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Alternative Strategies for Teaching Mathematics

Nathan D. Moore
The College at Brockport, NOMoore@bataviacsd.org

Alternative Strategies and Techniques for Teaching Mathematics

Nathan Moore

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Abstract

Underachievement in mathematics is an ongoing issue in schools across America. Many students, beginning at the elementary level, are not motivated in mathematics and perform poorly. Part of the reason for this problem may be due to poor attitudes towards mathematics and poor teaching strategies in mathematics. In order to begin to remedy this problem of poor mathematics motivation and achievement, elementary teachers need to be aware and implement the best teaching practices. Research validates the best teaching practices of games, use of manipulatives, real life application, differentiated instruction, and integrating technology into mathematics instruction.

Once aware of the best practices, teachers can begin to implement them in their own classrooms which will begin to remedy the problem of low mathematics motivation and achievement among students throughout America. Furthermore, this research will aid college professors in highlighting the best teaching practices in their instruction. Professors can then include this instruction in their teaching and pass this knowledge on to their students, pre-service teachers, thus making them more confident and knowledgeable as future elementary school teachers.

Key Words: Mathematics, Elementary, Manipulatives, Games, Real Life Application, Differentiated Instruction, Integrating Technology, Evidence-Based Teaching Practices, Motivation, and Achievement

Chapter 1: Introduction

The Math, Science, and Technology standards are the driving force for our educational system today. Our national government has recognized the importance of mathematics and the integration of technology in our present classrooms (Duncan, 2011). To stay aligned with the educational standards, our teachers must be able to teach mathematics using various techniques and alternative strategies to reach our learners. This differs from the predominant traditional method of teaching mathematics which usually consists of memorization, practical use of numbers and equations (lack of manipulation), work sheets, drill-and-kill methods (repetition of similar problems), and is usually teacher centered (direct instruction). In a 21st century classroom, a mathematics teacher must integrate technology and non-traditional strategies when teaching math to meet the requirements of our national and state government educational standards.

Problem Statement and Rationale

Mathematics is typically not the most preferred subject among students in America, whether it is at the elementary, intermediate, or secondary level (Lach & Sakshaug, 2005). This may be due to the emphasis traditional math instruction places on rote memorization, or perhaps the rule and sequence based nature of the subject. Most students in classrooms throughout the United States prefer subjects that involve creativity such as English Language Arts (ELA) or art, or those that involve hands-on activities such as science, or those that involve movement and play such as physical education (Lach & Sakshaug, 2005). Math, a subject involving numbers and calculations, is typically low on the list of interesting and exciting subjects for American students. This dislike of mathematics is a widespread problem that may be causing our students to be outperformed by their counterparts throughout the world. This discrepancy is most notable

in countries such as Japan, China, and Taiwain. Tsao (2004) compared American students' performance in mathematics to their international counterparts:

> In a recent cross-national study of mathematics achievement, American students in the eighth and twelfth grades were below the national average in problem solving, geometry, algebra, calculus, and other areas of mathematics. In contrast, Japanese eighth graders received the highest average scores of children from 20 countries, and, at the twelfth grade level, Japanese students were second only to Chinese students in Hong Kong. (p.1)

Negative attitudes and poor achievement in mathematics are not created simply because of the nature of the subject. Poor teaching strategies such as skill and drill, copying from the board, and memorizing formulas create low motivation in students which in turn leads to low academic performance. Teachers need to avoid these monotonous traditional approaches in order to create a more positive view of math in their students.

Purpose

The intent of this culminating project was to explore the use of best practices that are effective in improving student achievement in mathematics. The teaching strategies focused on all ages of students, but particularly on the elementary level because that is where negative views of mathematics typically emerge. Teaching strategies that were discussed include games, use of manipulatives, real life application, differentiated instruction, and integrating technology devices into mathematics. These strategies excite and engage students in the learning process, thus both student achievement and motivation will improve. The author developed four units that include all these research-based teaching strategies for a fourth grade mathematics class.

Research Questions

The author answered the following research questions through reviewing the existing literature to provide research-based evidence on the teaching strategies to be used in the units:

1.) To what degree does non-traditional teaching strategies such as games, use of manipulatives, real life application, differentiated instruction, and integrating technology devices effect student achievement in mathematics?
2.) To what extent do alternative teaching strategies effect student motivation?
3.) What is the correlation between student motivation and student achievement?

Hypothesis

Utilizing non-traditional teaching strategies and techniques will raise student motivation levels and their achievement levels.

Definition of Key Terms

To clarify any ambiguities that may arise in the presented research or in the topic of this report I will list key terms and define them. The key term *alternative* refers to different or out of the ordinary techniques that maybe used in mathematical instruction. Carpenter, Empson, Fennema, & Franke (1999) define *alternative* as "Instruction that builds on children's existing knowledge and teachers should help students to construct mathematical knowledge rather than passively absorb it." (p. 3). The key term *strategy* refers to a mode of teaching (i.e. verbally repeating a math fact for memorization). Ingram (2011) defines *strategy* as "a strategy is a clear decision and statement about a chosen course of action for obtaining a specific goal or result."(p. 1). The key term *technique* refers to the presentation of the strategy (i.e. direct instruction-teacher centered). Orwig (2003) defines technique as "an explicit procedure or strategem used to accomplish a particular learning objective or set of objectives"(n.a.). The key terms *traditional*

teaching refers to common teaching practices such as numeric drills, practice books, work sheets, text book driven, and teacher-centered instruction. Harris and Johnson (2001) define *traditional teaching* as "approaches that are generally teacher-directed and follow cookbook steps of activities and demonstrations"(n.a.)The term *non-traditional teaching* can be defined as strategies such as active, cooperative, collaborative and problem-based learning (Harris and Johnson, 2001). In addition, these non-traditional instructional techniques could include using games, manipulatives, differentiated instruction, and technology devices to enhance the teaching of mathematics. Furthermore, in the literature provided there is other key terms that may not have been discussed in this section however, they are defined clearly in the literature for comprehension.

There is one ambiguity in the key terms of this research that needs to be clarified. Traditional and non-traditional teaching strategies are clearly different; however there is one similarity that cannot be dismissed. One could evaluate and judge traditional teaching as differentiated instruction, which is a key component of non-traditional teaching. Differentiated instruction can be defined as individualizing instruction to meet the needs of every learner in a classroom. One could debate that traditional teaching, as defined above, could meet the needs of all learners in a classroom. A portion of students could benefit from learning visually (seeing the teacher model how to solve a math problem on the board), auditory learners could benefit from listening to the instructor explain how to solve a problem, and some students may have interpersonal intelligence (the ability to relate and understand others) and benefit from listening and watching the teacher model and explain a mathematical concept. However, non-traditional teaching methods are validated by the research presented in this report to not only meet the needs of all learners, but to also challenge them on varied levels through different modalities such as

manipulatives, differentiated instruction, games, real life application, and integrating technology into mathematics instruction.

With the rigorous educational standards evolving and American students falling behind their counterparts worldwide teachers must add non-traditional teaching techniques to their arsenal. In the following chapter, you will read about four researched non-traditional teaching techniques that are proven to motivate students and increase their academic success.

Chapter 2: Literature Review

Games

One best teaching practice to improve achievement in mathematics is incorporating the use of games in the subject. Lach (2007) commented, "Students were more motivated and more involved when learning could take place through game playing" (p. 172). Gallenstein (2005) added, "Children need to be presented with situations to be solved through games and activities that challenge their minds" (p. 37). Nisbet (2009) agreed, expanding upon the effect game playing has in mathematics:

> Games have always played a significant role in mathematics and its learning because they encourage logico-mathematical thinking, contribute to the development of knowledge while having a positive influence on the affective or emotional component of learning situations and can raise levels of student interest and motivation. (p. 27)

There are three main types of games that can be used in the classroom. These include commercially made games, games made available via the internet and/or computer software, and games made by both the teacher and students. Some commercially made games, which include board games and card games, that Lach (2005) used in her mathematics instruction included Connect Four, Mastermind, Tangramables, and 24 (p. 174). Computer games, or games made available via the internet can also be used in mathematics instruction. Ke (2007) commented, "Play performs important roles in a child's psychological, social, and intellectual development. Consistent with this proposition, many studies have demonstrated the instructional effectiveness of computer games" (p. 256). The last types of games that can be used in mathematics instruction are teacher and student made games. According to Jacobs (2007) student created games generate student interest, enthusiastic participation, and motivation (p. 54). Jacobs (2007) discussed how

students in a fifth grade classroom in Lake Villa, IL created their own games that integrated math, science, and social studies. Math concepts used included units in measurement and fractions among others. The students created games were an effective way of reviewing topics and encouraging higher levels of thinking and creativity in students at the end of the school year (p. 55).

Many success stories have been reported relative to the use of games in mathematics instruction. Nisbet (2009) researched the use of games in mathematics instruction and found one success story that involved two seventh grade math classes at Queensland Primary School. The two teachers developed a unit on probability involving six different games, to investigate the effect of games on students' motivation and understanding (p.27). According to Nisbet (2009) "At the end of the project students reported: greater motivation and desire to learn more about probability in class, and increased perception of the usefulness of probability in their lives [as measured by a student survey]" (p.35). Nisbet (2009) added that students enjoyed the "inherent sense of challenge and motivation provided by the games, and boosting of confidence" (p.35). Nisbet (2009) went on to report that some students didn't even realize that they were learning, because they were having so much fun (p.35).

There are many success stories of using games in mathematics. Lach (2005) discussed the effect of incorporating games into the mathematics curriculum in a middle school mathematics classroom. In order to examine the effects of the of the game playing on the student learning of mathematics, Lach (2005) "modified the teaching schedule on Tuesdays and Thursdays so that the students could spend thirty minutes on each of those days playing a game" (p. 174). According to Lach (2005), the games included "Connect Four, Guess Who, Izzi, Mastermind, Muggins, Rush Hour, Stormy Seas, Tangramables, and 24…all of which enhanced the

understanding of the concepts of problem solving in spatial sense and algebraic reasoning, which were the concepts being taught at that time" (p. 174). Such games engaged the students and enhanced their understanding of the mathematical concepts. Lach assessed the students' knowledge of the mathematics concepts by means of a twenty question test both before and after the games. Lach (2005) described the effects that game playing had on students' learning:

> I found that the students did much better on the assessment after they had played games for twelve weeks. Students also showed greater ability to solve the multistep problems that were on the assessment. In a few instances when students could not complete a problem, they were still willing to try strategies that they thought might work. Many such problems were not even attempted on the pretest. (p. 174).

Lach (2005) mentioned other positive effects of game playing which include higher self confidence in mathematical ability, increased engagement in the learning process, more positive views of mathematics, and improved communication and strategizing. Playing games also created a more relaxed classroom environment and provided the students with an opportunity to think in new ways and figure things out for themselves, both mathematically and socially (p. 175). Research clearly shows that incorporating games into mathematics instruction increases both student motivation and performance levels.

Use of Manipulatives in Mathematics

Another best teaching strategy to improve mathematics achievement is the use of manipulatives. Bouck (2010) defined mathematics manipulatives as "Physical objects students can manipulate to explore and develop an understanding of a mathematical concept" (p. 186). Fractions are often an extremely difficult concept for students to understand. Manipulatives makes fractions visual and concrete, through a hands-on learning experience. Teachers can use

almost anything as a math manipulative, which makes them low or no cost. Furthermore, most math textbook kits come with manipulatives so they are readily available to the teacher. According to Rapp (2009), manipulatives have been shown to help improve both achievement and motivation in mathematics among all students, especially visual-spatial learners (p. 9).

Using manipulatives is effective in teaching mathematics for several reasons. First, manipulatives allow children to have a hands-on learning experience. Chevalier (2008) discussed the positive impact manipulatives have on learning:

> A page of abstract symbols, no matter how carefully designed or simplified, because of its very nature, cannot involve the child's senses the way real materials can. Symbols are not the concept; they are only the representation of a concept, and such are abstractions describing something which is not visible to the child. Real materials, on the other hand, can be manipulated to illustrate the concept concretely, and can be experienced visually by the child. (p. 196)

Many mathematical concepts are difficult for students to fully understand. Before students are able to perform mental math or understand an abstract concept, they need to have a concrete understanding of the basic mathematical concept. Manipulatives allow students to see and touch the materials that represent mathematical concepts, which make these concepts real and concrete. Like games, research has shown that manipulatives improve student achievement in mathematics.

There have been many case studies done to analyze the effectiveness of manipulatives in mathematics instruction at the elementary and intermediate levels. Puchner (2008) discussed one such study that included study groups of teachers that taught math lessons at the 2nd, 3rd, 6th, and 8th grade levels (p.6). According to Puchner (2008), manipulatives were effective because they

created an external representation of the mathematical concepts being taught. They also increased student motivation and aided in forming internal understanding when some understanding of the mathematical concept was already present (p. 2). However, Puchner (2008) also found that in three of the four lessons analyzed, manipulatives were used as the basis to teach the lesson rather than as a tool to improve understanding. This is a common misuse of manipulatives. Puchner (2008) explained, "Manipulatives are used to create an external representation of the mathematical ideas but they do not automatically create an internal understanding of mathematical concepts" (p.2). In short, manipulatives are a hands-on tool that enhance student learning and improves attitudes, however, they do not in and of themselves lead to learning. Therefore, teachers need to be aware of how they are using manipulatives in their teaching and ensure they are used as a tool to enhance understanding when some understanding of the concept already exists.

Real Life Application in Mathematics

The next best teaching practice to improve mathematics achievement is incorporating real life application into the subject. Without real world application, students can find mathematics to difficult to relate to, boring and abstract. According to Farren (2008), many students expressed that math was boring, difficult, and hard to relate to because of the lack of real-world application in instruction (p. 3). Real world application brings life to mathematics, and students are able to make sense of and relate to the subject. Gallenstein (2005) expressed that, "teachers need to connect science and mathematics knowledge to real-life situations…for children to have a greater appreciation for the content" (p. 38). Farren (2008) added to this by reporting that several students who received instruction including how math related to the real world said they became more interested and motivated in math even though it wasn't one of their favorite subjects (p. 5).

Math is prevalent in many everyday life situations, which makes connecting mathematics instruction to real world application a very manageable task. Essentially, it is teachers' responsibility to show their students how math exists in their world. Gallenstein (2005) described how relevant math learning opportunities are present in classrooms, school buildings, homes, and local communities. Examples of specific opportunities for real world mathematic learning experiences include field trips to local grocery stores and restaurants (p. 39). Furthermore, many educators have connected specific mathematical topics to real-life application including area to measuring carpet, perimeter to measuring fence, and the addition, subtraction, and multiplication of decimals to ordering from a menu and calculating tax and tip. Giving students real-life application engages them. Increased engagement leads to increased performance.

Differentiated Instruction in Mathematics

Another best teaching strategy to improve motivation and performance in mathematics is differentiated instruction. According to Grimes (2009), "Differentiated instruction is a teaching method used to meet the diverse needs of learners. Teachers implementing this method provide instruction for individuals or groups of students to benefit both those who find academic concepts difficult and those who find them easy" (p. 677). Levy (2008) agreed by defining differentiated instruction as, "a set of strategies that will help teachers meet each child where they are when they enter class and move them forward as far as possible on their educational path" (p. 162). Differentiated instruction is an ideal teaching strategy considering the vast range of learners in today's classrooms. According to Kirkey (2005), differentiated instruction discourages teaching to the norm, but rather allows educators to meet all students' learning needs, whether struggling, average, or gifted (p.1).

There are three primary student factors in which educators can differentiate instruction. As Kirkey (2005) stated, differentiated instruction is a "pro-active approach" to improving classroom learning for all students by redesigning instruction on the basis of student abilities, needs and even interests (p. 4). Levy (2008) agreed that students can be placed into groups based on ability, learning styles, and interests. In math it is most common to group students by ability such as above, at, or below grade level for understanding of a specific skill. Students can also be grouped by learning styles (visual, auditory, analytical, kinesthetic, etc.). Lastly, students can be grouped based on interests such as sports, hobbies, or animals (p. 163).

Research and antidotal reports have shown the success of using differentiated instruction in mathematics to improve mathematics achievement. Grimes (2009) discussed research that involved differentiated instruction in a fourth grade math classroom (p. 677). Grimes (2009) differentiated the math class based on her students' comprehension levels of the specific skills being taught (p.678). Grimes (2009) stated, "I placed students in readiness groups based on their daily evaluations and my analysis of their pretests using the glass, bug, mud model" (p. 678). Grimes (2009) used three differentiated groups including glass (students who had a strong understanding of the concept), bug (students who had some understanding of the concept) and mud (students with no understanding of the concept). Students were then given a task card each day which depended on their level of readiness (p. 678). Through the glass, bug, mud model of differentiated instruction, Grimes (2009) reported, "Instruction was modified to meet each learners' needs…These tools allowed all students to reach *glass*, or mastery, at their individual paces, and students were challenged at their own levels" (p. 679).

Grimes (2009) found that differentiated instruction improved academic performance and motivation of both the low and high achieving groups. In addition, students were more engaged

in mathematics and held a more positive view of the subject (p. 679). Grimes (2009) described the effect differentiated instruction (her glass, bug, mud model) had on low achievers, "Their average unit test score before differentiation was 72%. After using the glass, bug, mud model, these students' average score was 91%" (p. 679). Grimes described the effect differentiated instruction had on the high achievers, "High –achieving students also gained understanding of mathematics by increasing from an average of 88% to 99% overall performance" (p. 680). Views and motivation toward mathematics as recorded by student journal responses improved for all students. Low achievers views went from very negative to hopeful and positive, while high achievers views went from positive but boring to positive but challenging (p. 680). Differentiation allows each individual student to be challenged at the appropriate level, therefore maintaining student interest and motivation while minimizing frustration. In short, differentiated instruction in mathematics increases motivation and thus, increasing the achievement levels of the students.

Overall, research has shown extremely positive results for differentiated instruction in mathematics. According to Kirkey (2005), "Differentiation improves enthusiasm, motivation, and confidence toward learning" (p. 1). Grimes (2009) added that differentiated instruction enables students to learn mathematics effectively and become motivated math students (p. 680). Differentiated instruction is not the easiest teaching strategy, which may turn some teachers away from it. Kirkey (2005) described her feelings toward differentiated instruction, "In the beginning, I found applying differentiated instruction tiring and overwhelming. Over time, my confidence as well as my understanding increased…I have come to believe that differentiated instruction is a pro-active approach to learning and classroom management" (p. 4). Clearly, the

research shows much more support for differentiated instruction and its positive effects on student motivation and achievement.

Integrating Technology in Mathematics

Finally, the last alternative strategy to improve student achievement and motivation in mathematics is integrating technology into mathematics instruction. There are numerous studies to support the effectiveness of technology use in the subject of mathematics. Gargiulo and Metcalf (2010) suggest that many students experience anxiety with mathematics which blocks initial learning and makes transferal of skills difficult. Cavanagh (2007) also highlights that this emotional response hinders working memory and subsequently the ability to recall basic facts. Automaticity of basic computations is considered important for students' mathematical achievement as information processing theory highlights that, without direct retrieval of basic facts, students experience difficulty performing more complex tasks (Woodward, 2006). Whitehurst (2003) suggests that one way around this is to ensure components of the problem-solving tasks become "routine and over-learned" which requires practice (n.a). If students do not develop fluent retrieval of basic facts, there is evidence that this limits the development of higher order mathematical skills. Integrating technology into a mathematics classroom will increase the transferal of skills, lower anxiety, promote automaticity of basic math computational skills, and will help develop higher order mathematical skills.

Main and Rourke (2011) completed a pilot study that compared the use of commercial off-the-shelf (COTS) handheld game consoles (HGCs) with traditional teaching methods to develop the automaticity of mathematical calculations for year 4 students (9-10 years old) in two metropolitan schools. One class conducted daily sessions using the HGCs and the Dr. Kawashima's Brain Training software to enhance their mental math skills while the comparison

class engaged in mental math lessons using more traditional classroom approaches. Students were assessed using standardized tests at the beginning and completion of the term and findings indicated that students who undertook the Brain Training pilot study using the HGCs showed significant improvement in both the speed and accuracy of their mathematical calculations (p.1). The research completed by Main and Rourke (2011) demonstrates the effectiveness of technology in a twenty-first century mathematics class.

Technology can serve a number of roles in increasing knowledge of basic skills in mathematics. For example, the use of calculators can increase a student's ability to problem solve. Bowes (2010) explores technology's place in the mathematics curriculum. Bowes (2010) states, "Technology supports achievement, enabling learners to be independent, competent and creative thinkers, as well as effective communicators and problem solvers" (p.1). Hudson, Siobhan, & Lavin (2010) completed a study that supports Bowes statement. The researcher/teachers used power points, web-based games, the internet, projectors, Smart boards, Elmos, calculators, videos, DVDs, and music to enhance their mathematics instruction. Hudson, Siobhan, & Lavin (2010) state, "Overall, targeted students in the fourth, fifth, sixth, and ninth grades improved their understanding of basic math skills by using technology. Their post intervention test scores indicated a noticeable increase in student mastery of basic mathematics. More students earned scores of 70% or higher when compared to the pre assessment scores" (p.3). The study conducted by Hudson, Siobhan, & Lavin (2010) demonstrates that technology improves achievement, enabling learners to be independent problem solvers, competent and creative thinkers, as well as effective communicators.

Interactive white boards are one of the most common pieces of technology found in a classroom today. Developed and introduced by SMART in 1991, the interactive whiteboard is

connected to an LCD projector and computer, and provides touch control of computer applications. Marr (2011) states this form of interaction creates a connection between the user and the application that personalizes the learning experience (p.31). Giley (2010) states the manipulation features of an interactive whiteboard enables students get to the board to connect with the material, because on the whiteboard you can present it in a way you couldn't do with a chalkboard or overhead projector. The ability to present multimedia material that is verbal, visual, auditory, and interactive is essential to draw today's students into the subject matter (p. 34). Interactive whiteboards can be used to meet the needs of all learners as depicted in the upcoming research.

Marzano & Haystead (2009) conducted a study that involved 85 teachers and 170 classrooms. The teachers used interactive whiteboards to teach a set of lessons, which they then taught to a different group of students without using the technology. The study results indicated that, in general, using interactive whiteboards was associated with a 16 percentile point gain in student achievement. This means that you can expect a student at the 50th percentile in a classroom without the technology to increase to the 66th percentile in a classroom using whiteboards. In addition, three features inherent in interactive whiteboards have a statistically significant relationship with student achievement.

The first is the learner-response device—handheld voting devices that students use to enter their responses to questions. The percentage of students providing the correct answer is then immediately displayed on the board in a bar graph or pie chart. Using voting devices was associated with a 26 percentile point gain in student achievement (Marzono, 2009).

A second feature is the use of graphics and other visuals to represent information. These include downloaded pictures and video clips from the Internet, sites such as Google Earth, and

graphs and charts. Use of these aids was also associated with a 26 percentile point gain in student achievement (Marzono, 2009).

A third feature is the interactive whiteboard reinforce-applications that teachers can use to signal that an answer is correct or to present information in an unusual context. These applications include dragging and dropping correct answers into specific locations, acknowledging correct answers with virtual applause, and uncovering information hidden under objects. These practices were associated with a 31 percentile point gain in student achievement (Marzono, 2009).

There is an abundance of research and evidence that supports the effectiveness of integrating technology into a mathematics classroom to increase student achievement and it is apparent that technology should be utilized by mathematic teachers at all academic levels.

Synthesis

The research that was conducted for this report is of high quality, reliable, and useful in determining the best practices to enhance student achievement in mathematics. Lach (2005), Nisbet (2009), and Jacobs (2007) all participated in action research studies dealing with game playing as an alternative technique to enhance student achievement in mathematics. Lach and Nisbet used commercial games as the main instructional tool for a full mathematics unit, where Jacobs incorporated the game playing technique by having students create their own games. All three studies have positive results in regards to student achievement and motivation. I would suggest that Lach probably incorporated traditional techniques in the instruction as well seeing that game playing was only incorporated on Tuesdays and Thursdays. Jacobs (2007) provided research on students creating games, but the study lent itself to be effective at the end of the school year which leads the reader to believe there were other instructional strategies being used

at that time. If Jacobs and Lach did incorporate traditional techniques accompanied by game playing (non-traditional), are the results valid for this topic? Is a combination of traditional and non-traditional methods a best practice for mathematics instruction? To answer these questions, further research and insight is needed.

Puchner (2008), like Nisbet (2009), analyzed an action research study. Puchner's focus was on the effectiveness of manipulatives in enhancing student achievement in mathematics. Puchner's results, like Nisbet's, were positive in that the research technique was effective in enhancing student achievement in mathematics. Both of the researchers were outside investigators analyzing the work and data of teachers who were conducting action research. This is an extremely effective way for the action researchers to stay objective in their research, and it allows outside researchers a chance to analyze and evaluate the appropriateness and effectiveness of the action research at hand.

Grimes (2009), like Lach (2005), took the rule of a researcher and a teacher and completed an action research study. Grimes, like the other researchers mentioned above, found positive results from her research. Differentiated instruction enhanced her low achieving students' average from 72 % to 91%. Grime's high achieving students went from averaging 88%-90% to averaging 98%-99%. In addition, Grimes and Lach assessed their students similarly. Both researchers/teachers administered a pre-assessment and a post assessment to evaluate the effectiveness of their action research. This makes their evidence more valid and persuasive when planning to change your instructional approach.

Main and Rourke (2011) and Hudson, Siobhan, & Lavin (2010) all completed a quantitative study to establish that technology is effective in mathematical instruction in enhancing student achievement. Their method contrasts from the action researchers in terms of

researching techniques and the way they collected their data. Main, Rourke, Hudson, Siobhan, and Lavin's quantitative research may not be the most common way of researching in terms of this topic, but it was effective, useful, and appropriate.

Now being aware of these practices and their effectiveness, the next best step in this field is to determine if educators are deploying these non-traditional strategies into their mathematics instruction. To compile this needed information teacher and administrative surveys would have to be completed from an extremely large population of our schools to render the needed results.

Conclusion

Underachievement in mathematics is an ongoing issue in schools across America. Many students, beginning at the elementary level, are not motivated in mathematics and perform poorly. According to the United States Department of Education and the National Center for Educational Statistics (2011), students in 4th and 8th grade that were administered the National Assessment of Educational Progress in mathematics (NAEP) scored as follows: 4th grade students scored on average 213-240 out of 500 and 8th grade students scored on average 263-283 out of 500 from 1990-2009. This underachievement of our nation's students may be due to poor teaching strategies in mathematics.

In order to begin to remedy this problem of poor mathematics achievement, teachers need to be aware of and implement the best teaching strategies. Research validates the best teaching practices of games, use of manipulatives, real life application, differentiated instruction, and integrating technology into their mathematics instruction. Once aware of the best practices, teachers can begin to implement them in their own classrooms which will begin to remedy the problem of low mathematics achievement among students throughout America.

In the next chapter the author developed unit plans that are aligned to the New York State Standards. The mathematic units contain elements of all the best practices mentioned in the above mentioned research.

Chapter 3: Units

Classroom management is an important aspect of teaching. One element of classroom management that does not receive a lot of attention is structural organization, where to place desks and materials and how to set up a room that is safe and productive for teaching and learning. The following paragraphs contain a description of the author's classroom and of the author's students.

The units that were created will be taught in a fourth grade general education room. The teacher teaches at Batavia City School District and has been teaching fourth grade for four years. The room is organized into 6 pods of desks, where each pod has three or four desks. There are posters for visuals aides on the walls and there are dry erase boards on two of the four walls. In the front and center of the classroom is a Promethean Smart board (interactive whiteboard) which is connected to the teacher's computer. Adjacent to the teacher's desk is a table with five computers on it for the students to use for instructional purposes. Overall, the physical make-up of the room is structured for students to be successful.

There were a total of twenty-two students present during the time of instruction for the mathematic units. Out of the twenty-two total students, three of the students have a 504 plan. In brief, the 504 plans are to accommodate the students during testing. In terms of mathematics, 36% (8 students) of the students are considered on grade level determined by their third grade New York State Math Test. One out of the eight students is considered above grade level. 74% (14 students) of the students are considered below grade level determined by their third grade New York State Math Test.

Project Title: Place Value and Time Unit	
Teacher/Grade: Mr. Moore Fourth Grade	
Subject and Topic: Math Place Value and Time Unit	
Enduring Understandings and Essential Questions	
Enduring Understandings	**Essential Questions**
Students will be able to read and write whole numbers to 10,000,000,000	Why is it imperative that you are able to read, write, order, compare, and round numbers in your everyday life?
Students will be able to compare and order numbers to 10,000,000,000	
Students will be able to round numbers less than 1000 to the nearest tens and hundreds	Why is it important that you are able to tell time and calculate elapsed time in your everyday life?
Students will Use the symbols <, >, =, and ≠ (with and without the use of a number line) to compare whole numbers	
Students will be able to calculate elapsed time in hours and half hours, not crossing A.M./P.M.	
Students will demonstrate comprehension of the base ten number system	
Determine acceptable evidence of understanding	
Objective	**Indicator**
Students will demonstrate understanding of reading and writing whole numbers by…	Participating in a lesson on reading and writing whole numbers, and by completing several internet activities in which they will be reading and writing whole numbers.
Students will demonstrate comprehension of the base ten number system by …	Successfully completing online interactive activities in which they will use the base ten number system.
Students will demonstrate application of comparing and ordering numbers by …	Successfully completing online interactive activities in which they will compare and order numbers.
Students will demonstrate synthesis of rounding numbers by…	Participating in a “Real World” game in which

	they will have a certain amount of money to use to buy and sell goods.
Students will demonstrate application of comparing numbers using the symbols <, >, =, and ≠ by…	Successfully completing online interactive activities in which they will compare numbers.
Students will demonstrate application of calculating elapsed time by…	Successfully completing online interactive activities in which they will have to calculate elapsed time.
Students will demonstrate application and synthesis of all fourth grade place value and time concepts by…	Successfully completing the district common assessment on place value and time

Classroom Procedures and Resources

Content	Resources	Instructional Strategies	Student Activities
Read and write whole numbers to 10,000	http://www.mathcats.com/explore/reallybignumbers.html - Reading and Writing Numbers http://www.funbrain.com/numwords/index.html - Reading and Writing Numbers Scott Foresman Math Textbook, Manipulatives, Student Workbook, and Teacher's Manual, teacher clock and individual clocks for each student	Teacher will demonstrate how students are to access and/or accomplish most online tasks.	Students will participate in discussion and in online activities.
Understand the place value structure of the base ten number system	http://www.learningbox.com/Base10/BaseTen.html - Base Ten practice http://nlvm.usu.edu/en/nav/framesasid152g1t1.html - Base ten Practice http://www.funbrain.com/tens/index.html -Place Value http://www.aaamath.com/B/g21b_px1.htm - Place Value Scott Foresman Math Textbook, Manipulatives, Student Workbook, and Teacher's Manual, teacher clock and individual clocks for each student	Teacher will demonstrate how students are to access and/or accomplish most online tasks.	Students will participate in online activities.
Telling Time and Elapsed Time. Calculate elapsed time in hours and half hours, not crossing A.M./P.M.	http://www.aplusmath.com/Flashcards/AnalogClock.html -Telling Time http://www.primarygames.com/math/timeclock/start.htm - Telling Time http://www.thatquiz.com/tq/practice.html?time – Elapsed Time	Teacher will demonstrate how students are to access and/or accomplish most online tasks. Teacher	Students will use the resources listed to learn, practice, reinforce, and review fourth grade place

	http://www.quia.com/mc/66516.html - Elapsed Time Scott Foresman Math Textbook, Manipulatives, Student Workbook, and Teacher's Manual, teacher clock and individual clocks for each student	will model how to manually use clocks.	value and time concepts.
Compare and order numbers to 10,000,000,000. Use the symbols <, >, =, and ≠ (with and without the use of a number line) to compare whole numbers	http://www.funbrain.com/tens/index.html -Rounding http://www.aplusmath.com/Flashcards/rounding.html - Rounding http://www.aaaknow.com/cmpk1dx2.htm - Comparing lesson and practice http://www.toonuniversity.com/flash.asp?err=509&engine=9 – comparing numbers game http://www.quia.com/servlets/quia.activities.common.ActivityPlayer?AP_rand=718356962&AP_activityType=6&AP_urlId=7512&AP_continuePlay=true&id=7512 – comparing numbers Brainpop – Inequalities video and quiz Scott Foresman Math Textbook, Manipulatives, Student Workbook, and Teacher's Manual, teacher clock and individual clocks for each student	Teacher will give "mini lessons" (short 10 minute introduction lessons) on most new concepts. Most lessons will include use of the Scott Foresman Math series materials, ELMO, projector, and hands-on use of the SMART board.	Students will work individually and in groups throughout the unit to create their own knowledge of place value and time.
Round numbers less than 1000 to the nearest tens and hundreds	**Brainpop** – Rounding video and quiz **Promethean Interactive Flipchart:** Rounding Whole Numbers Scott Foresman Math Textbook, Manipulatives, Student Workbook, and Teacher's Manual, teacher clock and individual clocks for each student	Teacher will aid students in constructing their own knowledge as they complete online tasks.	Students will be assigned homework randomly (at least four times a week) throughout the unit based on class needs and individual student needs.

Hardware and Software Considerations (put an X in front of all required by unit)			
X Computer Lab	X Classroom Center	Inspiration	X Microsoft Word
X SMART board	X Internet	PowerPoint	X Videos
X Brainpop Videos			

Daily Plan

Day 1 and 2

Content: Read and write whole numbers to 10,000

Objective(s): Students will demonstrate comprehension of reading and writing numbers up to 10,000 by participating in a teacher directed "mini" lesson and by successfully completing internet activities on reading and writing numbers

Resources: Scott Foresman Math Series Fourth Grade Edition, http://www.mathcats.com/explore/reallybignumbers.html, http://www.funbrain.com/numwords/index.html , place value block manipulatives

Teacher Instruction: Introduction: Practice skip counting by 1000's to begin lesson. Teacher directed "mini" lesson based on Scott Foresman series lesson 2-1 (Reading and writing numbers). Use the SMART Board to model to students how to access the websites above and how to complete the activities reading and writing numbers.

Student Activities: Participate in "Mini" lesson on reading and writing numbers. Practice reading and writing numbers using the websites listed above.

Assessment: Informal assessment by the teacher throughout the lesson. Math workbook page 16 for homework.

Day 3

Content: Understand the place value structure of the base ten number system

Objective(s): Students will demonstrate comprehension of the base ten number system by participating in a teacher directed "mini" lesson and by successfully completing internet activities on the base ten system

Resources: Scott Foresman Math Series Fourth Grade Edition, place value block manipulatives, http://www.learningbox.com/Base10/BaseTen.html , http://nlvm.usu.edu/en/nav/frames_asid_152_g_1_t_1.html

Teacher Instruction: Introduction: Practice skip counting by 1000's to begin lesson. Teacher directed "mini" lesson based on Scott Foresman series lesson 2-2 (Base Ten System). Using the SMART Board to model to students how to access the websites above and how to complete the activities using the base ten system.

Student Activities: Participate in "Mini" lesson on understanding the base ten number system. Practice creating numbers using the base ten system using the websites listed above.

Assessment: Informal assessment by the teacher throughout the lesson. Math workbook page 17 for homework.

Day 4 and 5

Content: Comparing numbers up to 10,000

Objective(s): Students will demonstrate application of comparing numbers by participating in a teacher directed "mini" lesson and by successfully completing internet activities on comparing numbers

Resources: Scott Foresman Math Series Fourth Grade Edition
http://www.aaaknow.com/cmpk1dx2.htm, http://www.toonuniversity.com/flash.asp?err=509&engine=9,

http://www.quia.com/servlets/quia.activities.common.ActivityPlayer?AP_rand=718356962&AP_activityType=6&AP_urlId=7512&AP_continuePlay=true&id=7512
BrainPop Video and quiz on inequalities
Teacher Instruction: Teacher directed "mini" lesson based on Scott Foresman series lesson 2-5 (comparing numbers). Use BrainPop video and quiz to help review/reinforce inequality concepts. Use the SMART Board to model to students how to access the websites above and how to complete the activities on comparing numbers.
Student Activities: Participate in "Mini" lesson on comparing numbers. Practice comparing numbers using the websites listed above.
Assessment: Informal assessment by the teacher throughout the lesson. Math workbook page 21 and 22 for homework.

Day 6 and 7
Content: Rounding numbers up to 1,000
Objective(s): Students will demonstrate application of rounding numbers by participating in a teacher directed "mini" lesson and by successfully completing internet activities on rounding numbers
Resources: Scott Foresman Math Series Fourth Grade Edition, http://www.funbrain.com/tens/index.html , http://www.aplusmath.com/Flashcards/rounding.html , BrainPop Video and quiz on rounding
Teacher Instruction: Teacher directed "mini" lesson based on Scott Foresman series lesson 2-7 (rounding numbers). Use BrainPop video and quiz to help review/reinforce rounding concepts. Use the SMART Board to model to students how to access the websites above and how to complete the activities on rounding numbers.
Student Activities: Participate in "Mini" lesson on rounding numbers. Watch the BrainPop video and complete the accompanying quiz. Practice rounding numbers using the websites listed above.
Assessment: Informal assessment by the teacher throughout the lesson. Math workbook page 23 and 24 for homework.

Day 8
Content: Telling Time
Objective(s): Students will demonstrate application of telling time by participating in a teacher directed "mini" lesson and by successfully completing internet activities on telling time
Resources: Scott Foresman Math Series Fourth Grade Edition, http://www.aplusmath.com/Flashcards/AnalogClock.html http://www.primarygames.com/math/timeclock/start.htm , teacher analog clock and student individual analog clocks
Teacher Instruction: Teacher directed "mini" lesson based on Scott Foresman series lesson 2-8 (telling time). Use the

SMART Board to model to students how to access the websites above and how to complete the activities on telling time.
Student Activities: Participate in "Mini" lesson on telling time. Practice telling time using the websites listed above.
Assessment: Informal assessment by the teacher throughout the lesson. Math workbook page 25 for homework.

Day 9

Content: Elapsed Time
Objective(s): Students will demonstrate application of finding elapsed time by participating in a teacher directed "mini" lesson and by successfully completing internet activities on finding elapsed time
Resources: Scott Foresman Math Series Fourth Grade Edition, teacher analog clock and student individual analog clocks, http://www.thatquiz.com/tq/practice.html?time , http://www.quia.com/mc/66516.html , http://nlvm.usu.edu/en/nav/frames_asid_318_g_3_t_4.html
Teacher Instruction: Teacher directed "mini" lesson based on Scott Foresman series lesson 2-10 (elapsed time). Use the SMART Board to model to students how to access the websites above and how to complete the activities on finding elapsed time.
Student Activities: Participate in "Mini" lesson on finding elapsed time. Practice finding elapsed time using the websites listed above.
Assessment: Informal assessment by the teacher throughout the lesson. Math workbook page 27 and 30 for homework.

Day 10

Content: Rounding Review and Rounding Money
Resources: Brainpop – Rounding video and quiz, http://www.funbrain.com/tens/index.html , http://www.aplusmath.com/Flashcards/rounding.html , fake Money for each pair of students, three products for each pair of students to sell (products like pencils, erasers, books, etc.)
Teacher Instruction: After several lessons and activities on rounding numbers, the teacher will **guide** (evaluation level) students through a lesson on rounding money amounts. Then the teacher will **show** (application) students how to play a "Market game" in which they will be buying and selling goods from other students by rounding the prices of the products they are buying. They teacher will then **observe** (analysis) as the students play the game, **clarify** (evaluation) the directions if needed, and **evaluate** (analysis) the success of the activity as students participate.
Student Activities- Students will first participate in several lessons and online activities in which they will be required to analyze **(analysis)** a Brainpop video on rounding and calculate **(application)** what numbers would be rounded to using online interactive activities. Then, in pairs, students will inspect **(analysis)** the three products they are given to sell and create **(synthesis)** a fair price (under 5 dollars to start, but not on the even dollar mark) for each of their products. Next the market will open and students can start buying and selling goods. The catch is that the price of each object must be rounded to the nearest dollar when bought (each pair of

students will be given $11.00 to spend on goods). If the price the student who is buying the product offers the seller is not rounded correctly the item cannot be sold to them. Once students have bought several items, they may revise **(synthesis)** the price on the items they bought and attempt to sell them again (for more money). The game will end after about ten minutes. The students with the most money win. In this activity students will have to prepare **(synthesis)** their shop and products, set up **(synthesis)** a fair price for their goods, assess **(evaluation)** the price of other students products, determine **(evaluation)** what the cost of each product is rounded to the nearest dollar, and discriminate **(evaluation)** what products to buy and sell in order to make the most money. Note: The students will be able to keep the products they have at the end of the game (the products will be things like pencils, erasers, and books).

Assessment: Informal assessment by the teacher throughout the lesson.

Day 11

Content: Place Value and Time Review

Objective(s): Students will demonstrate application of all Chapter II Place Value and Time concepts by participating in a teacher directed "mini" lesson review and by successfully completing internet activities in areas where they are weak

Resources: Scott Foresman Math Series Fourth Grade Edition, teacher analog clock and student individual analog clocks, All Place Value and Time Unit Websites used previously

Teacher Instruction: Teacher directed "mini" lesson based on Scott Foresman series lessons 2-1 through 2-10. Use the SMART Board to model to students how to access the websites above and how to complete the review activities.

Student Activities: Participate in "Mini" lesson review. Reinforce, review, and strengthen weak areas by using the websites listed above.

Assessment: Informal assessment by the teacher throughout the lesson. Math workbook page 31 for homework.

Day 12

Content: Place Value and Time District Assessment

Objective(s): Students will demonstrate synthesis of all Chapter II Place Value and Time concepts by successfully completing the District common math assessment on place value and time

Resources: District Common assessment (found in common area)

Teacher Instruction: Teacher hands out assessment, explains directions, and takes any questions.

Student Activities: Students successfully complete district common assessment

Assessment: Place Value and Time Assessment Grade

Standards and Performance Indicators	
NY Standards or Performance Indicators http://www.emsc.nysed.gov/nysatl/standards.html	**NETS Performance Indicators** http://cnets.iste.org/students/s_profiles.html
Standard 3: Mathematics: Students will understand mathematics and become mathematically confident by communicating and reasoning mathematically, by applying mathematics in real-world settings, and by solving problems through the integrated study of number systems, geometry, algebra, data analysis, probability, and trigonometry. **Number Sense and Operations Strand** ***Students will understand numbers, multiple ways of representing numbers, relationships among numbers, and number systems.*** *Number Systems* 4.N.1 Skip count by 1,000's 4.N.2 Read and write whole numbers to 10,000 4.N.3 Compare and order numbers to 10,000 4.N.4 Understand the place value structure of the base ten number system: 10 ones = 1 ten 10 tens = 1 hundred 10 hundreds = 1 thousand 10 thousands = 1 ten thousand 4.N.5 Recognize equivalent representations for numbers up to four digits and generate them by decomposing and composing numbers ***Students will compute accurately and make reasonable estimates.*** *Estimation* 4.N.26 Round numbers less than 1,000 to the nearest tens and hundreds	**Performance Indicators:** All students should have opportunities to demonstrate the following performances. Prior to completion of Grade 5 students will: 1. Use keyboards and other common input and output devices (including adaptive devices when necessary) efficiently and effectively. 2. Use general purpose productivity tools and peripherals to support personal productivity, remediate skill deficits, and facilitate learning throughout the curriculum. 3. Use technology tools (e.g., multimedia authoring, presentation, Web tools, digital cameras, scanners) for individual and collaborative writing, communication, and publishing activities to create knowledge products for audiences inside and outside the classroom. 4. Use technology resources (e.g., calculators, data collection probes, videos, educational software) for problem solving, self-directed learning, and extended learning activities. 5. Evaluate the accuracy, relevance, appropriateness, comprehensiveness, and bias of electronic information sources.

4.N.27 Check reasonableness of an answer by using estimation **Algebra Strand** ***Students will represent and analyze algebraically a wide variety of problem solving situations.*** *Variables and Expressions* 4.A.1 Evaluate and express relationships using open sentences with one operation ***Students will perform algebraic procedures accurately.*** *Equations and Inequalities* 4.A.2 Use the symbols <, >, =, and ≠ (with and without the use of a number line) to compare whole numbers 4.A.3 Find the value or values that will make an open sentence true, if it contains < or > **Measurement Strand** ***Students will use units to give meaning to measurements.*** *Units* 4.M.9 Calculate elapsed time in hours and half hours, not crossing A.M./P.M. 4.M.10 Calculate elapsed time in days and weeks, using a calendar	
Plan Assessment	
Students will be formally and informally assessed throughout the unit. **Observations –** Students will be informally assessed by the teacher daily as they complete their technology-integrated geometry activities	

Internet Activities – Students will receive grades based on their successful completion of many of the interactive Internet activities they complete throughout the unit
Market Game – Students will be assessed at the end of the place value and time unit by working in cooperative pairs to buy and sell goods in the classroom.
District Common Assessment – Students will be assessed at the end of the place value and time unit using the district common assessment on place value and time
Homework – Students homework assignments will be graded throughout the unit

Project Title: Measurement	
Teacher/grade: Mr. Moore/Fourth Grade	
Subject and topic: Math/Science - Measurement	
Enduring Understandings and Essential Questions	
Enduring Understandings	**Essential Questions**
Objects have distinct attributes that can be measured with appropriate tools and units of measure.	What tools could be used to find the mass, capacity, and length of a given object?
The perimeter and area of a rectangular object can be found using specific equations/operations.	What are the differences between the metric and customary measurement systems?
Inches can be converted to feet and vice-versa	How do you find the perimeter and area of a given object?
Yards can be converted to feet and vice-versa	How can you convert inches to feet and feet to inches?
	How can you convert yards to feet and feet to yards?
Determine acceptable evidence of understanding	
Objective	**Indicator**
Students will demonstrate synthesis of their knowledge of measurement and area/perimeter by using the correct formula to generate the area and perimeter of the classroom to the nearest inch, foot, centimeter, and meter.	Completed worksheet with classroom perimeter and area
Students will demonstrate comprehension of converting inches to feet, feet to inches, yards to feet, and feet to yards by completing an interactive internet activity in which they will be converting units of measure.	Successful completion of internet activities on converting measurements
Students will demonstrate comprehension of measuring to the nearest half centimeter and quarter inch by completing several interactive internet activities in which they will be measuring objects to the nearest half centimeter and quarter inch.	Successful completion of internet activities on measurement
Students will demonstrate synthesis of their knowledge of how to measure length, mass, and capacity (metric system) by choosing the appropriate tool to use to measure when given five objects (a jar of water [capacity], a pencil [length], a	Worksheet with each object measured accurately using the correct tool and unit.

marble [mass], cup of soda [capacity], a piece of candy [mass]).	
Students will demonstrate comprehension of finding area and perimeter by completing several interactive internet activities in which they will be finding the area and perimeter of given objects.	Successful completion of internet activities on finding area and perimeter
Students will demonstrate comprehension of all the topics in the measurement unit by successfully completing an Activote Quiz.	Successful completion of the quiz (80% or better)

Classroom Procedures and Resources

Content	Resources	Instructional Strategies	Student Activities
Customary Measurement System	Scott Foresman Math Textbook, rulers, Student Workbook, and Teacher's Manual, scales, hexagram weights, thermometers, yard sticks, meter sticks, graduated cylinders, beakers **http://www.athens.edu/vinsobm/student_8_files/frame.htm - Power point** Brainpop – http://www.brainpop.com/math/geometry/metricvsimperial/ : Metric versus Customary Measurement **http://www.onlineconversion.com/faq_05.htm - Lesson**	Teacher will give "mini lessons" (short 10 minute introduction lessons) on most new concepts. Most lessons will include use of the Scott Foresman Math series materials, ELMO, projector, and hands-on use of the Promethean board.	Students will work individually and in groups throughout the unit to create their own knowledge of measurement.
Metric Measurement System	Bill Nye Measurement Video Measurement Video – BOCES Catalog **http://oncampus.richmond.edu/academics/education/projects/webunits/measurement/length1.html - Lesson** **http://www.midwayisd.org/etrip/third/Math/meassavhunt/Scavhuntppt_files/frame.htm - Powerpoint** **http://lamar.colostate.edu/~hillger/frame.htm - lesson**	Teacher will demonstrate how students are to access and/or accomplish most online tasks.	Students will use the resources listed to learn, practice, reinforce, and review fourth grade measurement.

Length	**http://www.funbrain.com/measure/index.html - Game** **http://www.apples4theteacher.com/measure.html - Game** **http://www.rickyspears.com/rulergame/ - Game**	Teacher will aid students in constructing their own knowledge as they complete online tasks.	Students will be assigned homework randomly (at least four times a week) throughout the unit based on class needs and individual student needs.
Mass	http://www.ictgames.com/weight.html - Mass practice http://www.bgfl.org/bgfl/custom/resources_ftp/client_ftp/ks2/maths/weigh/1a.htm - Mass practice	Teacher will give students an Activote quiz on measurement	Students will complete an Activote quiz on measurement
Capacity/Volume	http://www.standards.dfes.gov.uk/primary/teachingresources/mathematics/nns_itps/measuring_cylinder/num_itp_measuringCylinder1_2.swf - Capacity Practice	Teacher will model capacity using a graduated cylinder.	Students participate in online practice using the resource listed.
Converting Units of Measure	http://oregonstate.edu/~reeset/html/scale.html - converting feet to inches/vice versa	Teacher will aid students in constructing their own knowledge as they complete online tasks.	Students participate in online activity.
Perimeter	**http://www.funbrain.com/poly/index.html** **http://www.shodor.org/interactivate/activities/perimeter/index.html**	Teacher will model how to use online activities and lead discussions.	Students participate in online activity.
Area	**http://www.funbrain.com/poly/index.html** **http://www.aplusmath.com/Flashcards/index.html** **http://www.shodor.org/interactivate/activities/perimeter/index.html**	Teacher will model how to use online activities and lead discussions.	Students participate in online activity.

Hardware and software considerations:

____Word ____Excel ____PowerPoint ____Inspiration ____Google Earth ____Audacity _____Moodle
__X__Internet ____Online databases __X__Videos __X__Brainpop
Specialized software (list)
__X__Computer lab ____Classroom center __X__Interactive whiteboard __X__Student response system (Activote)
____Wireless cart _____TI 84 calculators __X__basic calculators
Specialized hardware (list)

Daily plan:

Day 1

Content: Introduction to measurement
Objective(s): Students will demonstrate comprehension of measuring and measurement systems by watching a Bill Nye Video on measurement, taking notes on the video, and discussing what they learn from the video
Resources: Scott Foresman Math Series Fourth Grade Edition, Bill Nye Measurement Video
Teacher Instruction: Introduction: Weights of students (Discussion). Watch Bill Nye video and discuss.
Student Activities: Watch video and take notes. Participate in discussion on measurement
Assessment: Informal assessment by the teacher throughout the lesson. Assess notes.

Day 2

Content: Customary Measurement System
Objective(s): Students will demonstrate comprehension of the Customary Measurement System by viewing the Powerpoint presentation, brainpop video, and online lesson below and taking notes on their content.
Resources: Scott Foresman Math Series Fourth Grade Edition, **http://www.athens.edu/vinsobm/student_8_files/frame.htm - Power point**
Brainpop – http://www.brainpop.com/math/geometry/metricvsimperial/ : Metric versus Customary Measurement
http://www.onlineconversion.com/faq_05.htm - Lesson
Teacher Instruction: Teacher directed introduction lesson based on the Customary measurement system using the Promethean Board and the resources above.
Student Activities: Participate in lesson on the Customary measurement system by taking notes throughout the lesson and participating in a discussion.
Assessment: Informal assessment by the teacher throughout the lesson.

Day 3

Content: Measuring length using the customary measurement system

Objective(s): Students will demonstrate comprehension of measuring to the nearest quarter inch by completing several interactive internet activities in which they will be measuring objects to the nearest quarter inch.

Resources: Scott Foresman Math Series Fourth Grade Edition, yard stick, rulers, **http://www.funbrain.com/measure/index.html - Game**

http://www.rickyspears.com/rulergame/ - Game

www.thatquiz.com – Interactive measurement

Teacher Instruction: Teacher directed "mini" lesson based on the measuring length using the customary measurement system (using ELMO to demonstrate). Use the Promethean Board to model to students how to access the websites above and how to complete the activities on measurement.

Student Activities: Participate in "Mini" lesson on measuring. Practice measuring length using the websites listed above.

Assessment: Informal assessment by the teacher throughout the lesson.

Day 4

Content: Converting feet to inches, inches to feet, feet to yards, and yards to feet

Objective(s): Students will demonstrate comprehension of converting inches to feet, feet to inches, feet to yards, and yards to feet by completing an interactive internet activity in which they will be converting units of measure.

Resources: Scott Foresman Math Series Fourth Grade Edition, http://oregonstate.edu/~reeset/html/scale.html - converting feet to inches/vice versa

Teacher Instruction: Teacher directed "mini" lesson based on converting units of measure. Use the Promethean Board to model to students how to access the website above and how to complete the activity.

Student Activities: Participate in "Mini" lesson on converting units of measure. Practice converting units of measure using the website listed above.

Assessment: Informal assessment by the teacher throughout the lesson.

Day 5

Content: Metric Measurement System

Objective(s): Students will demonstrate comprehension of the Metric Measurement System by viewing the Powerpoint presentation and online lessons below and taking notes on their content.

Resources: Scott Foresman Math Series Fourth Grade Edition,

http://oncampus.richmond.edu/academics/education/projects/webunits/measurement/length1.html - Lesson

http://www.midwayisd.org/etrip/third/Math/meassavhunt/Scavhuntppt_files/frame.htm - Powerpoint

http://lamar.colostate.edu/~hillger/frame.htm - lesson

Teacher Instruction: Teacher directed introduction lesson based on the metric measurement system using the Promethean Board and the resources above.

Student Activities: Participate in lesson on the Metric measurement system by taking notes throughout the lesson and participating in a discussion.

Assessment: Informal assessment by the teacher throughout the lesson.

Day 6

Content: Measuring length using the Metric Measurement System

Objective(s): Students will demonstrate comprehension of measuring to the nearest half centimeter by completing several interactive internet activities in which they will be measuring objects to the nearest half centimeter.

Resources: Scott Foresman Math Series Fourth Grade Edition, meter stick, rulers, **http://www.funbrain.com/measure/index.html - Game**

www.thatquiz.com – Interactive measurement

http://www.rickyspears.com/rulergame/ - Game

Teacher Instruction: Teacher directed "mini" lesson based on the measuring length using the metric measurement system (using ELMO to demonstrate). Use the Promethean Board to model to students how to access the websites above and how to complete the activities on measurement.

Student Activities: Participate in "Mini" lesson on measuring. Practice measuring length using the websites listed above.

Assessment: Informal assessment by the teacher throughout the lesson

Day 7

Content: Measuring mass using the Metric Measurement System

Objective(s): Students will demonstrate comprehension of measuring mass to the nearest gram and kilogram by completing several interactive internet activities in which they will be measuring objects to the nearest gram and kilogram and by using scales and hexagrams to measure mass.

Resources: Scott Foresman Math Series Fourth Grade Edition, http://www.ictgames.com/weight.html - Mass practice
http://www.bgfl.org/bgfl/custom/resources_ftp/client_ftp/ks2/maths/weigh/1a.htm - Mass practice, scales and hexagrams

Teacher Instruction: Teacher directed "mini" lesson based on the measuring mass using the metric measurement system (using ELMO to demonstrate). Use the Promethean Board to model to students how to access the websites above and how to complete the activities on measurement.

Student Activities: Participate in "Mini" lesson on measuring mass. Practice measuring mass using the websites listed above and a scale with hexagrams.

Assessment: Informal assessment by the teacher throughout the lesson.

Day 8

Content: Measuring volume/capacity using the Metric Measurement System

Objective(s): Students will demonstrate comprehension of measuring volume/capacity to the nearest milliliter and liter by completing an interactive internet activity in which they will be measuring objects to the nearest milliliter and by using graduated cylinders to measure capacity.

Resources: Scott Foresman Math Series Fourth Grade Edition, graduated cylinders
http://www.standards.dfes.gov.uk/primary/teachingresources/mathematics/nns_itps/measuring_cylinder/num_itp_measuringCylinder1_2.swf - Capacity Practice

Teacher Instruction: Teacher directed "mini" lesson based on the measuring volume/capacity using the metric measurement system (using ELMO to demonstrate). Use the Promethean Board to model to students how to access the website above and how to complete the activities on measurement.

Student Activities: Participate in "Mini" lesson on measuring volume/capacity. Practice measuring volume/capacity using the website listed above and a graduated cylinder with water.

Assessment: Informal assessment by the teacher throughout the lesson.

Day 9

Content: Reviewing area and perimeter

Objective(s): Students will demonstrate comprehension of finding area and perimeter by completing several interactive internet activities in which they will be finding the area and perimeter of rectangles.

Resources: Scott Foresman Math Series Fourth Grade Edition, **http://www.funbrain.com/poly/index.html**
http://www.shodor.org/interactivate/activities/perimeter/index.html
http://www.funbrain.com/poly/index.html
http://www.aplusmath.com/Flashcards/index.html
http://www.shodor.org/interactivate/activities/perimeter/index.html

Teacher Instruction: Teacher directed "mini" lesson review based on finding the area and perimeter of rectangles (using ELMO to demonstrate). Use the Promethean Board to model to students how to access the websites above and how to complete the activities on finding area and perimeter.

Student Activities: Participate in "Mini" lesson review of finding area and perimeter. Practice finding the area and perimeter of rectangles using the websites listed above.

Assessment: Informal assessment by the teacher throughout the lesson.

Day 10

Content: Reviewing metric measurement

Objective(s): Students will demonstrate synthesis of their knowledge of how to measure length, mass, and capacity (metric system) by choosing the appropriate tool to use to measure when given five objects (a jar of water [capacity], a pencil [length], a marble [mass], cup of soda [capacity], a piece of candy [mass]).

Resources: Scott Foresman Math Series Fourth Grade Edition, graduated cylinders, hexagrams, scales, rulers, yard sticks, meter sticks, measurement worksheet for each pair of students, bag of five objects to measure for each pair of students (a jar of water [capacity], a pencil [length], a marble [mass], cup of soda [capacity], a piece of candy [mass]).

Teacher Instruction: Teacher directed "mini" lesson review of the metric system and choosing the correct tool to measure length, mass, and capacity/volume. Set up centers with five objects for students to measure using the metric system.

Student Activities: Participate in "Mini" lesson review of measuring using the metric system. Use the correct tools and units to measure the five objects in their bags.

Assessment: Informal assessment by the teacher throughout the lesson. Formal assessment in the form of a grade on their metric measurement worksheet.

Day 11

Content: Reviewing measurement, area, and perimeter

Objective(s): Students will demonstrate synthesis of their knowledge of measurement and area/perimeter by using the correct formula to generate the area and perimeter of the classroom to the nearest inch, foot, centimeter, and meter.

Resources: Scott Foresman Math Series Fourth Grade Edition, rulers, yard sticks, meter sticks, measurement area and perimeter worksheet for each group of students, calculators for students to use

Teacher Instruction: Teacher directed "mini" lesson review of area, perimeter and measurement. Teacher describes the activity, puts students into groups of four, gives students directions, and hands out tools.

Student Activities: Participate in "Mini" lesson review of area, perimeter and measurement. Students work in groups of four to find the area and perimeter of the classroom and complete the worksheet (students may use calculators).

Assessment: Informal assessment by the teacher throughout the lesson. Formal assessment in the form of a grade on their area and perimeter worksheet.

Day 12

Content: Measurement unit assessment

Objective(s): Students will demonstrate comprehension of all the topics in the measurement unit by successfully completing an Activote Quiz.

Resources: Scott Foresman Math Series Fourth Grade Edition, Promethean Board and Quiz

Teacher Instruction: Teacher gives quiz and records grades
Student Activities: Students take quiz using their individual Activotes
Assessment: Students will be formally assessed (in the form of a grade) based on the accuracy of their answers on the Activote Measurement
Quiz

<table>
<tr><th colspan="2">Standards and Performance Indicators</th></tr>
<tr><th>NY state standards
http://www.emsc.nysed.gov/nysatl/standards.html</th><th>NETS 2007
http://cnets.iste.org/NETSSstandards1-6.pdf</th></tr>
<tr><td>Mathematics

Geometry Strand

Students will use visualization and spatial reasoning to analyze characteristics and properties of geometric shapes.

Shapes
4.G.3 Find perimeter of polygons by adding sides

4.G.4 Find the area of a rectangle by counting the number of squares needed to cover the rectangle

Measurement Strand

Students will determine what can be measured and how, using appropriate methods and formulas.

Units of Measurement
4.M.1 Select tools and units (customary and metric) appropriate for the length being measured

4.M.2 Use a ruler to measure to the nearest standard unit (whole, ½ and ¼ inches, whole feet, whole yards, whole centimeters, and whole meters)</td><td>1. Creativity and Innovation
Students demonstrate creative thinking, construct knowledge, and develop innovative products and processes using technology. Students:
a. apply existing knowledge to generate new ideas, products, or processes.
c. use models and simulations to explore complex systems and issues.
2. Communication and Collaboration
Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others. Students:
a. interact, collaborate, and publish with peers, experts or others employing a variety of digital environments and media.
d. contribute to project teams to produce original works or solve problems.
3. Research and Information Fluency
Students apply digital tools to gather, evaluate, and use information. Students:
a. plan strategies to guide inquiry.
b. locate, organize, analyze, evaluate, synthesize, and ethically use information from a variety of sources and media.
c. evaluate and select information sources and digital tools based on the appropriateness to specific tasks.</td></tr>
<tr><td>4.M.3 Know and understand equivalent standard units</td><td>4. Critical Thinking, Problem-Solving & Decision-Making</td></tr>
</table>

	of length: 12 inches = 1 foot 3 feet = 1 yard	Students use critical thinking skills to plan and conduct research, manage projects, solve problems and make informed decisions using appropriate digital tools and resources. Students: a. identify and define authentic problems and significant questions for investigation. b. plan and manage activities to develop a solution or complete a project. c. collect and analyze data to identify solutions and/or make informed decisions. d. use multiple processes and diverse perspectives to explore alternative solutions. **5. Digital Citizenship** Students understand human, cultural, and societal issues related to technology and practice legal and ethical behavior. Students: a. advocate and practice safe, legal, and responsible use of information and technology. b. exhibit a positive attitude toward using technology that supports collaboration, learning, and productivity. c. demonstrate personal responsibility for lifelong learning. **6. Technology Operations and Concepts** Students demonstrate a sound understanding of technology concepts, systems and operations. Students: a. understand and use technology systems. b. select and use applications effectively and productively.
4.M.4	Select tools and units appropriate to the mass of the object being measured (grams and kilograms)	
4.M.5	Measure mass, using grams	
4.M.6	Select tools and units appropriate to the capacity being measured (milliliters and liters)	
4.M.7	Measure capacity, using milliliters and liters	

Plan Assessment

- Students will be formally assessed (in the form of a grade) based on the accuracy of their answers as they work collaboratively

(pairs) to find the area and perimeter of the classroom to the nearest foot, inch, centimeter, and meter.

- Students will be formally assessed (in the form of a grade) based on the accuracy of their answers as they choose appropriate tools and units to measure the mass, length, and capacity of five objects using the metric system of measurement
- Students will be informally assessed throughout the unit based upon their successful completion of the interactive internet activities
- Students will be formally assessed (in the form of a grade) based on the accuracy of their answers on the Activote Measurement Quiz

Project Title: Adding and Subtracting Fractions with Unlike Denominators	
Teacher/grade: Mr. Moore/Fourth Grade	
Subject and topic: Math/Fractions	
Enduring Understandings and Essential Questions	
Enduring Understandings	**Essential Questions**
Parts of a whole and equal parts can be represented by fractions, decimals, and a mixed numbers.	What is the definition of a fraction? A mixed number?
Equivalent fractions can be found by finding the greatest common factor to simplify the fraction.	How can one conclude that fractions are equivalent?
Numerator/denominator represent fractional parts	What is the definition of a numerator? A denominator?
Mixed numbers and whole numbers can be represented as a fraction	How can you convert integers with decimals into fractions?
Rewrite two fractions with unlike denominators to have common denominators in order to add or subtract fractions.	How you convert unlike denominators into like denominators in order to add and subtract them?
Determine acceptable evidence of understanding	
Objective	**Indicator**
Students will demonstrate comprehension of fractions and mixed numbers by using fraction manipulatives to represent whole and parts of a whole number.	Observe students' individual work and track with a check list.
Students will demonstrate analysis of fractions by breaking down the fractional parts using the greatest common factor to simplify the fraction.	Successful completion of internet activities on converting fractions.
Students will demonstrate comprehension of a numerator and denominator by manipulating virtual fractional parts on the Promethean Board.	Successful completion of internet activities on fractions.
Students will demonstrate synthesis of mixed numbers and whole numbers by creating a power point presentation that depicts mixed numbers and whole numbers.	Successful completion of power point presentations that depict student knowledge.
Students will demonstrate comprehension of adding and subtracting fractions with unlike denominators by solving problems on their quiz.	Successful completion of the quiz (80% or better)
Students will demonstrate comprehension of converting fractions to decimals by playing a game a successfully.	Successful completion of online game

Classroom Procedures and Resources			
Content	**Resources**	**Instructional Strategies**	**Student Activities**
Fractions and Mixed Numbers	Scott Foresman Math Textbook, Student Workbook, Teacher's Manual, fraction manipulatives, construction paper and pencils. **Power point:** http://math.pppst.com/fractions.html http://www.brainpop.com/math/numbersandoperations/addingandsubtractingfractions/: adding and subtracting fractions	Teacher will give "mini lessons" (short 10 minute introduction lessons) on most new concepts. Most lessons will include use of the Scott Foresman Math series materials, ELMO, projector, and hands-on use of the Promethean board.	Students will work individually and in groups throughout the unit to create their own knowledge of fractions.
Simplifying Fractions	http://www.mathwarehouse.com/fractions/algebra/how-to-simplify-fraction.php **- Powerpoint.** Promethean Board and computer	Teacher will demonstrate how students are to access and/or accomplish most online tasks.	Students will use the resources listed to learn, practice, reinforce, and review fourth grade fractions.
Fractional Parts	http://www.ixl.com/math/grade-5/fractions-review **–** Game. Computer, Promethean board, Scott Forrseman Math Text Book, and Student workbook.	Teacher will aid students in constructing their own knowledge as they complete online tasks.	Students will be assigned homework randomly (at least four times a week) throughout the unit based on class needs and individual student needs.
Decimal to Fraction Conversions	http://math.pppst.com/decimals.html**-Power point** http://www.wartgames.com/themes/math/decimals.html- **Game** Computer, Promethean board, Scott Forrseman Math Text Book, and Student workbook.	Teacher will aid students in constructing their own knowledge as they complete online tasks.	Students will complete an online game and complete a page in student workbook.
Adding and	http://math.pppst.com/fractions.html - **Power**	Teacher will demonstrate how	Students will use the

Subtracting Fractions with unlike Denominators	**point** http://www.adaptedmind.com/p.php?tagId=774# - **Game** Computer, Promethean board, Scott Forrseman Math Text Book, and Student workbook.	students are to access and/or accomplish most online tasks.	resources listed to learn, practice, reinforce new knowledge.

Hardware and software considerations:

____Word ____Excel _X_PowerPoint ____Inspiration ____Google Earth ____Audacity _____Moodle
__X__Internet __X__Online databases ____Videos __X__Brainpop
Specialized software (list)
__X__Computer lab ____Classroom center __X__Interactive whiteboard ____Student response system (Activote) ____Wireless cart _____TI 84 calculators ____basic calculators

Daily plan:

Day 1

Content: Introduction to fractions
Objective(s): Students will demonstrate comprehension of a numerator and denominator by manipulating virtual fractional parts on the Promethean Board.
Resources: **http://www.ixl.com/math/grade-5/fractions-review – Game.** Computer, Promethean board, Scott Forrseman Math Text Book, and Student workbook.
Teacher Instruction: Introduction: Fractional parts (Discussion). Model how to play game and closing discussion.
Student Activities: Participate in game and in class discussion.
Assessment: Informal assessment by the teacher throughout the lesson.

Day 2-3

Content: Fractions and Mixed Numbers
Objective(s): Students will demonstrate comprehension of fractions and mixed numbers by using fraction manipulatives to represent whole and parts of a whole number.
Resources: Scott Foresman Math Series Fourth Grade Edition, **Power point:** http://math.pppst.com/fractions.html
http://www.brainpop.com/math/numbersandoperations/addingandsubtractingfractions/: adding and subtracting fractions
Teacher Instruction: Teacher directed introduction lesson using the Promethean Board and the resources above.
Student Activities: Participate in lesson on fractions and mixed by taking notes on the video and participating in a discussion.
Assessment: Informal assessment by the teacher throughout the lesson especially during discussion and questioning.

Day 4-5

Content: Fraction to Decimal Conversions

Objective(s): Students will demonstrate

Resources: Scott Foresman Math Series Fourth Grade Edition, yard stick, rulers, **http://www.funbrain.com/measure/index.html - Game**

http://www.rickyspears.com/rulergame/ - Game

www.thatquiz.com – Interactive quiz

Teacher Instruction: Teacher directed "mini" lesson based on converting fractions to decimals (using ELMO to demonstrate). Use the Promethean Board to model to students how to access the websites above and how to complete the activities on Converting fractions to decimals.

Student Activities: Participate in "Mini" lesson on converting fractions to decimals. Practice converting fractions to decimals using the websites listed above.

Assessment: Informal assessment by the teacher throughout the lesson and observation of online quiz.

Day 6-7

Content: Simplifying Fractions

Objective(s): Students will demonstrate analysis of fractions by breaking down the fractional parts using the greatest common factor to simplify the fraction.

Resources: Scott Foresman Math Series Fourth Grade Edition, http://www.mathwarehouse.com/fractions/algebra/how-to-simplify-fraction.php - **Powerpoint**. Promethean Board and computer.

Teacher Instruction: Teacher directed "mini" lesson based on equivalent fractions and finding the greatest common factors of fractions. Use the Promethean Board to model to students how to access the website above and how to complete the activity.

Student Activities: Participate in "Mini" lesson on simplifying fractions. Participate in discussion.

Assessment: Informal assessment by the teacher throughout the lesson.

Day 8-9

Content: Adding and Subtracting Fractions with unlike Denominators

Objective(s): Students will demonstrate comprehension of converting fractions to decimals by playing a game a successfully.

Resources: http://math.pppst.com/fractions.html - Power point

http://www.adaptedmind.com/p.php?tagId=774# - Game, Computer, Promethean board, Scott Forrseman Math Text Book, and Student workbook.

Teacher Instruction: Teacher directed introduction lesson based on how to add and subtract fractions with unlike denominators using the Promethean Board and the resources above.

Student Activities: Participate in lesson on the promethean Board using the resources listed above and participating in a discussion.

Assessment: Informal assessment by the teacher throughout the lesson.

Standards and Performance Indicators	
NY state standards http://www.emsc.nysed.gov/nysatl/standards.html	NETS 2012 http://cnets.iste.org/NETSSstandards1-6.pdf
Mathematics **4.nf** **1.** Explain why a fraction a/b is equivalent to a fraction (n × a)/(n × b) by using visual fraction models, with attention to how the number and size of the parts differ even though the two fractions themselves are the same size. Use this principle to recognize and generate equivalent fractions. **2.** Compare two fractions with different numerators and different denominators, e.g., by creating common denominators or numerators, or by comparing to a benchmark fraction such as 1/2. Recognize that comparisons are valid only when the two fractions refer to the same whole. Record the results of comparisons with symbols >, =, or <, and justify the conclusions, e.g., by using a visual fraction model. Understand decimal notation for fractions, and compare decimal fractions. **5.** Express a fraction with denominator 10 as an equivalent fraction with denominator 100, and use this technique to add two fractions with respective denominators 10 and 100.4 For example, express 3/10 as 30/100, and add 3/10 + 4/100 = 34/100.	**1. Creativity and Innovation** Students demonstrate creative thinking, construct knowledge, and develop innovative products and processes using technology. Students: a. apply existing knowledge to generate new ideas, products, or processes. c. use models and simulations to explore complex systems and issues. **2. Communication and Collaboration** Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others. Students: a. interact, collaborate, and publish with peers, experts or others employing a variety of digital environments and media. d. contribute to project teams to produce original works or solve problems.
6. Use decimal notation for fractions with denominators 10 or 100. For example, rewrite 0.62 as 62/100; describe a length as 0.62 meters; locate 0.62 on a number line diagram.	**3. Research and Information Fluency** Students apply digital tools to gather, evaluate, and use information. Students: a. plan strategies to guide inquiry. b. locate, organize, analyze, evaluate, synthesize, and ethically use information from a variety of sources and media. c. evaluate and select information sources and digital tools based on the appropriateness to specific tasks. **4. Critical Thinking, Problem-Solving &**

	Decision-Making Students use critical thinking skills to plan and conduct research, manage projects, solve problems and make informed decisions using appropriate digital tools and resources. Students: a. identify and define authentic problems and significant questions for investigation. b. plan and manage activities to develop a solution or complete a project. c. collect and analyze data to identify solutions and/or make informed decisions. d. use multiple processes and diverse perspectives to explore alternative solutions. **5. Digital Citizenship** Students understand human, cultural, and societal issues related to technology and practice legal and ethical behavior. Students: a. advocate and practice safe, legal, and responsible use of information and technology. b. exhibit a positive attitude toward using technology that supports collaboration, learning, and productivity. c. demonstrate personal responsibility for lifelong learning. **6. Technology Operations and Concepts** Students demonstrate a sound understanding of technology concepts, systems and operations. Students: a. understand and use technology systems. b. select and use applications effectively and productively.
Plan Assessment	

• Students will be formally assessed (in the form of a grade) based on the accuracy of their answers as they work to building their understanding of fractions and decimals. • Students will be formally assessed (in the form of a grade) based on the accuracy of their answers as they complete online and paper quizzes. • Students will be informally assessed throughout the unit based upon their successful completion of the interactive internet activities • Students will be formally assessed (in the form of a grade) based on the accuracy of their answers on the Unit summative assessment.

Chapter 4: Estimated Impact on Students' Learning

As mentioned in chapter one, mathematics is a subject that is unpopular and difficult for students to grasp. Negative attitudes and underachievement is a widespread problem throughout our country. My classroom is no different; students have carried negative attitudes into my classroom and tend to under achieve their true potential. The units created for this culminating project are based on research that has proven to motivate students and increase their achievements in mathematics. In chapter four, you will read about the anticipated impact of the students' learning due to the teaching methods that will be deployed during the instructional time of the units.

The first unit that will be taught is the place-value and time unit. Throughout my years of teaching I have seen students and teachers struggle to learn and teach place-value and time. For fourth grade students, place-value is a tough concept to grasp. It seems to be abstract to them and they struggle to really understand the base-ten system. To enhance the students' chances at success I inundated this unit with engaging visuals, interactive games, manipulatives, and I created a lesson that simulates a real-world situation where the students will have to apply their understanding of curriculum while completing the activity. In addition to the activities in this unit, I will teach the students in a whole group setting, in small groups where the students switch from one center activity to the next, and they will also be working in cooperative groups while developing their understanding of the curriculum. I am anticipating that this unit will be successful by engaging and motivating the students, which in turn, will increase their chances at being successful.

The second unit that will be taught is the measurement unit. This topic is one of my favorite units to teach. Moreover, the students seem to really enjoy it as well. I believe teaching

measurement, capacity, area, and perimeter lends itself to creating hands-on activities where the students are physically manipulating objects to construct their understanding of the curriculum. The content of this unit is rigorous and teachers need to allot a lot of time for students to gain an understanding of the customary measuring system and then move on to the metric system. In addition, students will need time and practice manipulating the tools needed to measure items correctly. In this unit scales, thermometers, graduated cylinders, rulers, yard sticks, and meter sticks are all used when measuring capacity, length, mass, area, and perimeter. Overall, this unit tends to be a favorite among the students.

Throughout the years the measurement unit has been successful in terms of student achievement. I have added some activities to this unit that allows the students to use technology to construct their understanding. I believe that the interactive games and websites that will be used in this unit will only enhance student motivation and will hold their attention throughout the lessons in this measurement unit. In conclusion, I anticipate that the students will be excited to learn during this unit. The hands-on constructivist approach of this unit is engaging and will motivate students to master the content on the unit.

The third unit that will be taught is the fraction unit. During this unit students will be adding and subtracting fractions with like and unlike denominators. In addition, students will also be converting fraction and mixed numbers into decimals and via versa. This unit will be the most difficult for the students and for the teacher. Similar to place-value, factions are very abstract for students. To minimize this abstractness for the students I have incorporated manipulatives, interactive technology and engaging visuals into the unit plan.

Due to the rigor of the content it is essential for students to have a concrete understanding of the idea that a fraction is a part of a whole (i.e. number or item). In anticipation of student confusion, modeling what a fraction is and what it means with fraction tiles is necessary. Throughout this unit I will review what a fraction is and how to represent a part of a whole. Continuous review will help remedy the abstractness of fractions.

In this unit I plan to utilize technology to engage students. The interactive capability of the Promethean Smart board will be the center piece to the entire unit. From my experience, students enjoy the interactive white board and being able to manipulate the virtual manipulatives. In addition, adding games to the unit where students can have fun and learn simultaneously will enhance their chances of being successful during this difficult unit.

Overall, I feel the fraction unit will be the most difficult to teach and the most difficult for the students to gain a firm understanding of the curriculum. In anticipation of the rigor and difficulty of the content of this unit I plan to review the basics of what a fraction is and how to represent a part of a whole. I believe that the technology and the use of manipulatives in this unit will help minimize the abstractness of the curriculum.

As mentioned in the beginning of chapter four, mathematics is not a very popular subject among students. Negative attitudes and perceptions of the subject begin to appear in the early stages of a student's academic career. To combat the negative attitudes and the unpopularity of mathematics I have inundated the mathematics units with hands-on activities, interactive technology, games, real-life scenarios, and throughout the unit I utilized differentiated instruction. In conclusion, I believe that the instructional methods used in these units will increase student motivation, engagement, and achievement.

References

Bouck, E., & Flanagan, S. (2010). Virtual manipulatives: What they are and how teachers can use them. *Intervention in School and Clinic, 45* (3), 186-191.

Bowes, K. (2010). Technology: Its place in math standards and getting it there. Retrieved from: users.math.umd.edu/~dac/650/bowespaper.html#National Council of Teachers

Burrows, W. E. (1998). *This new ocean: The story of the first space age*. New York: Randal House.

Carpenter, T. P., Fennema, E., Franke, M. L., Levi, L., & Empson, S. B. (1999). *Children's mathematics: Cognitively guided instruction.* Portsmouth, NH: Heinemann 3 (3).

Cavanagh, S. (2007). Math's anxiety confuses the equation for students. *Education Week, 26* (24), 12.

Chevalier, C., Pippen, M., & Stevens, D. (2008). MIM: Math in motion for K-2. *Teaching Children Mathematics, 15* (4), 196-200.

Duncan, A. (2011). Sharpening mathematics tools for the 21st century, *NCTM Summing Up.* Retrieved from http://www.nctm.org/about/content.aspx?id=29275

Farren, V. (2008). A reflection on my teaching practices using students' math moments. *College Quarterly, 11* (4), 74-81.

Gallenstein, N. (2005). Engaging young children in science and mathematics. *Journal of Elementary Science Education, 17* (2), 27-41.

Gargiulo, R.M., & Metcalf, D. (2010). *Teaching in today's inclusive classrooms: A universal design for learning approach.* Belmont, CA. Wadsworth Cengage Learning. Retrieved from ERIC.

Grimes, K., & Stevens, D. (2009). Glass, bug, mud. *Phi Delta Kappan, 90* (9), 677-680.

Harris, P., & Johnson, R. (2001). *Non-traditional learning and teaching strategies.* Retrieved from http://www.montana.edu/teachlearn/Papers/activelearn2.pdf

Heath, T. (1963). In the case of mathematics, it is the Greek contribution which is most essential to know, for it was the Greeks who first made mathematics a science. *A Manuel of Greek Mathematics,* 1.

Hudson, S., Kadan, S., Lavin, K., & Vasquez, T. (2010). Improving basic math skills using technology. Retrieved from: http://web.ebscohost.com.ezproxy2.drake.brockport.edu/ehost/detail?vid=21&hid=15

Hu, I., & Iwaki, L. (2000). Turning points in the cold war: Sputnik and Apollo 11. *The Cold War.* Retrieved from: http://www.angelfire.com/stars/lunareclipse/

Ifrah, G. (1985). *From one to zero: A universal history of numbers.* Hoboken, NJ: Wiley Press 1985.

Ingram, S. (2011). What is a strategy: Fundamentals of strategic planning. *Actionable Strategic Planning.* December 8, 2011. Retrieved from http://www.actionablestrategicplanning.com/?p=61

Jacobs, A., & Kohl, J. (2007). Fun and games. *Teaching Pre K-8, 37* (4), 54-55.

Joyce, D. (1994) History of mathematics. Retrieved from http://aleph0.clarku.edu/~djoyce/mathhist/

Ke, F., & Grabowski, B. (2007). Gameplaying for maths learning: Cooperative or not?. *British Journal of Education Technology, 38* (2), 249-259.

Kirkey, T. (2005). Differentiated instruction and enrichment opportunities: An action research report. *Ontario Action Researcher, 8* (3), 10-13.

Lach, T., & Sakshaug, L. (2005). Let's do math: Wanna play?. *Mathematics teaching in the middle school, 11* (4), 172-176.

Levy, H. (2008). Meeting the needs of all students through differentiated instruction: Helping every child reach and exceed standards. *Clearing House: A Journal of Educational Strategies, Issues and Ideas, 81* (4), 161-164.

Main, S., & O'Rourke, J. (2011). New Direction for traditional lessons: Can handheld game consoles enhance mental mathematics skills? *Australian Journal of Teacher Education, 36*, 43-55.

Marr, J. (2011). Education Week: A digital immigrant's interactive whiteboard experience, 3, 34.

Marzano, R. J., & Haystead, M. (2009). *Final report on the evaluation of the Promethean technology*. Englewood, CO: Marzano Research Laboratory. Retrieved from: http://www.ascd.org/publications/educational-leadership/nov09/vol67/num03/Teaching-with-Interactive-Whiteboards.aspx

Nisbet, S., & Williams, A. (2009). Improving students' attitudes to chance with games and activities. *Australian Mathematics Teacher, 65* (3), 25-37.

Puchner, L., Taylor, A., & O'Donnell, B., & Fick, K. (2008). Teacher learning and mathematics manipulatives: A collective case study about teacher use of manipulatives in elementary and middle school mathematics lessons. *School Science and Mathematics, 108* (7), 313-325.

Orwig, C. (2003). Prepare for language learning. In LinguaLinks library 5.0 plus. n.p. Dallas: SIL International Digital Resources. Retrieved from www.sil.org/lingualinks/LANGUAGELEARNING/PrepareForLanguageLearning/PrepareForLanguageLearning.htm

Rapp, W. (2009). Avoiding math taboos: Effective math strategies for visual-spatial learners. *Teaching Exceptional Children Plus, 6* (2), 121-135.

Schiel, S. (2002). A digital time line. *A History of Digital Technology.* Retrieved from: http://teeksaphoto.org/Archive/DigitalTimeline/DigitalTimeLineWeb1.html

Tsao, Y. (2004). A comparison of American and Taiwanese students: Their math perception. *Journal* of *Instructional Psychology, 31* (3), 206-213.

U.S. Department of Education, National Center of Educational Statistics, (2011). *Digest of Education Statistics,* 2. Retrieved from: http://nces.ed.gov/fastfacts/display.asp?id=514

Whitehurst, G. (2003). Research on mathematics instruction. Paper presented at the Secretary's Summit on Mathematics, Washington, DC. Available: www.ed.gov/rschstat/research/progs/mathscience/whitehurst.html

Woodward, J. (2006). Developing automaticity in multiplication facts: Integrating strategy instruction with timed practice drills. *Learning Disability Quarterly*, *29* (4), 269-289.