Effects of Different Approaches on Student Math Achievement

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Abstract

The objective of this project was to discover how students at the research site best learn math. Nineteen third grade students, in a self-contained classroom at the research site, learned math using three different approaches. The eclectic approach (researcher's personal approach), Peer Assisted Learning Strategies (peer pairs helping each other), and the Multiple Intelligences Approach (based on Howard Gardner's theory that all people learn differently), were each used for six weeks. Data collection occurred through chapter tests, class papers, video taped lessons, observation, journaling, and attitude surveys. Results show that students learned best with the Multiple Intelligences Approach. Based on the findings the researcher will use this approach more at the research site.

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Chapter One – Introduction

Ourcity is never a stranger to a windy day. The wind howls through this coastal town as if it owned the place. Locals chuckle when they see a tourist try to manage an umbrella in this wind. The seagulls let the wind gusts pick them up and push them through the sky like soaring acrobats. Its 70 mph gusts have the power to tear off shingles, move garbage cans, and topple over the sturdiest of trees. The wind has recently caused the local schools to be canceled due to power outages and trees falling on school buildings. In the eyes of the students and even some of their teachers, the wind is a hero for the day.

Ourcity is nestled snuggly between the Pacific Ocean and a large river. It is 100 miles north of the California border ("_____ Chamber of Commerce," 2008). The nearest Wal-mart or Starbucks is a thirty minute drive, and the nearest large metropolitan city is a three hour trip. Though this small town is out of the way thousands of tourists come each year to enjoy its special amenities.

Some of the town's amenities include a state-of-the-art golf resort. The courses at this resort are world-renowned and have been given glowing recognition by many golf magazines ("_____ Dunes golf resort," 2004). Many tourists come to play golf in Ourcity every year.

Another tourist attraction is this town's beautiful sandy beaches. They are a great place to fly a kite, or search for seashells. Ourcity also has great restaurants, nice hotels, a new boardwalk, new sidewalks, beach rentals, fishing in the ocean and river, crabbing, birding, surfing, and mushroom picking ("_____ Oregon Chamber of Commerce," 2008).

This town has not always been a tourist attraction. It started out with a cheese factory, sawmill, school house, and Catholic Church. It grew to incorporate a lighthouse and woolen mill. “By 1910 there were five sawmills, a woolen mill, two shipyards, a creamery, and two canneries. By 1912, the town had developed into a principal port between San Francisco and Portland. Three-hundred vessels put into port at (town’s name) that year. As with many other new towns, a terrible fire burned down part of the town. For (town’s name), it lost its entire waterfront business district in 1914 (Gibson, 2000).”

As time went on the cranberry industry continued to grow with the tourism industry. Today more than 100 growers harvest about 1,600 acres of cranberries annually. This makes up about 5% of the national crop (Gibson, 2000).

The ethnicity in Ourcity is predominately white. 3% of the population is Hispanic, and 2% is American Indian. 17 residents are of Asian decent, and there are about 7 African American residents ("U.S. Census Bureau," 2007). This community has a much higher Caucasian population than the national average. In contrast, the school district has 13% minority students in attendance ("Oregon Department of Education," 2008).

The retirement community here is very large. Ourcity has a population of about 2,900 people. Thirty percent of those are over 64 years of age. The median resident age is 49.3 years old ("U.S. Census Bureau," 2007). This trend has opened up a job market for nursing homes, and medical professionals. Because Ourcity has turned into a retirement community, the prices of homes have gone up. This makes it difficult for average families to buy or rent homes in the area.

The average household income is 12% less than the national average. Twelve percent of Ourcity’s families are below poverty level ("U.S. Census Bureau," 2007). Many families have moved out of the area to find jobs in the larger cities, because they cannot find work that will pay

enough to live here. Because of this, there are fewer students in this school district each year.

The school district's leadership has recently gone through a transition. In 2005, the high school athletic director moved into the high school principal job, and a new elementary school principal was hired. The following year the elementary principal became the superintendent, and another elementary school principal was hired. In 2007 a new vice principal at the high school was hired. The middle school administrators are both nearing retirement. They share the job as middle school principal. Their intention is to retire from the principal job at the end of the 2008-2009 schoolyear. The elementary principal has now been in the district for two years, and is also nearing retirement age.

There are about 250 kindergarten through 4th grade students at the elementary school. There are 11 regular education teachers, 1 special education teacher, and 1 Title I teacher. Due to budget cuts and decreasing student enrollment in 2006 the district eliminated two teaching positions. Because of this staffing decrease, many of the elementary classes are large. Currently the first and fourth grade classes are at 30 students each. The other elementary classes are all under 25 students for the time being.

The teachers at the school have an average of 20 years teaching experience. Twenty-one percent have a master's degree or above, and a few of the teachers are in the process of earning their master's degree ("Oregon Department of Education," 2008).

Of the 250 students, about half of them receive free or reduced lunch. This qualifies the school as a Title I school. With the Title 1 money, the school has hired a full time Title I teacher and two educational assistants.

Ourcity's elementary school had an "exceptional" rating for the 2006-2007 school year. The school was above state average in reading, and below state average in math. The third and

fourth grade math scores were 6% lower than the state average ("Oregon Department of Education," 2008).

The researcher is a 3rd grade teacher at this elementary school. She has been teaching 6th grade Math, Social Studies, and PE at Ourcity's Middle School for the past five years. Now she teaches in a self-contained 3rd grade class in Ourcity's elementary school. She has nine total years of teaching experience. The researcher has taught at all grade levels and subjects from kindergarten reading to high school weight training. She is committed to her students. Helping students learn and understand in all subject areas is a priority for her.

The third grade math curriculum was purchased less than five years ago. It seems to be well aligned with the state standards. Some parts of the curriculum seem to be missing. One important missing part is the manipulatives.

The researcher encourages her students to do their best. She is always trying different lesson ideas to engage the students in the math curriculum. She knows it is important for the students to have good math skills so they can be successful in school and in life. To that end, the researcher asks: "How do the students in the research site classroom best learn math?"

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Chapter Two – The Issue

Third grade math curriculum is challenging to learn and to teach. Students learn how to do all sorts of things during their third grade math experience. The topics range from rounding large numbers to finding time to the nearest minute. The math learned in third grade lays a foundation for more complex mathematical learning in the higher grades, and throughout life. Because of the importance of students learning mathematical concepts, the researcher asks: How do the students in the research site classroom best learn math?

The students at Ourcity Elementary School need to be learning at their full potential. Many of the students are lacking the basics like memorized addition, and subtraction facts. There lack of subject mastery is evident in the third grade standardized test scores. The third graders scored lower than the state average on their math assessments in 2007("Oregon Department of Education," 2008). They often struggle with story problems. Some students cannot remember what was learned the day before, let alone a week, month, or year ago. Many of the upper elementary teachers are concerned about the students' lack of basic math knowledge. The students will have trouble doing upper level math if they cannot comprehend the third grade math first.

There is a lack of parent concern about math. Parents say things like, "Well, I wasn't any good at math either." In addition, give excuses for not spending time at home with their child doing homework. A few of the parents do not understand some of the math even at the third grade level, and some of them are just not available to help. Because of the lack of parent involvement if a student does not understand the concept at school it is likely, the student will

not understand it at all.

There are three groups of math students at the research site. One group of students can understand and remember a concept with minimal practice and are able to remember that concept and apply it to further learning. Another group falls farther and farther behind each year because they have not mastered the math curriculum in the years before. They are overwhelmed by the ideas being presented because their mathematical foundation to this point is faulty. The last group is somewhere in between.

Positive and negative attitudes toward math affect the students learning. Most third graders still like math and enjoy learning. They can get easily frustrated if they don't understand something right away. Some students don't have the will power to figure it out. They seem to give up almost before they really try it.

Students learn in many different ways. If a teacher wants her students to learn, she must know how they learn best. Third grade math at the research site poses many different obstacles to success, these include: lack of parent involvement, lack of math manipulatives, a large learning spectrum, individual learning gaps, students' lack of perseverance, and students different learning needs and preferences. Considering all this, it is of the utmost importance that the teacher knows how to best teach the students at the elementary school so they can get as much math learning done as possible.

Literature Search

The researcher has spent many hours reading articles on student learning and mathematics. Through this process the researcher has come to the conclusion that there are at least three main factors to consider in finding out how students best learn math. These factors are the content, the learner, and the teaching. The content deals with the curriculum to be taught

and learned. The next factor is the learner. This is the most complicated factor and deals with the student's ability, learning styles, attitudes, and more. The last factor is the learning. This deals with educational strategies, and teaching philosophies. This literature review will start by giving an overview of mathematic education, and then discuss the factors listed above.

Overview

In the U.S., students have been learning math since slates and paddles ("A History of Public Schools," 2001). In the 1800's math education consisted mostly of arithmetic and basic geometry. These skills were needed for daily life. Around the turn of the century, there was a strong push to beef up the math being taught. Throughout the 1900's math education had its vicissitudes due to economic conditions, and war conditions (Shirley, 2000).

In 1975, Congress enacted IDEA to make sure that children with disabilities had the opportunity to receive an appropriate education including math instruction ("IDEA," 2006). In the late 1980's the reform movement brought national standards to mathematics. Then in 2001, NCLB was established (Witzel & Riccomini, 2007).

The U.S. educational system is potentially on the brink of another educational change. Many people have apposed NCLB. Critics suggests that it was not properly funded, has not shown significant improvement in student learning, and it is not practical to fully implement (Lee, 2006). With a new president in office, it is certain that some educational reforms will take place. President Obama is reserved in stating what exactly those reforms may consist of, but increase in teacher salary has been mentioned (Bombardieri, 2007).

The Content

In Singapore, students learn math through a three-step approach: concrete – pictorial - abstract. They also use a bar model technique for doing story problems (Hoven & Garelick,

2007). Singapore students do very well, and often are top-ranked on country comparison tests (Darling-Hammond, 2008). Many U.S. schools are adopting the Singaporean curriculum and their students are being successful with it.

Unlike Singapore, the U.S. does not have one curriculum that all schools follow. However, most teachers do stick to their district-adopted curriculum. Seventy-five percent of teachers' instructional decisions are based on their current math curriculum (Witzel & Riccomini, 2007). Because of this significant number, it is important that the curriculum being used does what it is supposed to. A good math curriculum can help a teacher do an effective job of educating students. All teachers should have access to a logical, challenging math curriculum (Woodward & Brown, 2006).

Oregon has a list of state math standards that the chosen curriculum should follow. These standards are based on the National Council of Teachers of Mathematics Focal Points. In the past, there have been state approved curriculums that meet the standards the state has set. Oregon has recently (December 2007) changed its grade level standards to more in-depth coverage of fewer topics per grade level ("State of Oregon mathematics content standards for kindergarten through grade 8," 2008). This means that to meet the state standards current classroom curriculum must be reviewed and restructured.

The Learner

Probably the most important factor to consider when doing this educational research project is the learner. Each student is unique. How a student learns and perceives affects how he/she achieves. Each student brings with him or her to math class an individualized set of variables, which may limit or free the budding mathematician within.

Some variables that have negative impact on mathematic learning are race, gender, and

socioeconomic status. These variables cannot be changed by the student, but the students learning is affected by them. Low-income students are four times more likely to have math problems (Nancy, 2007). Another external variable is gender. “Female students tend to have less interest in mathematics and less confidence in their mathematic abilities (p. 199 Catsambis, 1994).” Ethnicity also plays an external role. Minority students of both genders statistically have limited learning opportunities and low levels of achievement (Catsambis, 1994). The researcher assumes that another factor that may effect student achievement would be the student’s health. If a student is sick a lot and unable to attend classes the learner may fall behind. If a student has poor eyesight and does not have glasses, she or he may not be able to see the instruction material. If a student is hurting or sick, he or she may not be able to focus on the lesson because he or she is in pain.

Students with special learning needs may be particularly susceptible to low achievement. One way to combat that is through early identification of students with math difficulties. If students can get extra help when they are very young, their chances improve for achievement. 6-10% of the population have number sense difficulties. For this reason, all learners should develop a number sense in kindergarten and first grade. This foundation will help special needs students as well as the general population be successful learners (Nancy, 2007).

5-10% of elementary learners without disabilities have trouble with math. Students with organization problems are particularly susceptible to math problems (Allison, 2007). These students need extra support in the classroom to be successful.

Students learn in many different ways, but some attributes all learners have. The information being presented needs to be important at some level to the learner. It must be meaningful to the learner. Information is stored in long-term memory based on the learners

existing understanding of the world around them. This is why there is such an importance on meaning and importance. If the material being taught lacks these qualities then the learner will most likely forget it (Grasha, 2001).

There are many different ways to categorize student-learning styles. Some of these include Multiple Intelligences, Kolb's learning styles, field dependence and independence, and Learning Modalities. According to the Learning Modalities approach, students learn in four basic ways. These are auditory, visual, tactile, and kinesthetic. An auditory learner learns best through listening. A visual learner can best learn by reading and responding to visual cues. A tactile learner prefers to touch and best learns through the hands on method. The kinesthetic learner likes to learn through experiential activities (Grasha, 2001). Students learning styles can be unveiled with a learning styles inventory.

The Teaching

There are many different teaching philosophies. Some say the best way to teach math is through a problem solving approach. Others suggest math should focus on rote memorization and the accumulation of facts (Ernest, 1998). Some recent philosophers and mathematicians have concluded that math is flawed, and is a product of human inventiveness (Ernest, 1991). This philosophy lays the premises for learning through exploration and experimentation. Many educators agree that it is important to find a balance between math facts and math understanding (Cavanagh, 2007).

While philosophers and mathematicians debate the best way to teach math, and if math should be taught or created, some people are actually doing the teaching. Millions of teachers all over the world are teaching their students math everyday. These teachers use a variety of educational strategies to help them teach their students. A classroom teacher could use many

potentially beneficial math practices. Deciding which activities to use, and when to use them can be tricky. The teachers use such variables as personal experience, and instructional goals to choose which activity to use (Durik & Eccles, 2006).

Cooperative, competitive, and individual learning activities are beneficial when used appropriately. Cooperative learning refers to students working together for a common goal. New teachers in the field of education generally use cooperative learning. "Cooperative classroom activities have been shown to be beneficial for learners on a number of levels p. 37 (Durik & Eccles, 2006)." Competitive learning helps students cement easily memorized facts into long-term memory. Competitive activities are beneficial for review and drill of previously memorized math facts. Individual activities are also beneficial, but may take away from the students' motivation to learn (Durik & Eccles, 2006).

Another teaching strategy is tiered instruction. In this strategy, the teacher gives a lesson then assigns independent practice at varying difficulties. The foundational level practice activity would be just the basics. The intermediate level would be a bit more difficult. The advanced level would be even higher up on blooms taxonomy. At this level, the learner uses new information to solve difficult problems. Students tend to do the harder practice activity because it is more fun to be challenged then to not. It is important when doing the tiered activities that the activities are challenging without being overwhelming (Suarez, 2007).

Brain based research has inspired some teaching strategies that improve student learning. The best time for the brain to learn new information is the first 20 minutes of class, and the last five minutes of class. Most classes start with attendance, collection papers, and other nonessentials. The brain best functions in the first 20 minutes, and that is when the instruction should occur (David, 2001).

Teaching through the multiple intelligences is also a good instructional strategy. Howard Gardner's Multiple Intelligences theory demonstrates that everyone learns differently (Stager, 2008). Because students learn differently, it is important to differentiate instruction. This involves using music, drama, art, conversation, and more in the math classroom. The multiple intelligences are: "Linguistic intelligence ("word smart"), Logical-mathematical intelligence ("number/reasoning smart"), Spatial intelligence ("picture smart"), Bodily-kinesthetic intelligence ("body smart"), Musical intelligence ("music smart"), Interpersonal intelligence ("people smart"), Intrapersonal intelligence ("self smart"), and Naturalist intelligence ("nature smart") ("Multiple intelligences," 2007)." Teaching with the MI makes learning more fun for students and more memorable. It also provides more opportunities to succeed for all learners, and it is proven to increase the quality of work students produce (Smith, 2002).

Here is a list of proven teaching strategies, and techniques that can help all learners better learn mathematics.

- Use enlarged graph paper to help students keep their numbers in the right place. This is particularly helpful in addition, subtraction, multiplication, and division (Allison, 2007).
- Do not make students copy assignments from a book or the board. Have the assignments already written down so they do not make an error in copying or spend all their time copying problems (Allison, 2007).
- Allow students to use math fact charts. When a student has a fact memorized the teacher will use a black marker and mark out that fact so the student will rely on his or her memory for the facts he or she already knows (Allison, 2007).
- If a student has trouble being organized get him or her organized (Allison, 2007). Teach students the organizational skills that will help them in all their classes.

- Let students use calculators as much as possible (Allison, 2007).
- Have manipulatives available for the students to use (Allison, 2007).
- When giving worksheets increase student interest by adding pictures, and not an overwhelming number of problems (Allison, 2007)
- The learner will better understand math if it is taught as a whole both relevant and sophisticated (Madison, 2004). Similarly, teach concepts rather than just procedures (Smith & Geller, 2004).
- Hands on learning is important to help students understand abstract ideas (Smith & Geller, 2004).
- Use story problems that relate to the learners everyday life (Smith & Geller, 2004).
- Give many opportunities for students to succeed because motivation decreases with failure (Woodward & Brown, 2006, p.158).

There are many different teaching strategies and tools at a teacher's dispense. A teacher should know his or her students well so he or she can choose the best approaches to use in that setting for those students (Stager, 2008).

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Chapter Three – The Goal of the Action Research Project

The goal of this research project is to determine how the students at the research site best learn math. If the researcher is able to reach this goal then she can do her part to make sure the solution is implemented. Her part would include providing instruction and environment, based on the research outcomes, that best facilitate student learning. If this is accomplished students will be able to learn to the best of their abilities. The researcher will know the goal is met when students collectively score 80% or better on a posttest.

The researcher will know that the students are best learning math when she sees the students responding positively to the curriculum, understanding the ideas being presented, are confident in activities and independent practice, answer oral questions correctly, and do well on assessments.

The data that will be gathered to indicate students are or are not learning to the best of their ability will be a pretest and posttest, completed projects, student daily assignments, 2 or more video recorded class sessions, student surveys and researcher collected notes on informal assessments.

The researcher hopes that this action research project will be successful so student learning can be improved in the classroom. If student learning improves, the researcher assumes state assessments will improve. This will benefit the school and district that are required to meet certain standards. It will also greatly benefit the students by preparing them for their future in mathematical education, and in daily life. No matter what the outcome, this project will enable the researcher to better understand the learning needs of her students.

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Chapter Four - Action Steps

The researcher seeks to find how students at the research site best learn math. In the endeavor to find this answer, the following three things need to be considered: The students' needs, the curriculum, and the teaching strategies. The content to be taught is none negotiable. It is provided for the research site via the state of Oregon content standards. How that content is taught based on researched techniques and student needs is what is being addressed here. By experimenting with different teaching techniques, the researcher hopes to find out how students at the research site best learn math.

Possible Solutions

Some schools have improved student learning by teaching with activities prepared according to Gardner's Multiple Intelligence Theory. This theory asserts that all students learn differently and are smart in different ways. There are eight different ways to be smart. These are: word smart (Linguistic intelligence), number or reasoning smart (Logical-mathematical intelligence), picture smart (Spatial intelligence), body smart (Bodily-Kinesthetic intelligence), music smart (Musical intelligence), people smart (Interpersonal intelligence), self smart (Intrapersonal intelligence), and nature smart (Naturalist intelligence) (Armstrong, 2000).

Each of the eight multiple intelligences are part of what make each person unique. Although a person is born with certain intelligence tendencies intelligences are developed by the person's environment as well (Temur, 2007).

The Private Primary School of Gazi University found that students in a fourth grade classroom who where given math instruction based on the multiple intelligences scored

significantly higher on a posttest than other students from the same school. The students also had improved leadership skills, and more confidence in independent work. The teachers observed that the students remembered what they learned from the beginning of the semester, which is not a typical occurrence (Temur, 2007).

Using the multiple intelligences to teach math in the research setting would be one solution to finding out how students learn best. The researcher thinks that more than one approach should be attempted in the research setting. This would be a good approach to try. The researcher believes it would increase student learning, but is not sure if it would produce the best student learning. She is also concerned about the amount of time needed to present MI activities. The research site allows for 50-minute math sessions each day. The MI activities could be linked to other areas of study through theme integration so the researcher could use other time throughout the day to teach math using this approach.

A middle school study in the Midwest shows one way to increase student learning is through PALS. PALS stands for: peer-assisted learning strategies. "The overall structure of the PALS program creates a climate of reduced anxiety (Kroeger & Kouche, 2006, p. 9)."

In the PALS program, students are paired by ranked ability. All the students are tested and then the group is arranged by scores. The group is then split in half pairing the strongest student from the top half with the strongest student from the bottom half. Because of this method of pairing, students do not have huge gaps in their learning difference, which is sometimes the case with student tutoring. Throughout the year about once or twice a quarter, the pairs are changed to give the students the opportunity to work with other students.

The PALS program is designed to work three days a week, and is designed to reinforce the initial teacher instruction. It is important to train the students how to use the program.

Training involves such things as reminding the students to keep their voices low, and cooperate with their partner. The pairs take turns being the coach and the player. The coach reads a script prepared by the teacher that takes the player systematically through the mathematical process. Then the roles are reversed. In the middle school class studied the teacher saw 100% of her class engaged for the entire class time (Kroeger & Kouche, 2006).

The researcher thinks this technique would increase student learning in the research setting. The researcher is concerned about the time it would take to implement the program and write the scripts. She is also concerned about the pairing, noting that third grade boys have a tendency to be goofy and squirrelly when paired together, and third grade girls love to giggle and argue. The researcher is also concerned that the strategy may work better for older students and not be well suited for 3rd graders. The researcher believes that these hurdles may be overcome and that the program is worth a shot.

The last solution being studied is the teaching approach that uses Direct Instruction. "Direct Instruction (DI) is a model for teaching that emphasizes well-developed and carefully planned lessons designed around small learning increments and clearly defined and prescribed teaching tasks. It is based on the theory that clear instruction eliminating misinterpretations can greatly improve and accelerate learning ("National institute for direct instruction")." The researcher has a tendency to shy away from this solution because she personally has never been taught by this format. The researcher has never been advised to teach by this format by her professors of education with the exception of ESL instruction. Many educators do not believe in direct instruction, and it has found its way into the taboo closet in some schools of education. Through research, the researcher has discovered that it does have its place and can be effective.

American Association of School Administrators (AASA), American Federation of

Teachers (AFT), National Association of Elementary School Principals (NAESP), National Association of Secondary School Principals (NASSP), and National Education Association (NEA) are all national associations for education. They sponsored a study of 24 instructional models. Direct instruction was one of only two to receive a strong rating for evidence of positive effects on student achievement. There were three other reputable sources that gave positive research outcomes to the direct instruction approach ("Research base for the effectiveness of the direct instruction model," 2002).

One specific example of the positive effects of direct instruction was a school in Baltimore. It was the second lowest performing elementary school out of 114 schools in the district. After using the direct instruction approach for five years it is now ranked one of the highest, ranking 10th in reading and 20th in math ("National institute for direct instruction").

One study the researcher found to disprove the benefits of Direct Instruction was from What Works Clearinghouse. This research reviewed six studies done on DI with young learners. In this study, the researchers concluded that of the six studies reviewed only one of them had significant evidence that this instructional strategy was beneficial. Besides its lack of proven benefits the study calculated a nearly $800 cost for the yearly curriculum ("Direct instruction, DISTAR, and language for learning," 2007).

The researcher is not sure if Direct Instruction would benefit the students in the research site. The specific example of DI making significant gains was in a district that was very low in achievement. The students at the research site are not in a low achieving school. The approach may be beneficial, but the researcher believes the other two approaches would be a better fit for her research site.

Action Plan

In this action research plan the researcher is trying to answer the question: How do students at the research site best learn math? The researcher has decided the best way to do this is by trying two different approaches to teaching, as well as what the researcher generally does, and see what the outcomes are. The two new approaches will be teaching using lessons based on the multiple intelligences, and teach lessons with peer assistance using the PALS model. What the teacher generally does is a mixture of different techniques based on what she thinks will work best, what the textbook says to do, and with the preparation time restraints generally related to teaching in a public school (about 50 min. for all prep work for all subjects and anything else the teacher needs to do each day). The MI and PALS approaches will not fit into the typical teacher time restraints. The researcher assumes it will take extra time to prepare and organize materials. The content to be studied will be provided by the Oregon State Standards and Practices Commission.

At the beginning of the action research plan students will need to have their parents sign a permission slip to be part of the action research. The class will be video taped at least once for each of the six-week intervals. The researcher thinks that one fun way to wrap up the action research project is to show the edited video to the students. The researcher needs to make sure that it is okay with parents to video tape their child.

The study will follow the following timeline:

Week 1-6	Teacher's typical instruction
Week 7-12	PALS support
Week 13-18	multiple intelligences instruction
Week 19-24	Data Analysis and final write-up

The first six weeks the focus will be on getting to know the students in the class. The

researcher will learn about the students' learning styles, strengths and weaknesses through observation. She will journal daily on what was taught, how it was taught, and any specific student interaction that seems note worthy. The grading system will be traditional. Daily assignments will be graded and worth 60% and weekly tests will be graded and worth 40% of the overall grade.

The teacher will start each class by explaining what is to be learned and giving examples on the white board of how to do the new math concept. Additional concrete examples may be given from time to time, and hands on learning may be used on occasion. The teacher will have the students do one independent practice problem (or more if needed). The teacher will check each student's paper to make sure the student has the correct answer and understands the concept. After the student has the correct answer, they will do their practice activity. This will be 10 to 20 practice problems in worksheet form or using the textbook. Students will have the chance to get assistance from the teacher and classroom instructional assistant for the rest of the class session, and help at home, if they need the extra time or help.

The researcher will give a 15-problem pretest of the material to be covered in the first six weeks and then the same test will be administered at the end of the six weeks. The researcher will keep a photo copy of all students weekly test results as well as the pre and post test in student folders (the folders will be used for the entire action research project). The researcher will rate students' attitudes toward math, and work ethic on a scale of one to ten, and note any specific behaviors that may hinder or help student learning. The researcher may ask the student about specifics if they are unclear. The ranking will be put into the students' folder. The rankings will be given every six weeks to see if there are any changes. An example of the ranking chart is below.

Name _____ Date_____

Rank students in each area 1 is the lowest and 10 is the highest possible.

How happy is the student to learn math ____

How confident is the student in his/her math ability ____

How well does the student pay attention ___

How well does the student use class time to do seat work ____

How good is the student in turning in completed homework/class work ____

The second six weeks will be the implementation of the PALS program. The students will be sorted from highest to lowest by the pretest given at the beginning of week 7. The group will be split in half separating the top 50% from the bottom 50%. The top student will be paired with the top student from the low half and so on. On day two, the teacher will assign the pairs and explain their purpose.

The teacher would talk about the following:

- The class is starting a new program called PALS. PALS stands for Peer Assisted Learning Strategies. Each person will have a partner called a PAL.
- Your partner will be the first person you turn to when you are confused or need help with your math.
- In the PALS program, there is a coach and a player. Each person will play both rolls.
- You will always be able to ask your pal for help during work time but two days a week there will be a lesson designed specifically for PALS. After the teacher gives the lesson the students will get with their PAL and do the coach/player activity.
- Show the students what the script for the activity looks like. Do an example using a

student volunteer to be the player.

- Remind students to keep quiet voices, work together, stay on topic, be polite, and follow classroom rules (be respectful, be responsible, and be ready).
- Tell students that they will be graded on their own work.
- Allow students to get with their PAL and do the practice activity.
- The practice activity will be very simple so the students are not learning new math they are just practicing the format.

Student Worksheet:

Name _____ Date _____

1. 5 + 6=

2. 8 + 4=

3. 6 + 6=

4. 5 + 1=

Coaching Sheet:

Adding one digit numbers

Coach's Question Sheet

Look at the problem.

What type of problem is it?

Where do you start?

Do not forget to complement and encourage the player!

The researcher will use her normal lesson format, but add the PALS activity two days a week for weeks 7-12. The pairs will be encouraged to look to each other for help with math work

even when there is not a specific PALS activity. During this time, the teacher will use the same grading system as the first six weeks.

Weeks 13 – 18 the researcher will use multiple intelligence activities to teach her lessons. This will involve hands on learning, group learning, and asking leveled thinking questions (recall, summary comprehension, analysis, evaluation, and application) (Buher). It will also involve projects, visuals, manipulatives, charts, graphs, and more. Depending one the content the researcher will tailor make each lesson to involve at least three of the eight multiple intelligences.

To assess student learning during this six weeks the teacher will use projects, pictures, illustrations, group assessments, and other authentic assessment. At the beginning and end of these six weeks the researcher will give a pre and posttest to evaluate student learning using this method.

The researcher realizes that using the multiple intelligences to teach may be the most time consuming aspect of the teaching in the action research project. Because of that the researcher will use the first 12 weeks to break down the math curriculum and find activities and projects that will teach the content through the multiple intelligences.

Conclusion

The researcher will provide a classroom atmosphere that is respectful both of the teacher and of the student. Mutual respect and a real concern for students as individuals will set the scene for this action research project. The researcher is hopeful that through implementing different teaching strategies she will be able to find how students at the research site best learn math.

Action Research Project

Chapter Five – The Results

The purpose of this action research project was to answer the question: "How do students at the research site best learn math?" To do this the researcher chose to teach math using three different approaches. The first teaching approach was the researcher's normal, eclectic, method. The second approach was teaching with the Peer Assisted Learning Strategies (PALS) model. The final approach was teaching using the multiple intelligences. Each approach lasted six weeks, and during that time, the researcher gathered data to help answer the research question.

Since the original conception of this project, the research site has changed. The researcher relocated from a sixth grade classroom to a third grade classroom. Because of this change, the researcher re-evaluated the relevance of the research question. She found that it was a legitimate question to answer even at the lower grade level. Then the researcher had to decide if the three teaching strategies originally planned would still work. After thorough and specific research of the PALS strategy, (usually used with older students), the researcher decided that with a few minor changes to protocol the original action research project plan would work. Then the researcher had to re-write certain parts of the original action research document to focus on the elementary school, rather than the middle school students. The researcher also determined that an 80% class average on the posttest would not be a legitimate measure to indicate which approach worked best, so it was not used as an indicator.

Typical Instruction

The first approach was six weeks in length. During that time, the researcher taught the students using her normal approach to teaching math. This approach is a mixture of different

teaching strategies the researcher has become accustom to using. This instruction includes the use of the overhead projector, white board, math books, manipulatives, games, teacher's manual, student practice pages, and various activities that seem to reach the desired objective. The researcher has used this eclectic approach successfully for a number of years.

During the eclectic approach, the researcher taught Chapter 5 through Chapter 7. The content of these chapters included:

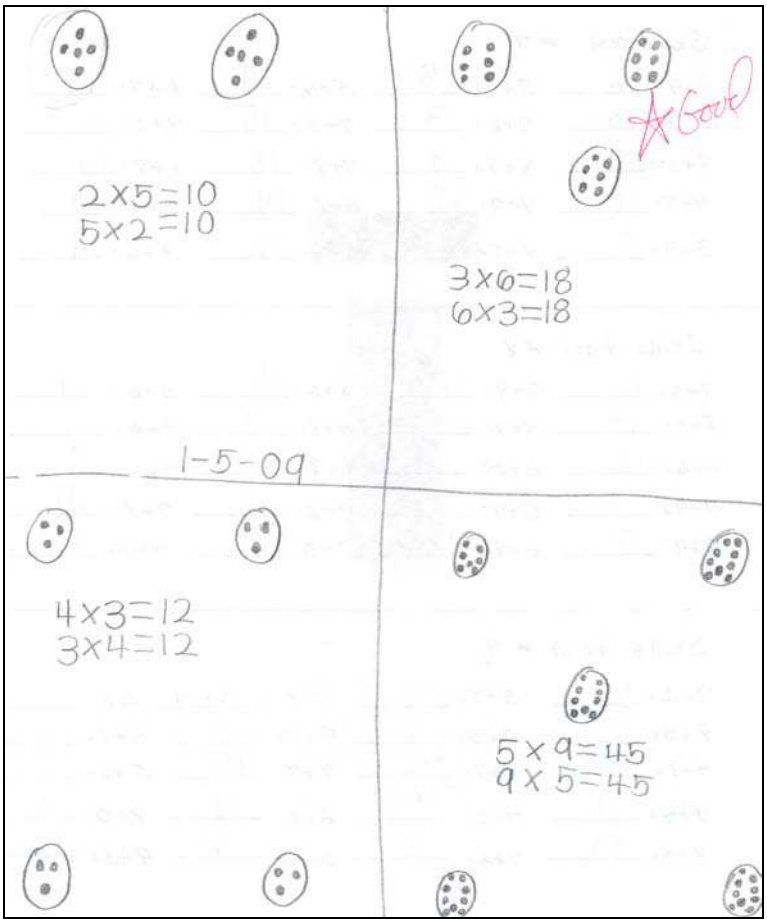
- basic multiplication,
- arrays,
- problem solving,
- pictographs,
- lines,
- line segments,
- rays,
- angles,
- plane figures,
- congruence,
- symmetry,
- perimeter,
- area

The first chapter taught to the students was Chapter 5 of the third grade Houghton Mifflin 2002 math series. It was about basic multiplication. The assessment used for the pretest was from the chapter 5 test in the student book. The pre- and posttests for the action research project were always the same. On the pretest student scores averaged 65%. The students seemed

excited to learn multiplication. Many of them learned about multiplication in second grade, and the researcher had mentioned it a few times in earlier lessons. The high pretest score made the researcher think that she probably did not need to spend too much time on this chapter. The researcher taught four lessons on the topic of basic multiplication.

During the first lesson, the researcher reviewed with the students how to count by 2, 5, and 10. Then she explained to the class using words, and pictures on the whiteboard that multiplication is just counting by a given number or factor. The teacher wrote a multiplication problem on the whiteboard and labeled it- factor, factor, and product. Then she drew an array to match the equation and wrote the word array. She explained to the students the definitions to the three vocabulary words. Then the students were assigned independent practice problems from the text. Each student worked quietly while the researcher walked around the room to answer questions, and give clarification when needed. Student instruction for the next two lessons was the same structure as the first lesson.

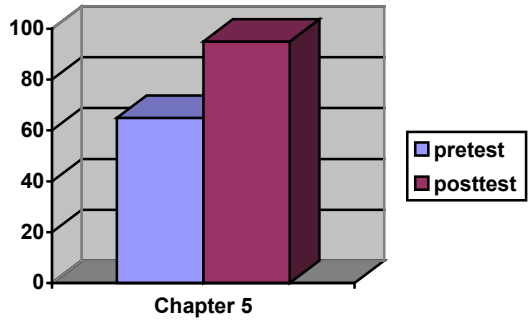
For the fourth lesson, the students did an activity where they had to create a multiplication sentences for a group of dots they arranged on a page. A student sample is below.



The students enjoyed the activity. One student did not quite understand what to do, and needed individualized help. A few other students had the wrong multiplication answer, and had to correct their error. Then the class did an activity where the students split 12 students into equal groups of 2,3,4,6,12,1 (all factors of 12). The researcher wrote the multiplication sentences for these factors, and their product on the board. The students did a textbook practice page, and they seemed to do well on it. The students seemed to enjoy this lesson's varied activities.

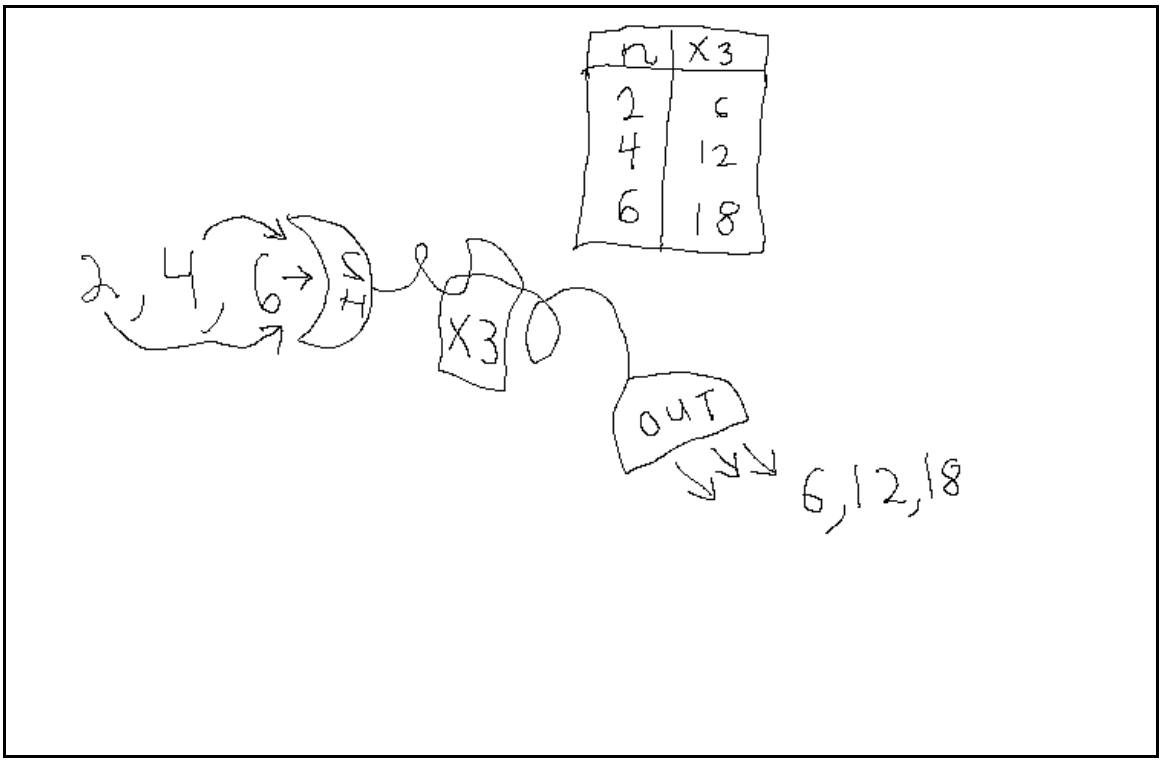
After teaching four lessons on basic multiplication, the researcher gave the posttest. The student scores averaged 95% on the posttest. The researcher realized that with such high results it was evident that the students only needed a few lessons to master the idea of basic multiplication. Below is a graph that shows the class average on the pre- and posttests for

Chapter 5.



The second chapter taught using the researcher's typical instruction method was Chapter 6. This chapter was again on basic multiplication, but this time the focus was on the rules of multiplication, reading and writing pictographs, and two-part story problems. The students scored 73% on the pretest. Because the pretest scores were so high, the researcher only taught seven lessons from Chapter 6.

The first lesson taught was to review with the students how to read a pictograph. The researcher drew a pictograph on the board and explained how each symbol represents a certain number of objects. The researcher gave examples on the whiteboard until she was certain most students knew how to read a pictograph. For the next lesson, the teacher taught students how to make input/output machines for multiplication. The researcher drew Input/output charts on the board, and the students had to figure out which factor the machine was. Below is an example of that.



The third lesson was to review the vocabulary and teach the commutative property of multiplication. For this lesson, the researcher used the book, whiteboard, and oral response from the students. The students did a practice page in the book to practice these concepts.

- The next lesson's objective was to answer story problems with two parts using multiplication, and one other operation. The researcher used one side of the worksheet to teach the lesson, and the other side for student independent practice. The four problems on the worksheet took 20 minutes to explain and solve together. The researcher showed the students the steps on the board to take to solve each problem. The teacher asked students questions like:
  - What is the problem asking?
  - What should we do first?
  - Why do you think so?
  - What should we do now?

- Why should we do that?

Then she drew pictures on the board to help.

The students began to do the other side independently, and seemed overwhelmed by it. Four students stared at their paper, as if they had no idea where to start. Four students came directly to the researcher for help without even looking at the problems. The rest struggled at their seats. The teacher ended up with a group of six pupils around her desk full of props and manipulatives to help them understand. When students were finished, the researcher checked their work. There was not one perfect paper turned in.

The students' lack of understanding made the researcher wonder how the students did on their pretest for Ch. 6 on these problems. When she looked back, the teacher saw that:

- five students missed all four problems
- six students got only one of them right
- three students got two of four
- two student got three correct
- one student got all four correct

At this point, the researcher realized that the students had not mastered the concept.

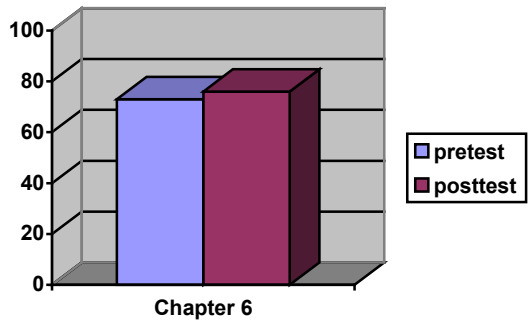
The next lesson was again to work on the two-part story problems. The teacher solved four problems on the board, and showed systematic procedures for solving each problem. Then the researcher put the students into groups of two to solve six problems on their own. Although the students seemed to like the activity, the inaccuracy, and confusion from the day before were still there. The researcher decided to move on, because she felt that the students might not be ready for mastery of this concept at this grade level.

The sixth lesson for Chapter 6 was how to use parentheses when multiplying. The

researcher explained the concept using the whiteboard. Then students did an independent assignment from the textbook. Most students seemed to understand, and that was evident by many correct responses on their assignment papers.

The last lesson taught for this chapter was on square numbers, and a review of the other topics introduced in the chapter. The researcher used the whiteboard to teach this lesson. The students raised their hands to answer specific questions as groups, and individuals.

The posttest average for Chapter 6 was 76%. The researcher was surprised that there was minimal gain between the pre- and posttests. She realized after taking a close look at the assessment that there were many wrong responses on the two-part story problems on the test. There were four of these problems, which made up 27% of the test. These problems were extremely difficult for the students. The researcher remembered the students were confused about these kinds of story problems during instructional time. The test was only 14 problems long so those four problems brought the students' grades down considerably. Next is a graph that shows the class average on the pre- and posttests for Chapter 6.



The last chapter taught using the researcher's eclectic approach was Chapter 7. On the pretest for Chapter 7 the students scored an average of 14%. There were eleven lessons taught for this chapter. During these lessons the students learned about

- lines,

- segments,
- rays,
- angles,
- shape names,
- perimeter,
- area,
- congruence,
- symmetry

The first lesson taught was lines, line segments, rays, right angles, and comparing angle sizes. For this lesson, the researcher used two yardsticks to represent two line segments. She moved them all around to represent different angles and line parts. She also used the whiteboard to show what each thing meant. The students then did an independent worksheet. All the students did well on this assignment. The researcher noted that the students seemed to soak up the new information like a sponge.

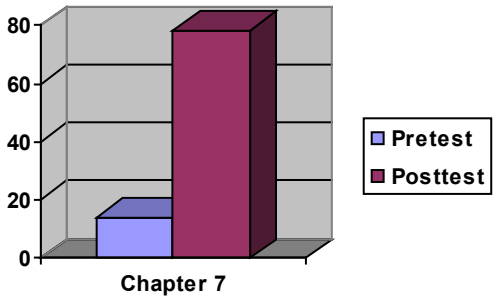
The next lesson's objective was to identify the six basic polygons, and their names. The researcher showed the students a picture of each shape using the textbook, and then drew the shapes on the whiteboard and labeled them. The students did a practice worksheet, and used the board and book as references. The researcher taught several of the other lessons using this same format with seemingly successful results.

On Valentine's Day, the researcher taught a lesson on symmetry using hearts. Students cut out hearts from construction paper, and then used string to show the lines of symmetry. Next, the researcher taught a lesson on perimeter. The objective was that the students would understand that perimeter was the outside edge of a shape, and that to find the perimeter you add

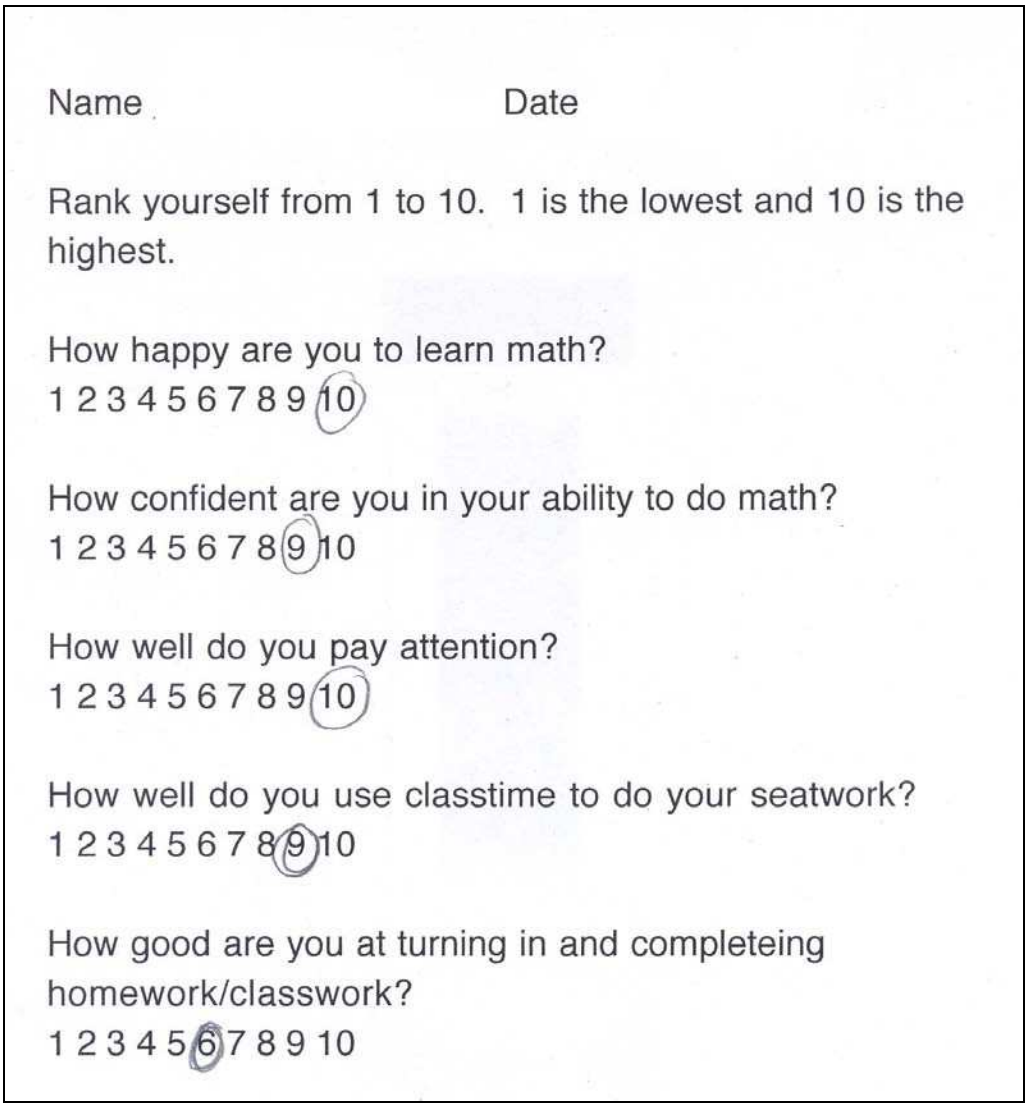
up all the sides. The researcher walked around the outside of the classroom to show what perimeter was. Then she had students outline things with their finger to show perimeter. The researcher drew some examples on the whiteboard, and explained how to find perimeter using those examples.

The eclectic approach part of the action research project was ending. To stay on track the researcher cut the section on three-dimensional shapes out of the test (and eliminated those answers from the pretest data) so she could do a posttest on Chapter 7.

On the posttest, the class average was 78%. The researcher thinks the students could have done better with a day to review, but she needed to get the posttest done so the class could move on to the next lesson. The students seemed to grasp all the concepts taught in this chapter. They just forgot some of the specifics because there was so much vocabulary to remember. Below is a graph that shows the class average on the pre- and posttests for Chapter 7.



In the middle of the eclectic approach there was an attitude survey given to see how students felt about their own math experiences. A student copy of this survey is below.



Name Date

Rank yourself from 1 to 10. 1 is the lowest and 10 is the highest.

How happy are you to learn math?
1 2 3 4 5 6 7 8 9 10

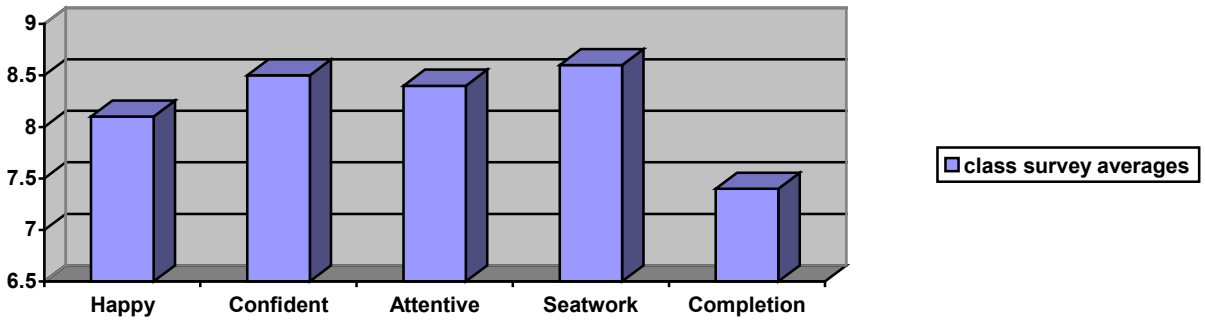
How confident are you in your ability to do math?
1 2 3 4 5 6 7 8 9 10

How well do you pay attention?
1 2 3 4 5 6 7 8 9 10

How well do you use classtime to do your seatwork?
1 2 3 4 5 6 7 8 9 10

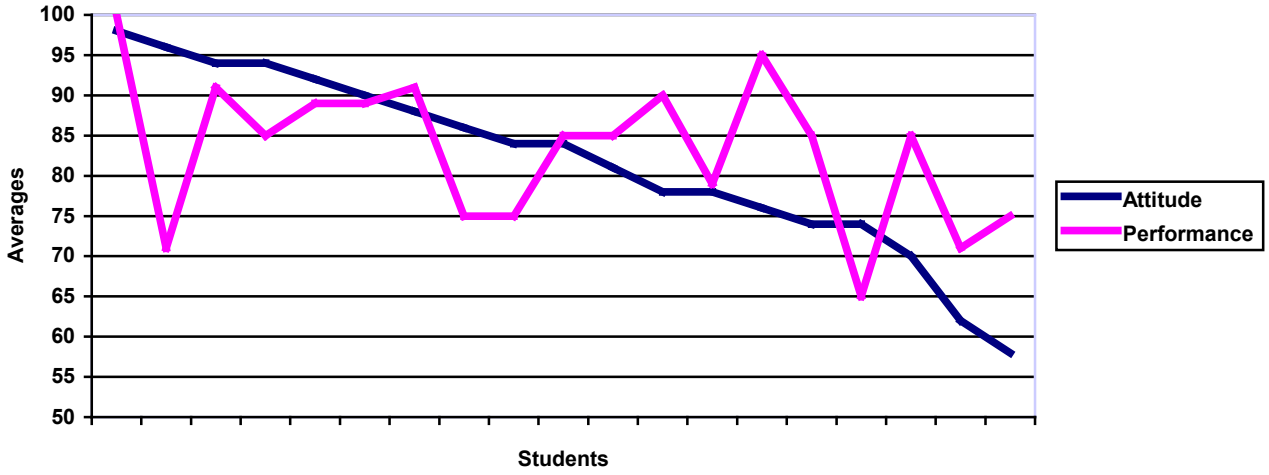
How good are you at turning in and completeing homework/classwork?
1 2 3 4 5 6 7 8 9 10

The graph below shows the average score on each of the five questions listed above for the attitude survey. The overall survey average for the first approach was 8.2 on a scale of one (poorest response) to ten (strongest response).

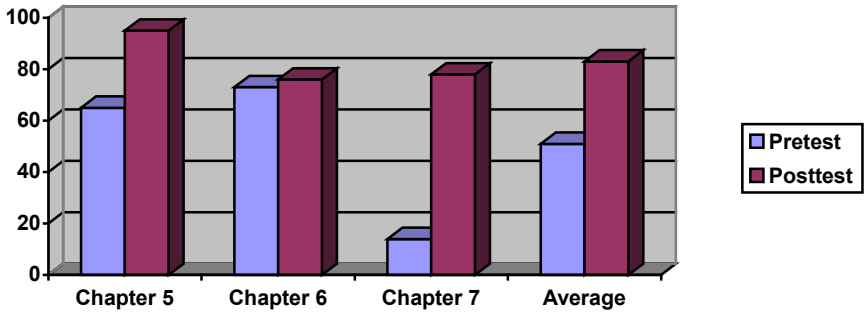


The researcher found it interesting that the students felt that they were considerably lower at completion than the other four areas. The researcher also found it interesting that the students, in general, felt more confident than happy about math.

In an effort to find the answer to the research question the researcher thought that maybe there would be a connection between the students' attitudes about math, and their achievement in math. Because of this curiosity, the researcher examined the students' individual assignment, and test scores. Then she compared them to the attitude score. Of the students who marked a ten on their attitude survey for being happy, there were two A- grades, two B's, and three C's. The data showed that class grades and personal attitudes toward math had little to do with each other. Sometimes high achievers had poor attitude scores, and some of the time low achievers had high attitude scores. One notable result the researcher found was that the person who scored the highest on the attitude chart overall also got the highest grade in the class for this approach. Below is a graph showing the inconsistency between each student's average attitude score, and their actual assessment score for this approach.



The researcher has looked over all the data for the first approach, and concluded that significant learning took place during this six-week period. The objective of answering a two-part story problem was the only objective not reached in the researcher's opinion. The students all seemed to make significant progress in the curriculum presented. Here is a graph that shows all the pre- and posttest scores together, and then averages them for the first six weeks of the action research project.



PALS Instruction

The second part of this action research project was teaching using PALS instruction. Students received PALS instruction two days a week, and the teacher's typical instruction the other days. PALS is an acronym for Peer Assisted Learning Strategies. To implement this

program the researcher had to arrange students by their class average. Then split the list in two. The researcher paired the top students on each list together. For each lesson, a script was given to one of the students in the pair, and that student would read the systematic instructions for the other to follow. Below is one of the scripts that the researcher used.

PALS

Script for 3rd grade math book pg. 329 #1- 15

Coach:

- Look at the figure.
- Is it round?
- Does it have points?
- What shape do you think it is?
- Does it look like the _____ on page 328?
- Good, now go ahead and write down your answer.

As part of the pairing process, the researcher moved the desks together so the pairs were sitting by each other. The researcher allowed the pairs to help each other as needed at anytime during the practice portion of the lesson. The researcher told the students to ask their PAL before asking the teacher for help.

The content covered during the six week PALS approach was the end of Chapter 7, all of Chapter 8, and Chapter 10. Students learned about:

- solid figures,
- volume,

- basic division,
- data collecting,
- making pictographs,
- plot lines,
- bar graphs,
- ordered pairs,
- probability,
- predictions,
- problem solving

The researcher had to create the first pretest because it was combining two chapters. On this pretest, the students scored an average of 22%. Because of the low pretest score, the researcher realized that the students would need a lot of instruction in this content area.

During the first lesson for Chapter 7/8 the researcher explained the PALS process, and helped the students arrange their desks so they were sitting with their PAL. Then she gave an example of a PALS activity, and explained the roles of coach and player. The researcher explained on the whiteboard the lesson for the day, solid figures, and passed out the PALS script.

The teacher did #1 as an example, and then told the students which partner would be the coach first. Then she walked around and monitored the students' progress, and interaction. The students were full of anticipation, and did not really believe the researcher when she told them that they were going to help each other. Students responded with:

- Cool!
- Awesome!
- So, we get to help each other?

- Can I keep the script?
- So, we get to help each other on all the math days?"

They were very excited about the new teaching method.

Initially some of the students wanted to rush ahead without the coach's help. The researcher told the coaches that if their players were writing the answer down too soon that they could hold the pencil until it was time to write. Some of the students found the script to be a bit redundant. The papers that day were all in the A and B range.

The second lesson's objective was to find the number of faces, edges, and vertices on three solid figures. For this lesson, the researcher gave the students tag board shapes for the students to color, cut, and tape into three-dimensional objects. Then the researcher used the whiteboard to fill-in a chart using the data the students had discovered from the building project.

For the next lesson, the researcher used the textbook and whiteboard to help students understand the concept of volume. The students did a practice worksheet with the help of their PALS partner. The researcher taught the next lesson using the same formatted as this one.

The sixth lesson taught with PALS was at the end of the month of February. During this period the researcher noted many students were absent because of illness. Because of this the researcher had to match students with others who were present, rather than their assigned partner. The researcher observed students saying, and doing the following things:

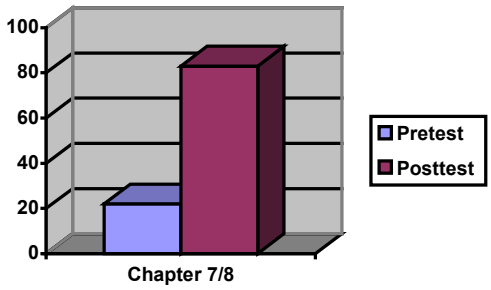
- squirming
- standing
- leaning
- quiet interaction
- smiles

- giggles
- disagreeing
- explaining
- on knees
- on chairs
- side by side
- facing each other
- "(*Student name*) stop! Seriously you are annoying me"

Through all the movement and chatting the researcher realized 100% of the students were focused on the review lesson. The students earned an average of 87% on the assignment.

The next lesson in the PALS approach was an introduction to division. The researcher gave students groups of 20 things for them to divide into groups of 5,4,10, and 2. The students and researcher discussed the correlation between multiplication and division. They talked about fact families, and the teacher wrote different families on the board. Half the class seemed excited to learn division, but the other half did not seem to be interested in it.

The next few lessons were hands-on using counters to solve division problems orally. Then there were two more PALS lessons with the scripts and coach/player rolls. These assignments came from the 3rd grade math text. After that, the students took the posttest on the last part of Chapter 7 and all of Chapter 8. The pre- and posttest results are on the following graph.



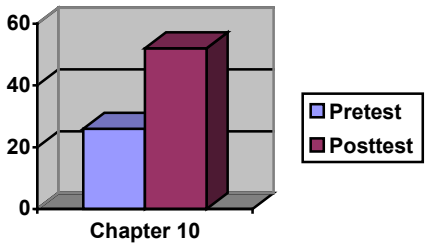
Chapter 9 was more practice on division facts. The researcher took into account the curriculum that she needed to teach for the entire year, and felt that this chapter was not critical. The mathematical topic for Chapter 10 was data and probability. The students' pretest scores on this chapter averaged 26%.

The first lesson for Chapter 10 was collecting and organizing data. The researcher passed out a worksheet. The class did one side together as a whole group. The other side the students did in pairs using a PALS script. The researcher had to reassign partners because of student illnesses.

All the rest of the lessons for chapter 10 all followed a similar pattern. First, the instructor taught the initial concept using the whiteboard. Then the researcher gave the students an individual assignment, or given a PALS assignment. For both of these options the teacher was always walking around to answer questions, redirect students, and help students. The researcher often had to reassigned PALS partners because of student illnesses.

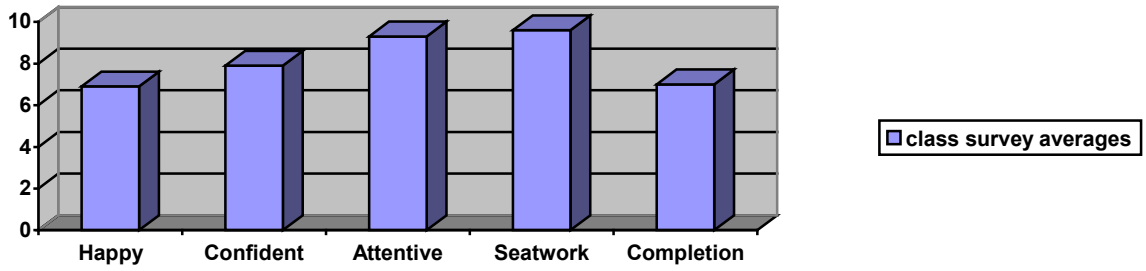
On the posttest for Chapter 10 the class average was 52%. The researcher thinks the students could have done better if they had been in school more. There were many students absent during this chapter. The researcher gave students the assignments they missed for make-up work, but most did not do them. When the students were gone they missed the PALS sessions, and the teacher instruction. Below is a graph of the pre- and posttest for Chapter 10.

The researcher was surprised at the low posttest score for chapter 10. After looking over the data the researcher noticed that the assignment scores were acceptable, and showed mastery of the objectives day-by-day. However, the researcher noticed that there were lots of missing assignments during this Chapter. She remembered that the attendance during four of the 6 weeks of the approach had been poor. Many students throughout the building had missed school because they were sick. That generalization held true for the research site as well. Although the students that were there worked well together, did their assignment, and learned the lesson, the sick students did not.

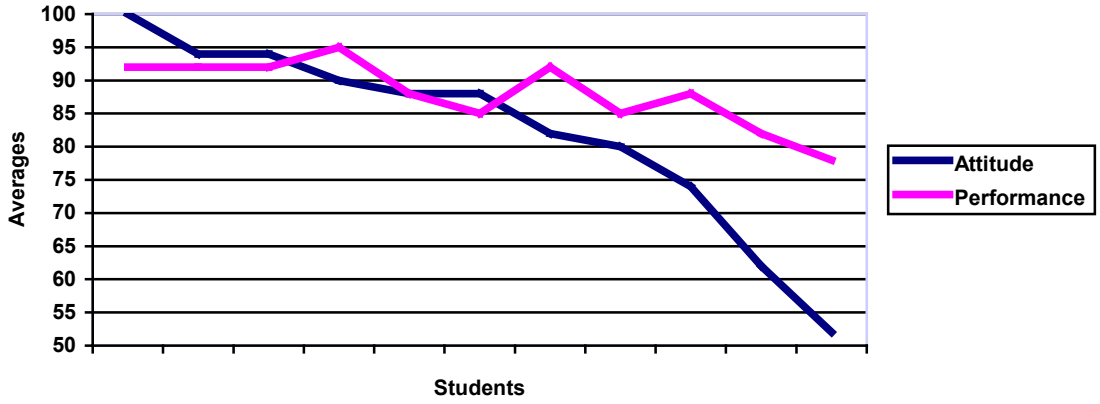


In the middle of the PALS approach there was an attitude survey given to see how students felt at this point about their own math experiences. Students were asked to rank themselves from one (being the lowest) to 10 (being the highest) about different aspects of their math learning. Below is a list of the questions asked, and a graph of the average student responses for each question.

- How happy are you to learn math?
- How confident are you in your ability to do math?
- How well do you pay attention?
- How well do you use class time to do your seatwork?
- How good are you at turning-in and completing homework/class work?

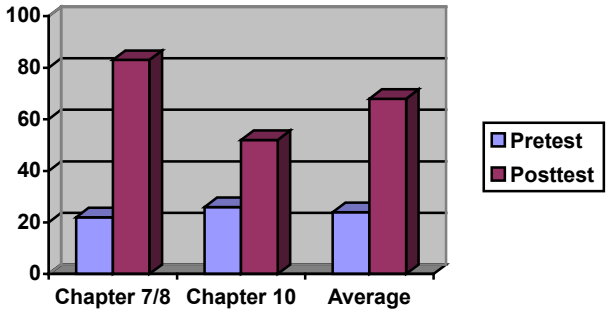


The researcher compared the students' attitude to their assessment scores for the PALS approach. The researcher noticed that the student with the lowest attitude score also had the lowest performance score. Below is a graph showing each student's average attitude score, and their overall grade for this approach.



The researcher has reviewed all the data for the PALS approach. She feels that the students were successful at reaching the objectives for Chapter 7b and eight, but not Chapter 10. She feels that the students would have done better on the posttest for Chapter 10 if they had been in class more often to learn the lessons in Chapter 10. The researcher did note that there was considerable learning taking place even though the objectives were not fully mastered. The test results did not lean toward one specific area of concern. Students missed different problems, which shows some learned it and others did not. In reference to the research question, "How do students in the research site best learn math?" the researcher has reached a fundamental

conclusion: The students can learn math the best when they are in the classroom. Below is a graph of the pre- and posttest assessments given to the students in the research site for the PALS approach section of the action research project. Along with that is an average of the two chapters' assessment scores.



Multiple Intelligences

During the last six weeks of the action research project the researcher used multiple intelligences to teach math. According to Howard Gardner (1983) there are eight different ways to be smart, and these are the Multiple Intelligences listed below.

- word smart (Linguistic intelligence)
- number or reasoning smart (Logical-mathematical intelligence)
- picture smart (Spatial intelligence)
- body smart (Bodily-Kinesthetic intelligence)
- music smart (Musical intelligence)
- people smart (Interpersonal intelligence)
- self smart (Intrapersonal intelligence)
- nature smart (Naturalist intelligence) (Armstrong, 2000)

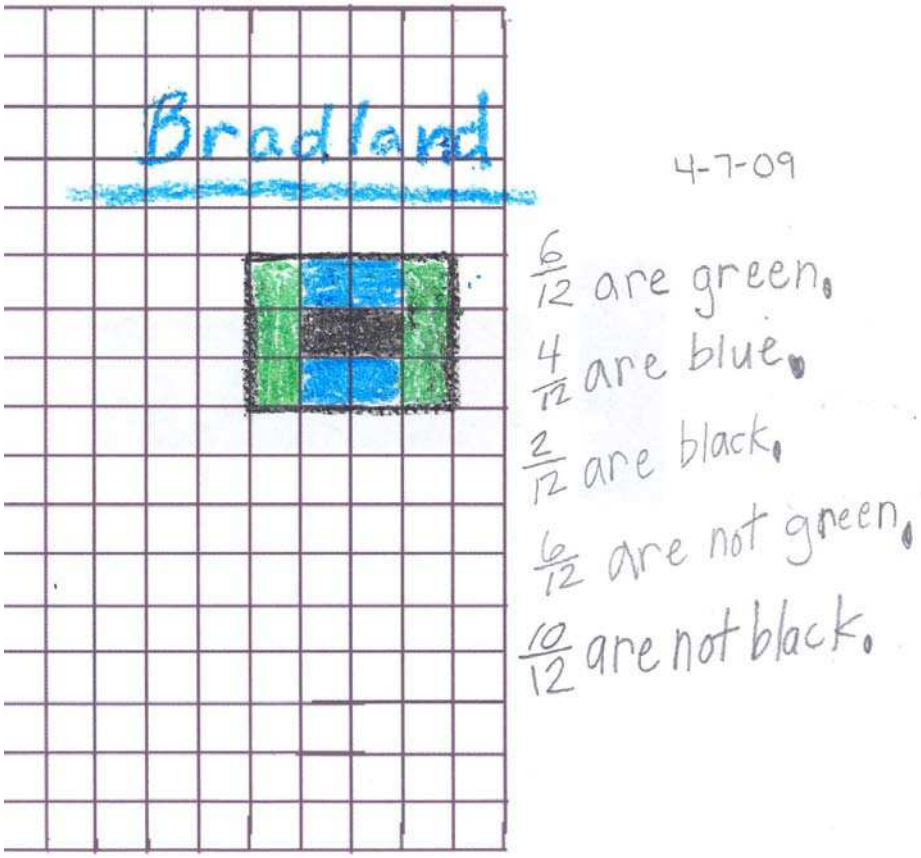
Gardner's Multiple Intelligence Theory (1983) asserts that all students learn differently and are smart in different ways. The researcher incorporated different activities into her lessons

that enhance learning throughout the multiple intelligences based on this theory.

During the multiple intelligences approach, the students learned Chapter 11. The content of this chapter was fractions and decimals. Third graders at the research site had had little exposure to these two topics until this time. The pretest and posttest given was from the Chapter 11 test in the textbook. On the pretest, the student scores averaged 13%. Because of this low average, and the importance of the content, the researcher spent the entire six weeks on these topics.

The objective for the first lesson taught was that students would understand fractions as part of a whole. For this lesson, the researcher showed the students a flag example given in their textbooks. The researcher talked briefly about the flag and the parts that made up the flag. She told the students that they were each going to create a flag for their own country. The rules were that each student could only use three colors, and each flag had to be three-by-four squares on the graph paper. The students made their flags then wrote five fractions for their flag, and five fractions for a friend's flag. Many students needed help initially but figured it out quickly.

The students really enjoyed the activity. The teacher monitored the students' coloring and designing of their flags. Some students did not follow the directions and had to start again. Below is an example of the assignment.



For the next lesson, the students used five cubes in two different colors to learn about ordering fractions. Each student had five cubes, some were red and some were blue. The researcher had students get into small groups and decide among themselves who had the largest fraction of blue cubes. Then who had the smallest fraction of blue cubes. Then the three students stood from least to greatest with their cubes. Each student said his or her fraction. The researcher had the students repeat the activity with the focus on the red cubes. Next, the class folded and cut paper to order fractions with different denominators. The students were able to order any fraction with a one for the numerator, or any fractions with the same denominator using their fraction strips. The researcher had to help many students along the way with the assignments for the day.

The third fractions lesson was on fraction equivalents. The researcher had students each

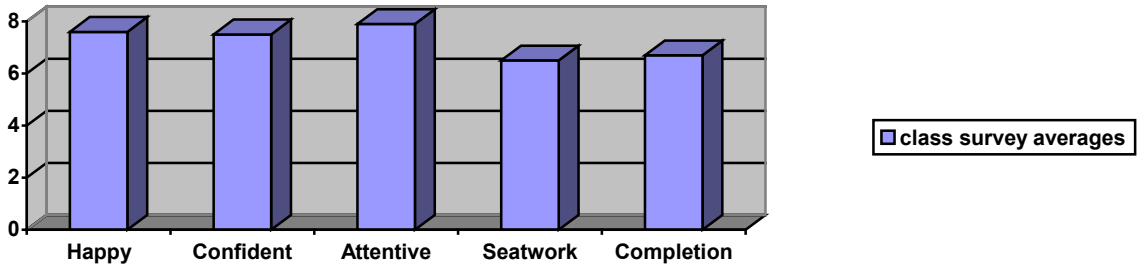
cut out a circle. Then the students folded their circles into halves, fourths, or eighths. Then the researcher had them all shade in half of the circle. She explained to them using their circles that it does not matter what numbers you have, if the denominator is twice the numerator then you have half. The researcher then used the whiteboard to draw fraction strips. Each strip represented a different fraction, but they all were equivalent. Then she told a story of when she ate six pieces of pizza. They seemed amazed. Then the researcher drew a circle and broke it into 24 slices. The class discussed how it would be possible to eat one piece of pizza, or six pieces, and still eat the same amount depending on how the pizza was cut. The pizza analogy really seemed to help the students realize what equivalent fractions are.

The researcher used many different activities like the ones described above to teach this chapter's content. Most lessons ended with a short practice page that the students did independently to review the day's lessons. The researcher observed students getting an initial understanding of fractions and decimals through the multiple intelligences approach. Below is a list of the other activities the instructor used to teach the lessons in this chapter.

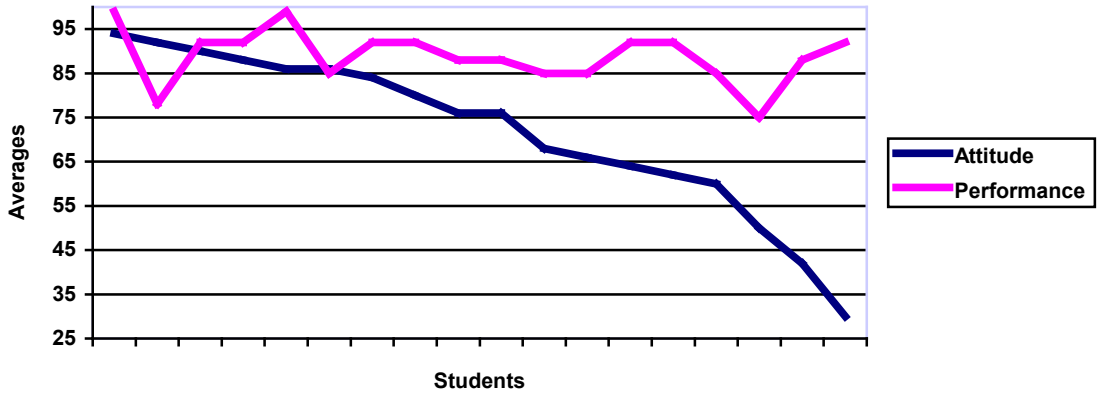
- Make fraction strips
- Look at patterns
- Predict what comes next
- Draw a picture
- Set goals for the lesson
- Do an assignment together
- Play a competitive game
- Use math cubes
- Use graph paper

- Fraction song
- Decimal song
- Written assignments
- Flash cards with a partner
- Use money to find fractions and decimals ($.26 or 26/100)

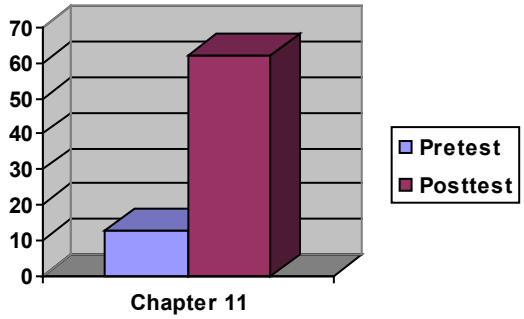
In the middle of this approach there was an attitude survey given to see how students felt, at this point, about their own math experiences. Students were asked to rank themselves from 1 (being the lowest) to 10 (being the highest) for different aspects of their math learning. Below is a graph of the average student responses for each question.



The researcher compared the students' attitudes to their assessment scores for the last approach. The researcher noticed that, once again, the student with the highest attitude score also had the highest academic score. The researcher also noticed that the majority of students had lower attitude scores than actual assessment scores. Below is a graph showing each student's average attitude score and their overall grade for this approach.



At the end of the six weeks, teaching using the multiple intelligences the students had a posttest. Their scores averaged 62%. Below is a graph of the pre- and posttest for Chapter 11 using the multiple intelligences approach to teach math.

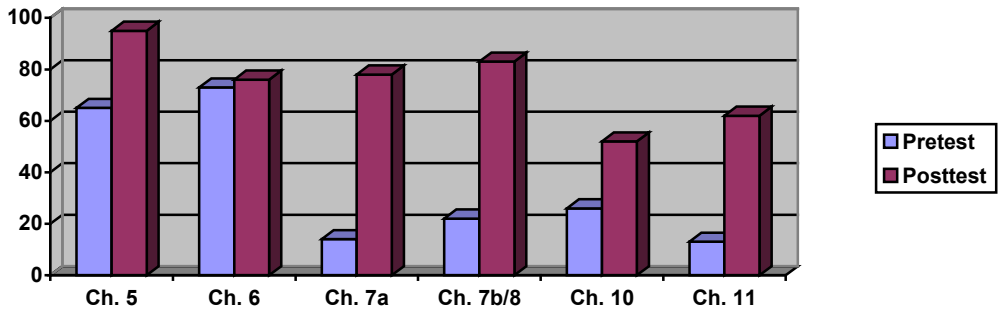


The researcher has reviewed all the data for the Multiple Intelligences approach. She feels that the students were successful in learning much of Chapter 11. She feels one reason that the test scores were low was that the content was so vast, and six weeks is a long time for eight and nine-year-old students to remember everything they have learned. The researcher did note that there was considerable learning taking place even though the objectives were not fully mastered. In addition, the students and the researcher enjoyed the activities used to teach using this approach.

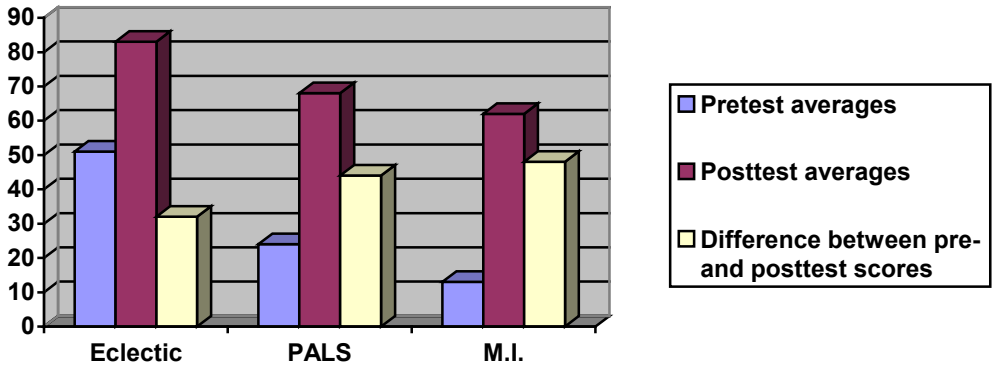
Summary

The 18 weeks of this action research project covered seven chapters of a 12-chapter third grade math book. Based on the pretest results, and the researcher's deemed value of the content, each chapter was taught at a different speed, and with different emphasis. The researcher taught each six-week period using a different learning approach. The researcher believes it is noteworthy to add that 18 of the 19 students at the research site passed or exceeded their state assessment test in math. This assessment took place in May during the last part of the project. Because of the state assessment results, and the obvious student growth in content understanding, the researcher believes that every method was successful in teaching math at the research site.

To answer the question how do students at the research site best learn math the researcher went back to the data compiled. The researcher believes the most important data to consider is the pre- and posttests. The researcher used the same test for the pre- and posttest on each chapter. That way the researcher would know that the gains were not due to an easier test, or a better test. Below are the pre- and posttest averages for each chapter.



According to the data above, the chapter where students did the most learning was Chapter 7a. The students went from 14% on the pretest to 78% on the posttest. During Chapter 7, the researcher was using her eclectic approach to teach math. The eclectic approach does not show the strongest results though, when comparing each approach's average test scores to each other. Below is a graph of that.



According to these results, the Multiple Intelligences approach showed the highest learning. Just slightly lower was the PALS approach. The eclectic approach showed the least amount of student learning.

The researcher was wondering if students in the research site best learned math based on their attitude toward math. From the attitude survey the researcher pulled the two most important questions in determining feeling about math these were:

- How happy are you to learn math?
- How confident are you in your ability to do math?

From these two questions, she averaged the results and compared them to the three approaches. The students' attitudes were the highest for the eclectic approach at 8.3. The students' attitude average for the PALS approach was 7.4, and it was 7.5 for the multiple intelligences approach.

Interpretation

When just looking at the numbers it seems obvious that the students at the research site learn best when taught using the multiple intelligences. However, on closer look one cannot ignore the many variables that may have hindered the results of this study.

The researcher sees many inconsistencies with her study that could have influenced the results. First, the number of lessons, and length of time for each approach was different. Because

of time restraints, some chapters allowed for a day of review before the assessment and others did not. One test covered six weeks of instruction, while another covered only a few days of instruction. Some of the information the students only had to remember for a few days, but for other chapters the students may have had to remember information from a month before.

The next flaw the researcher noticed was that for a few weeks there was very poor attendance due to illnesses. The students did not get the instruction from the research site at all if they were absent. The final variable was that some of the test questions were simply too hard. It did not matter how the lesson was taught, there was no way most of the students at the research site could understand the concept for at least a few more years. Some tests were reasonable, but others demanded too much of the students.

All this considered, the researcher still thinks that three conclusion can be made from this action research project. The first conclusion is that the researcher does not believe that poor attitudes affected student learning. The researcher believes this is because the research site is a caring, nurturing environment, and even on the worst of days, students could not help but to do their best. The students' knew that they were accountable for the product of their learning. If they were not trying, understanding, or caring about their work their teacher noticed and help them wherever they needed it. The researcher focused on encouragement rather than guilt when a student did not understand a concept.

The second conclusion the researcher believes is very evident when looking at the data is that students best learn math when they are at the research site, rather than not at the research site. The students who missed math class due to illness did poorly on the assessment. The students that did not miss school had better results than the students that did.

The last conclusion the researcher found was that the multiple intelligence approach

really is the way students at the research site best learn math. The researcher believes this is true for a few reasons. First, the researcher noticed that both the teacher's eclectic approach and the PALS approach had varied instruction. Many of those lessons were multiple intelligences lessons. The researcher noticed that anytime there was an interactive lesson the students were more engaged in learning. The research data shows that the most learning took place while using this approach. Although the data is not flawless it still has merit, and the researcher believes it is a fair conclusion.

Teaching using the multiple intelligence approach is fun for the students, and energizing for the teacher. The concepts taught using this engaging, and interactive approach seemed to be more memorable to the learner than the more traditional approach. The researcher created two songs during the action research project that she will incorporate into her math lessons for next school year. Because of the research results, the researcher will be using more of the multiple intelligences approach in her classroom in the years to come.

Suggestions for Further Study

This study would work well in a school district that has three third grade classrooms. With the research question broadened to, "How do third grade students at this elementary school best learn math." Three teachers could teach the same content their own classes using one of the three approaches. Then, using identical pre- and posttests the researcher could identify which group made the most academic growth. The research could continue by having each teacher change approaches, and again teach the same curriculum as the other classes. Then change approaches for the final time, while keeping the third grade content across the board a constant. Using the data collected from the three classes, the researcher would be able to answer the research question above.

A researcher could use a project like this one for a subject other than math. This study would work with science or social studies. The PALS scripts would need to be modified, but the idea of peer learning would still be the same. The researcher could do this study at a higher level, up through high school.

This research project was easy to implement. A classroom teacher should be able to do something like it to see how students in his or her classroom learn a subject best. To simplify the research the teacher could focus on the pre- and posttest scores primarily. The conclusions gained from a study like this will help the classroom teacher be a more effective educator.

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