve.

1.) There are 47 red pens in Desmond's classroom. There are 45 more black pens than red pens. There are also 57 more blue pens than red pens. How many pens are there in all?

2.) Haley bought stamps at the post office. Some of the stamps had a snowflake design, some had a truck design, and some had a rose design. Haley bought 108 snowflake stamps. She bought 143 truck stamps. She also bought 32 more rose stamps than truck stamps. How many stamps did Haley buy in all?

3.) Susan was collecting coins. She got 134 coins from her piggy bank and 59 coins from her brother. Her father gave Susan 102 coins. Susan received 38 coins from her friend Danny. How many coins did Susan have in all?

4.) For a school fundraiser, Ben needs to sell candy bars. So far, he has sold 127 candy bars to his family, 237 candy bars to his neighbors, and 4 candy bars to a teacher. How many candy bars did Ben sell altogether?

Third Grade
SLO Post-Assessment
Subtracting Whole #s with Place Value Strategies

Name: _____

Level 1
Represent the following numbers using base ten blocks.

Draw a  to represent 10. Draw a ● to represent a unit.

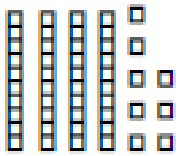
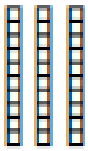
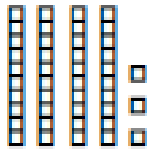
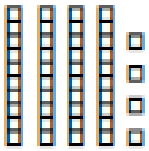
1.)	2.)	3.)
23	18	35

Provide the answer for the following.

4.)	5.)	6.)
15 - 7	10 - 5	13 - 7
7.)	8.)	9.)
15 - 9	12 - 7	14 - 6

Level 2

Solve.

1.) 48 - 13 	2.) 30 - 21 	3.) 43 - 20 
4.) 19 - 7 	5.) 44 - 35 	6.) 38 - 19 

Level 3

Solve.

1.) 954 - 604	2.) 821 - 413	3.) 583 - 412
4.) 505 - 359	5.) 703 - 604	6.) 988 - 909

Level 4

Solve.

1.) Perin's high school played 32 baseball games this year. He attended 25 games. How many baseball games did Perin miss?

2.) Robert's peach orchard grew 958 peaches in the past two months. 452 of those peaches were grown this month. How many peaches were grown last month?

3.) The town library bought 905 new books in the last two years. 750 of those books were bought this year. How many new books did the library buy last year?

4.) Taddy's coffee shop sold 835 cups of coffee on Monday and Tuesday combined. 452 of the coffees were sold on Tuesday. How many coffees did the shop sell on Monday alone?

Level 5

Solve.

1.) Mrs. Wiltshire makes 238 cakes for the Children in Need Cake Sale. Mrs. Marsh buys 29 of them before the sale starts, and Father Eugene buys 45. How many cakes are left for the sale?

2.) Our archery team has two members, Seema and Yusef. At the competition, Seema scored 182. Yusef scored 236. The winning team's score was 511. Compared to the winning team, how many fewer points did our team score?

3.) The teachers bought a new box of tea bags for the staff room. The box contained 480 tea bags. Last week, they used 86 bags. This week they used 155 tea bags. How many tea bags are left?

4.) There are 385 picture books in the library. On Monday 103 were checked out. Tuesday 215 were checked out. How many picture books are left at closing on Tuesday?

Level 4

Solve.

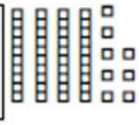
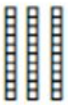
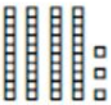
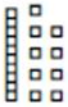
1.) Carter's high school played 47 basketball games this year. He attended 17 games. How many basketball games did Carter miss?

2.) Richard's apple orchard grew 884 apples in the past two months. 399 of those apples were grown this month. How many apples were grown last month?

3.) The school library bought 1,004 new books in the last two years. 170 of those books were bought this year. How many new books did the library buy last year?

4.) Vanessa's coffee shop sold 1,620 cups of coffee on Monday and Tuesday combined. 897 of the cups were sold on Tuesday. How many cups did the shop sell on Monday alone?

Level 2
Solve.

1.) 48 - 13 	2.) 30 - 21 	3.) 43 - 20 
4.) 19 - 7 	5.) 44 - 35 	6.) 38 - 19 

Level 3
Solve.

1.) 954 - 604	2.) 821 - 413	3.) 583 - 412
4.) 505 - 359	5.) 703 - 604	6.) 988 - 909

Level 4

Solve.

1.) Carter's high school played 47 basketball games this year. He attended 17 games. How many basketball games did Carter miss?

2.) Richard's apple orchard grew 884 apples in the past two months. 399 of those apples were grown this month. How many apples were grown last month?

3.) The school library bought 1,004 new books in the last two years. 170 of those books were bought this year. How many new books did the library buy last year?

4.) Vanessa's coffee shop sold 1,620 cups of coffee on Monday and Tuesday combined. 897 of the cups were sold on Tuesday. How many cups did the shop sell on Monday alone?

APPENDIX C – TEACHER MADE PRE-TEST AND POSTTEST

Name _____ Date_____

Addition Assessment

1 In the following problem, the number 533 is the _____. a) difference b) sum c) addend d) product 374 +159 533	2 When I add numbers and the answer is more than nine, I have to _____. a) multiply b) round c) add d) regroup
3 What is another way to show three hundreds, two ones, five tens? a) 200+50+3 b) 300+50+2 c) 300+20+5 d) 300+20+20	4 Find the sum. 52 + 37
5 Cayden has 272 pennies in a jar. She also has 528 pennies in a piggy bank. How many pennies does she have altogether?	

6 The chart shows the number of students in each grade at Elm Street Elementary.

1st Grade	182
2nd Grade	179
3rd Grade	201
4th Grade	164

What is the total number of 2nd and 3rd grade students?

7 Find the sum.

$$\begin{array}{r} 41 \\ +\ \ 4 \\ \hline \end{array}$$

8 Find the sum.

$$\begin{array}{r} 536 \\ +\ 168 \\ \hline \end{array}$$

9 Jack spent 173 minutes reading last week. He read for 118 minutes this week.
How many minutes did he read in all?
SHOW YOUR WORK!!

10 Find the sum.

$$\begin{array}{r} 372 \\ +\ 129 \\ \hline \end{array}$$

11 On Monday, 479 people visited the reptile exhibit at the zoo. The next day, there were 386 visitors. What is the total number of people who visited the zoo? *Show your work!!*

Name _____ Date_____

Subtraction Assessment

1 Find the difference. $\begin{array}{r} 82 \\ -\ 37 \\ \hline \end{array}$	2 Find the difference. $\begin{array}{r} 71 \\ -\ 47 \\ \hline \end{array}$
3 Jason spent 673 minutes reading last week. He read for 318 minutes this week. How many more minutes did he read last week? SHOW YOUR WORK!!	4 Find the difference. $\begin{array}{r} 536 \\ -\ 120 \\ \hline \end{array}$
5 Casey received 432 pieces of candy for Halloween. Her sister, Sarah, received 805 pieces of candy. How many more pieces of candy did Sarah receive? SHOW YOUR WORK!	
6 The chart shows 3rd grades favorite Halloween candy. Candy Corn 582 Sour Candy 479 Gum 601 Chocolate 864 How many more students liked chocolate than sour candy?	

APPENDIX D – LESSON PLANS

Unit (7 Days)
Math Standards 3. ATO.8 Solve two-step real-world problems using addition, subtraction, multiplication, and division of whole numbers and having whole number answers. Represent these problems using equations with a letter for the unknown quantity. 3. NSBT.2 Add and subtract whole number fluently to 1,000 using knowledge of place value and properties of operations.
Math
Monday: Addition Lesson 1-Discovery & Manipulatives **APK**: Write these numbers in expanded form. **Mini Lesson**: *Start with independent/small group problem solving with manipulatives (base ten blocks). This is meant to be a student-led time; have a guided discussion/math talk about different strategies that students experiment with and uncover their misconceptions. There are example problems on SB for problems with and without regrouping, as well as a word problem. (Based on Van De Walle's introduction in *Teaching Student Centered Mathematics)* **Guided**: *Mini Lesson – Demonstrate regrouping base ten blocks using place value chart on SB* **Independent**: Four-quadrant practice in SB – can use whiteboards to answer. **Closure**: Why is place value important to addition? /Create your own addition problem for a partner to solve. **Tuesday: Addition Lesson 2-Partial Sums** **APK:** Write these numbers in expanded form. **Mini:** Model partial sums with example problems. **Guided:** Smartboard problems **Independent:** 4 Smartboard problems **Closure**: How can place value help me add larger numbers? **Wednesday: Addition Lesson 3-Partial Sums** **APK:** Solve these multiplication problems. **Mini Lesson:** Model solving partial sums word problems. **Guided:** Partial sums word problems on Smartboard

Independent: Addition Word Problems wks.
Closure: What does the word "partial sum" mean to you? Do you think you will use partial sums to solve addition problems?
Extra Practice: Addition wks.

Thursday: Addition Lesson 4- Traditional Algorithm
APK: Regroup to find the standard form.
Mini Lesson: Model regrouping and solving additional problems using the traditional algorithm.
Guided: 4 Smartboard problems
Independent: Math Aids Worksheet 2 digit
Closure: Explain the steps of the traditional method.

Friday: Addition Lesson 5- Traditional Algorithm
APK: Regroup to find the standard form.
Mini Lesson: Model regrouping and solving three digit addition problems using the traditional algorithm.
Guided: 4 Smartboard problems
Independent: Math Aids Worksheet 3 digit
Closure: Explain the steps of the traditional method with a three-digit addition problem.

Monday: Addition Lesson 6- Review
APK: Review the traditional method and partial sums method with students on the whiteboard.
Mini Lesson: Review with students how to play Scoot.
Independent: Students will complete Scoot with 2 & 3-digit addition.
Closure: Review the scoot answer sheet whole class.

Tuesday: Unit Test

Subtraction Unit (7 Days)
Math Standards 3. ATO.8 Solve two-step real-world problems using addition, subtraction, multiplication, and division of whole numbers and having whole number answers. Represent these problems using equations with a letter for the unknown quantity. 3. NSBT.2 Add and subtract whole number fluently to 1,000 using knowledge of place value and properties of operations.
Math
Monday: Subtraction Lesson 1-Discovery & Manipulatives **APK**: Write these numbers in expanded form. **Mini Lesson**: *Start with independent/small group problem solving with manipulatives (base ten blocks). This is meant to be a student-led time; have a guided discussion/math talk about different strategies that students experiment with and uncover their misconceptions. There are example problems on SB for problems with and without regrouping, as well as a word problem. (Based on Van De Walle's introduction in *Teaching Student Centered Mathematics)* **Guided**: *Mini Lesson – Demonstrate trading/borrowing base ten blocks using place value chart on SB* **Independent**: Four-quadrant practice in SB – can use whiteboards to answer. **Closure**: Why is place value important to subtraction? /Create your own subtraction problem for a partner to solve. **Tuesday: Subtraction Lesson 2-Place Value via Expanded Form** **APK:** Write these numbers in expanded form. **Mini:** Model expanded form subtraction. **Guided:** Smartboard problems **Independent:** 4 Smartboard problems **Closure**: How can place value help me subtract larger numbers? **Wednesday: Subtraction Lesson 3-Subtraction using a number line** **APK:** Solve these multiplication problems. **Mini Lesson:** Model solving partial sums word problems. **Guided:** Partial sums word problems on Smartboard

Independent: Addition Word Problems wks.
Closure: What does the word "partial sum" mean to you? Do you think you will use partial sums to solve addition problems?
Extra Practice: Addition was.

Thursday: Addition Lesson 4- Traditional Algorithm
APK: Regroup to find the standard form.
Mini Lesson: Model regrouping and solving additional problems using the traditional algorithm.
Guided: 4 Smartboard problems
Independent: Math Aids Worksheet 2 digit
Closure: Explain the steps of the traditional method.

Friday: Addition Lesson 5- Traditional Algorithm
APK: Regroup to find the standard form.
Mini Lesson: Model regrouping and solving three digit addition problems using the traditional algorithm.
Guided: 4 Smartboard problems
Independent: Math Aids Worksheet 3 digit
Closure: Explain the steps of the traditional method with a three-digit addition problem.

Monday: Addition Lesson 6- Review
APK: Review the traditional method and partial sums method with students on the whiteboard.
Mini Lesson: Review with students how to play Scoot.
Independent: Students will complete Scoot with 2 & 3-digit addition.
Closure: Review the scoot answer sheet whole class.

Tuesday: Unit Test

APPENDIX E – SLO PRE-TEST DATA WORKSHEET

3rd Grade Math SLO Pre-Assessment Data								
Student's Name	Adding Whole #s with Place Value Strategies				Subtracting Whole #s with Place Value Strategies			
Student 1	Level	# of Items Correct	Total # of Items	% Correct	Level	# of Items Correct	Total # of Items	% Correct
	Level 1		9	0.00%	Level 1		9	0.00%
	Level 2		6	0.00%	Level 2		6	0.00%
	Level 3		6	0.00%	Level 3		6	0.00%
	Level 4		4	0.00%	Level 4		4	0.00%
Student 2	Level	# of Items Correct	Total # of Items	% Correct	Level	# of Items Correct	Total # of Items	% Correct
	Level 1		9	0.00%	Level 1		9	0.00%
	Level 2		6	0.00%	Level 2		6	0.00%
	Level 3		6	0.00%	Level 3		6	0.00%
	Level 4		4	0.00%	Level 4		4	0.00%

APPENDIX F – SLO POSTTEST DATA WORKSHEET

3rd Grade Math SLO Post-Assessment Data								
Student's Name	Adding Whole #s with Place Value Strategies				Subtracting Whole #s with Place Value Strategies			
Student 1	Level	# of Items Correct	Total # of Items	% Correct	Level	# of Items Correct	Total # of Items	% Correct
	Level 1		9	0.00%	Level 1		9	0.00%
	Level 2		6	0.00%	Level 2		6	0.00%
	Level 3		6	0.00%	Level 3		6	0.00%
	Level 4		4	0.00%	Level 4		4	0.00%
	Level 5		4	0.00%	Level 5		4	0.00%
Student 2	Level	# of Items Correct	Total # of Items	% Correct	Level	# of Items Correct	Total # of Items	% Correct
	Level 1		9	0.00%	Level 1		9	0.00%
	Level 2		6	0.00%	Level 2		6	0.00%
	Level 3		6	0.00%	Level 3		6	0.00%
	Level 4		4	0.00%	Level 4		4	0.00%
	Level 5		4	0.00%	Level 5		4	0.00%

APPENDIX G – STUDENT GROWTH WORKSHEET

3rd Grade Math Student Growth Target Worksheet												
Teacher:		School:										
Objective Statement: Students will use place value strategies to: round and compare numbers, read and write numbers through 999,999 in standard form, and add and subtract whole numbers with place value strategies.												
Class:	Assessment Name: SLO Pre and Post Assessments											
						Optional						
						MI		Benchmark Data			SC Ready	
	Date(s) Given		Adding #s	Subtracting #s	Total Points	2016 Spring MI Data	2017 Spring MI Data	Benchmark 1	Benchmark 2	Benchmark 3	2016 SC Ready Data	
Student 1		Pre-Assessment			0							
		Growth Target			0							
		Post Assessment			0							
		Was Growth Target Met?										

APPENDIX H – STUDENT TARGET WORKSHEET

Student Growth Target Worksheet						
Teacher:	**School:**					
Objective Statement: Students will use place value strategies to: round and compare numbers, read and write numbers through 999,999 in standard form, and add and subtract whole numbers with place value strategies.						
Class:	**Assessment Name: SLO Pre and Post Assessments**					
Student Name	**Pre-assessment Score**	**Date Given:**	**Growth Target**	**Post-assessment Score**	**Date Given:**	**Exceeds/ Meets Target? (yes/ no)**
Student 1	0	1/0/1900	0	0	1/0/1900	0
Student 2	0	1/0/1900	0	0	1/0/1900	0
Student 3	0	1/0/1900	0	0	1/0/1900	0
Student 4	0	1/0/1900	0	0	1/0/1900	0
Student 5	0	1/0/1900	0	0	1/0/1900	0
Student 6	0	1/0/1900	0	0	1/0/1900	0
Student 7	0	1/0/1900	0	0	1/0/1900	0
Student 8	0	1/0/1900	0	0	1/0/1900	0
Student 9	0	1/0/1900	0	0	1/0/1900	0
Student 10	0	1/0/1900	0	0	1/0/1900	0
Student 11	0	1/0/1900	0	0	1/0/1900	0
Student 12	0	1/0/1900	0	0	1/0/1900	0
Student 13	0	1/0/1900	0	0	1/0/1900	0
Student 14	0	1/0/1900	0	0	1/0/1900	0
Student 15	0	1/0/1900	0	0	1/0/1900	0

APPENDIX I – MATH LEARNING PROGRESSION

Students will use place value strategies to add and subtract whole numbers with place value strategies.

Level 1: Intensive	Level 2: Strategic	Level 3: Core I	Level 4: Core II	Level 5: Above Level
• The student can compose a base-ten unit. • The student has automaticity of their basic addition facts	• The student can solve a multi-digit addition problem with base ten blocks.	• The student uses place value strategies to solve multi-digit addition problems.	• The student uses place value strategies to problem solve real-world addition problems.	• student can solve multistep real-world problems with multi-digit addition fluently. • student can explain thinking for how they solved a multi-step real-world problem.
• The student can decompose a base-ten unit. • The student has automaticity of their basic subtraction facts	• The student can solve a multi-digit subtraction problem with base ten blocks.	• The student uses place value strategies to solve multi-digit subtraction problems.	• The student uses place value strategies to problem solve real-world subtraction problems.	• The student can solve multi-step real-world problems with multi-digit subtraction fluently. • The student can explain their thinking for how they solved the multi-step real-world problem.