An Action Research
The Effect of Computer-based Mathematics on Problem Solving

Contact Information: Daisy T. Emanuel
3rd Grade Teacher Sadie Tillis

Contents

Chapter 1... Overview

ABSTRACT

The purpose of this study is to examine the effects of computer-based mathematics curriculum on problem solving and the students' attitudes toward computer-based mathematics. Participants will be my 3rd grade students who will receive 2 hours weekly computer-guided math instruction along with their regular *Math Investigations*. The computer program that will be used in this study is *Edutest. Edutest* is a computer program that focuses on problem solving strategies, geometry, number sense, logic patterns, measurement, probability, and word problems that are in line with the district standards. The students will work independently on the computer with computer-guided instruction. During the study, students will take a pre test and posttest as well as on-going daily instruction in mathematics along with teacher made assessment tests in mathematics to measure their achievement levels. I will also take an attitude survey to gauge their feeling about using computer mathematics. A survey was given pre study and post study. This information was used to assist me in planning and implementing computer-based curriculum and to see whether their attitudes towards computer math will have an effect on how well they implement the program. I chose to study math because I enjoy teaching mathematics. Mathematics is the only subject that I have found in my career as a teacher that many students fear and feel inadequate.

Chapter 2…….. Introduction

While planning for my third grade math class, I often wonder to myself how effective is the use of computer-base math on students' problem solving. What are students' attitudes toward computer-based mathematics and, what effect their attitudes have on implementation of computer-based math?

My research will answer these questions by looking at the effect computer-based mathematics curriculum have on problem solving. Problem solving is one of the hardest concepts for students to grasp especially in word problems. Students generally have a difficult time determining what information they need or which operation they should perform. Difficulty comes from the inability to understand the wording of the problems. In my school here at Sadie Tillis I believe the problem stems from the lack of background knowledge and the meager help these students receive from home. Sadie Tillis is a Title 1 School which means the majority of our students are on free or reduce lunch. We are also a Reading First School. Sadie Tillis is located on the southwest side of Jacksonville, Florida. Our students come from two low income apartment complexes, trailer parks, and at least three stable sub divisions. Fifth grade students at Sadie Tillis have a history of low *FCAT* math scores. Students in grade 3 and 4 have shown progress, but fifth graders are still struggling to meet the standards in math. This problem is the reason I decided to look at the effect computer-based math program have on problem solving. I think fifth grade math students need an extensive background in math, which most of our students do not have. The deficiencies do not surface until later grades. If I can find a way to bridge the gap in the earlier grades it will prevent the deficiencies in upper grades. I am a 3rd grade teacher at Sadie T. Tillis Elementary. I am also a member of the Jacksonville Urban Systemic Initiative in Jacksonville, Florida. I received my master's degree from The University of North Florida.

Chapter 3……..LITERATURE REVIEW

"Many people regard mathematics as the crown jewel of sciences. Yet math has historically lacked one of the defining trappings of science: laboratory equipment. Physicists have their particle accelerators' their electron microscopes: and astronomers, their telescope. Mathematics, by contrast, concerns not the physical landscape but an idealized, abstract world. For exploring that world, mathematicians have traditionally had only their intuition" (Klarreich, 2004, p 266). Now, computers are starting to give mathematics the lab instruments they have been missing. A study by Klarreich (2004) discusses the role computers play in mathematics. The authors stated that computers' power is enabling mathematicians to make quantum leaps into mathematics. Computers take only seconds to calculate and create beautiful graphics of three-dimensional shapes. Computers can solve complex problems and computers can remediate students in mathematics.

A study by Leigh (2004) discusses the idea that games promote cognitive and problem-solving skills. The paper states that most children are "masters of the game. Young children can sit at a computer for hours on hours playing computer games. Therefore, since children like playing game, teachers should create computer math game so that students may practice computation on the computer. The computer games should include learning strategies to increase students' comprehension. These games should reinforce learning, provide immediate feedback, and improve test-taking skills. The computer math practice can also be used to replace drill work. Computer games can be constructed to meet the curriculum objective.

Another study by Lederman & Niess (1999) discusses the role computers play in helping students study math and science in the real world. The authors' primary point is that computer technology, along with other technology enhancements, affords students and efficient means through which higher level thinking skills can be enhanced. The authors state that math should be "authentic."

A study by Cyr (2004) examines a gifted boy who used an accelerated math computer curriculum to challenge his intellect. A teacher of the gifted decided to do a case study on the effectiveness of accelerated computer math, in order to enrich a gifted student she had in her class. This student scored a 150 on the *Otis Lennon Exams* and had a 99th percentile rank complete battery score for the fifth grade *Stanford Achievement Test,* as well as the higher rank possible on the *TOMA (Test of Mathematics Ability).* The computer math

session had a racing game that involved dividing four digits numbers by two digits numbers. The boy in this study was successful. Therefore, it may have implications for success in a regular classroom.

Crawford & Snider (2004) contributes to my research because the study evaluates the effectiveness of different kinds of mathematics curriculum. Two fourth grade teachers conducted a study with randomly assigned students in their classrooms. This study lasted for two years. The two curricula that were compared are *Invitation to Mathematics* by Scott Foresman and *Connecting Math Concepts*. This study was helpful because it taught me how to conduct a research study using different mathematical concepts. The study conducted by that school district answered an unknown question. Which is a better math textbook or connected math? The study concluded that connected math was better because it went into the contents more deeply and it did not cover as many topics as a textbook.

A study conducted by Roschelle, Pea, Hoadley, Gordin, and Means (2000) supports the use of computer-base math education in the classroom. Their finding indicates that computer technology can help support learning, and that it is especially useful in developing the higher-order skills of critical thinking, analysis, and scientific inquiry. This article explores the various ways computer technology can be used to improve how and what children learn in the classroom by helping students understand core concepts in math, science and literacy. These authors agree that computer-based math builds confidences and is a great tool for remediating slower learners.

Hubbard (2000) concedes that computer-based curricula can help teachers get the results they are seeking from their students. He stated in this study that students who are tutored with math program did 25% better in skill assessment tests than students who did not. This study was conducted in a high school algebra class with a math program called *The Cognitive Tutor*. This program tracks the student learning style and pinpoints flaws in their reasoning. As mistakes are made, the computer gives the student clues for rethinking the problem so that he or she can get back on track. Teachers in this study reported increase interest doing math class. The result is the right computer-based curriculum can help teachers reach tremendous results with students.

Inkrott (2001) stated in her article that computer courseware can help break through remedial barriers. Students and teachers are given an easy, flexible and effective way to learn, perform, assess and improve their skills. She also stated that this is a great way to measure the students' progress which otherwise would be difficult. The advantage using this software was valuable because she treated it as another set of eyes. The work is saved and

the teacher can review work after the students are gone. Another advantage noted by the author is the ability to tailor questions and exercises according to each student's abilities. Students' curriculum is based on their placement tests. They can all work at a pace that's comfortable and appropriate to their learning level.

A study by Macnab and Fitzsimmons (1999) indicates that the *TLE* math program *(The Learning Equation)* has had a positive impact on student learning. This study was conducted in Alberta and British Columbia, using 1,184 students in 14 schools. The instructional material was evaluated by looking at students who used *TLE* as their main method of instruction and comparing their math achievement scores to students who used traditional classroom techniques and materials as their main method of instruction. The results of the study are *TLE* students scored significantly higher on the Math Achievement Test than did non-*TLE* students. The results indicate the *TLE* math program have a positive effect on students learning. *TLE* seems to be an efficient method of instruction that has enhanced learning. The schools that implemented this program experience growth in all areas of the achievement test knowledge skill, number pattern, statistics, and probability.

Additionally, a study by Staples, Pugach and Himes (2005) this is a case study of three urban elementary schools conducted to document the integration of technology in schools given identical resources. The task was to determine how technology and curriculum would strengthen students' learning. The three principals made the same commitment to technology in their schools but the results were very different. The analysis of qualitative data from these three schools suggests technology should be alignment with the school's curriculum and the teacher has to be a leader for her students. If the teacher drops the students off in the computer lab the students placed less important on the instruction. The teacher needs to demonstrate teacher leadership in technology. Throughout this project each of the three partners was provided with the same technology resources, each utilized those resources in very different ways and all had different results. The article stated to be integrated successfully, there must be a clear understanding that technology is not a just a resource to be added it can be a powerful tool for moving schools towards their fundamental goals of supporting student learning.

A conclusion can be drawn from these studies that computer-based mathematics curriculum can be a useful tool in the advancement toward students' academic gains in mathematics. Implications from my literature review are that computer-based mathematics curriculum can provide

additional practice in the areas of need, and it can give advanced students a more challenging conceptual development.

Chapter 4….Description of The Research

The participants are my third grade students, who were divided into two groups. There were seven students in each group. My class size is unusually small this school term. I did not have to secure additional internet parental consent forms; this was taken care of by Duval County Public Schools. The internet form is apart of the registration package. I checked to make sure all students had signed forms on record. During computer Lab, Group One (control group) worked on *Edutest* reading strands while Group Two (treatment group) worked on *Edutest* mathematics strands. We used the math lab 2 hours per week. A pretest was administered before assigning the students a particular math strand. The class was taken to the lab and orientated to the computer and the *Edutest Computer Program*. The groups were assigned math strands based on the results form the pretest. Each student was placed in the area of math he/she scored the lowest. The strands are the requirements mandated by the Duval County Public School. The whole class continued with our normal *Math Investigation* pacing guide. The study took place from in the regular classroom and the math lab. Each group spent approximately five weeks on each computer subject reading or mathematics. At the end of five weeks, the groups rotated computer subjects. The Students were chosen by random selection. I chose to work with math because math is a subject Sadie Tillis needs improvement in, especially when the students reach fifth grade. The students seem to score fairly well on the *FCAT* test in grades 3 and 4. The lack of a strong math foundation seems to accelerate once the students reach 5th grade. I believe building a solid foundation will be useful in their academic future.

Chapter 5……Results
Table 1

First Rotation

Group Two Math Treatment Group computer # of students tested 7	Group One Math Control Group textbook # of students tested 7
Report card------ Bench mark	Report card------- Benchmark
Median ---72---46	Median 70--- 42%
Mode --- 77 --- 47	Mode 70-----46%
Means--- 74--- 48.5	Mean 70-----41%
Range-----61--- 42	Range 53-----31%

Second Rotation

Table 2

Group Two Treatment Group textbook # of students tested 7	Group One Math Control Group Computer # of students tested 7
Report card-----Benchmark	Report card-------Benchmark
Median 77---56%	Median 80----71%
Mode 76 ---62%	Mode 80---73%
Means 77.4 ----51%	Means 79---61%
Range 29------38%	Range 39 ---49%

Table 3 Report Card Achievement

First Rotation Computer Math	First Rotation Math Investigation
Median-------72	Median--------- 70
Mode---------77	Mode----------70
Means--------74	Means----------70
Range-------- 61	Range----------53

Table 4

Second Rotation Math Investigation	Second Rotation Computer Math
Median------ 77	Median-------80
Mode-------- 76	Mode---------80
Means------- 77.4	Means--------79
Range------- 29	Range---------39

Table 5

Benchmarks Tests achievement

First Rotation Computer Math	First Rotation Math Investigations
Median------46%	Means--------42%
Mode--------47%	Mode---------46%
Means-------48.5%	Means---------41%
Range---------42%	Range---------31%

Table 6

Second Rotation Math Investigations	Second Rotation Computer Math
Median------56	Median-------71
Mode--------62	Modes--------73
Means-------51	Means--------61
Range-------38	Range--------49

Attitude Questionnaire Results

A ten item attitude questionnaire was administered at the beginning of the action research to assess the students' attitudes with reference to computer-based math program and their attitudes toward working on computers. The survey was given to determine the computer usage background and motivation of the students. Students were asked to express their likes and dislike concerning math and computer math program. The students were given the exact questionnaire at the end of the research to see what effect the computer-based math had on their attitudes. The results are:

Pretest	Posttest
Like math 7 students	Like math 14 students
Like computers 14 students	Like computers 14 students
Own computers 3 students	Own computers 3 students
Are you good in math? 7 students	Are you good in math? 12 students
Do you like computer math? 3 students	Do you like computer math? 14 students
Do you like using computer lab 14 students	14 students

Figure 1

Pretest

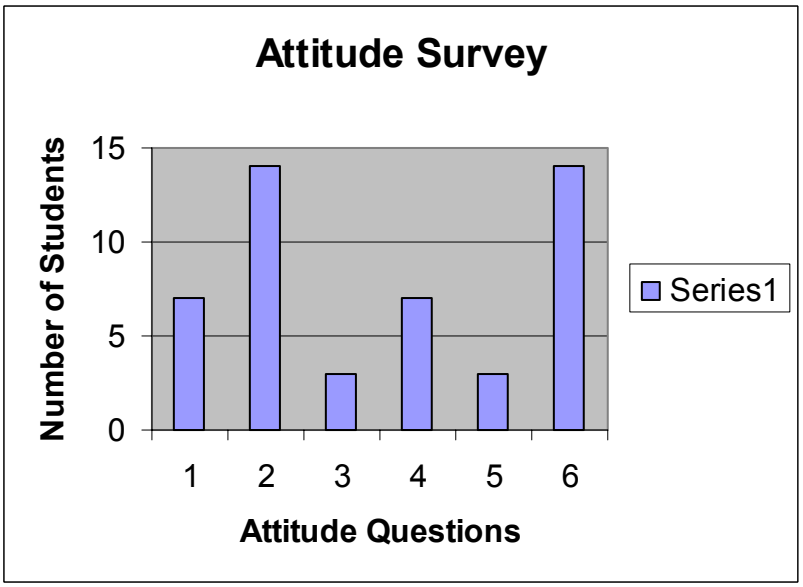
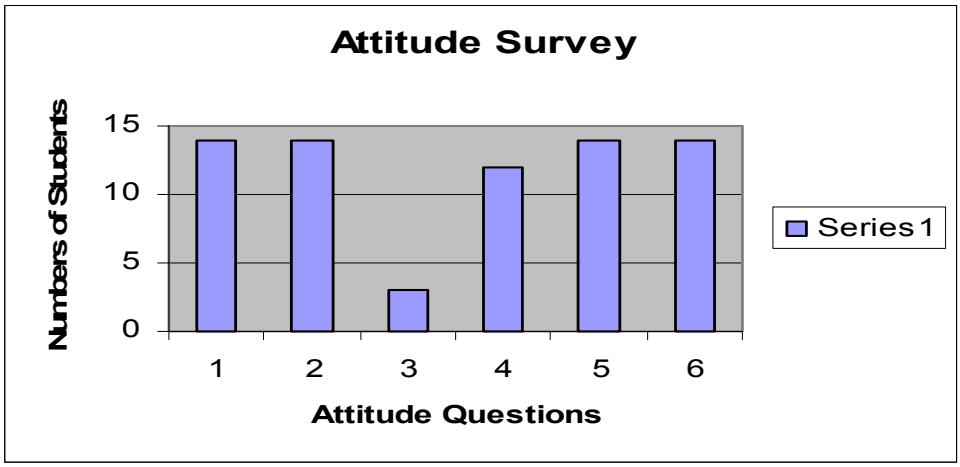


Figure 2

Posttest



Chapter 6….Discussion

Students' attitudes are positive concerning computer-based mathematics. Students were excited and happy to do math on the computer. They would asked, 'Is it computer time yet?" The students took a pretest and were placed on a level based on the data collected, instead of teaching the students on a third grade level just because the students were in the 3rd grade. The purpose of the computer-based math is to bring the students up to standards at their own pace without making the student feel inadequate or dumb. The computer-based math worked with students on an individual basis. No student has to feel academically inferior to his/her peers. My research supports the literature finding that computer-based math does increase problem-solving. The groups that received extra support in math scored higher than the group that did not received extra support. This conclusion is based on the data I collected from the Duval County Public Schools Benchmark Tests that was administered by Duval County Public Schools, and the grades from grading periods 1 and 2. Tables 1-6 demonstrate the growth experimented by each group.

At the onset of my study the level one students did not like math. The negative feeling concerning math was based on information gathered from the questionnaire. Level one students felt they were not good in math. These students became frustrated doing regular *Math Investigations* class. They required small group interventions anytime a new concept was introduced and often times they still did not grasp the concept. It usually took level one students many class hours to understand the concept being taught. Sometimes the subject matter did not stay in their scheme long. Although, level one students did not like math at the on set of this study they enjoyed math on the computer. Figures 1 and 2 reflect how students' attitude impact how well computer-based instruction is implemented in a classroom.

The students in the control groups experience growth. Although, the level one students did not show tremendous gain on their reports card they did show slight gains in the district benchmark test, nevertheless they showed gains. The students that were already on grade level experience an increased on their report cards and the district's benchmark tests.

Chapter 7……..Conclusion

The students in my third grade class have benefited greatly from computer-based mathematics. They have shown growth in mathematics as well as growth in personal confidences. Most students started out with limited ability navigating a computer, now they are able to surf the web with great confidence. My class continues to work with the *Edutest Math Program* although we are only guaranteed one hour per week. If there is a vacancy in the schedule my class eagerly signs up for that slot. Math skills that are covered in class are reiterated in the computer lab. It is easy to circulate among the students to assess the students as they work. The program gives the students 9-10 problems, the computer grades their work, saves their work and allow the student an opportunity to go back and see their mistakes. I have an easier time with conferences, because each student is engaged in the math activity.

My third grade students enjoy math on the computer. They receive instant feedback from their work, which they seem to enjoy. Students are allowed to redo skills, once they have reviewed and discussed their errors with me. The computer-based mathematics program has been a positive addition to regular classroom math. All students are 100% engaged with math while working on the computer.

I think the skills are retained when the teacher aligns the computer time with what is taught in the classroom. Computer time has to be meaningful and focus. The computer curriculum should be aligned with district's standards.

References:

Karreich, E. (2004). Math lab: computer experiments are transforming Mathematics. *ProQuest Education Journals.* 165, 266-268

Leigh, C. (2003/2004). It's all in the game. *ProQuest Education Journals.* 80(2), 59-64

Lederman, N., Niess, M. (1999). Is it live or is it Memorex? *ProQuest Education Journals.* 99(7), 357-359.

Cyr, S. (2004). Can distance learning meet the needs of gifted elementary Students? *ProQuest Education Journals*. 27(2), 42-51.

Crawford, D. (2000). Effective mathematics instruction the importance of Curriculum. *ProQuest Education Journals.* 27(2), 122-142.

Roschelle, J.m., Pea, R.D., Hoadley, C.N., Gordin, D.N., Means, B. M. (2000). Changing how and what children learn in school with Computer-based technologies. *Future Child.* 10(2), 76-101.

Hubbard, L. (2000). Technology-based math curriculums: custom built for Today's classroom. *T.H.E. Journal*. (28)3, 80-84.

Inkrott, C. (2001). Beyond drill and practice: Managed courseware and electronic portfolios. *MultiMedia Schools.* (8)2, 44-47

Macnab, D., Fitzsimmons, G. (1999). Enhancing math learning through Computer- assisted instruction. *Education Canada*.(39)1, 38-39.

Staples, A., Pugach, M.C., Himes, Dj. (2005) Rethinking the technology Integration challenge: case from three urban elementary schools. *Journal of Research on technology in Education. (* 37)3, 281-307.