Increasing Mathematics Computation Through the Use of Computerized Software

A Special Project

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FACULTY APPROVAL

Increasing Mathematics Computation Through the use of Computerized Software

A Master's Special Project

By

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ABSTRACT

Title: Increasing Mathematic Computation Through the use of Computerized Software

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Many educators hypothesize that computerized instructional games are more effective in providing students with motivating practice; research on instructional gaming is inconclusive. The intention of this study was to verify the effect on motivation and performance of using a computerized instructional game in conjunction with paper and pencil practice. A third grade classroom participated in two methods of practice. The first semester the treatment group solely used the traditional worksheet to practice. The second semester included traditional practice as well as the computerized instructional game. Results indicated that there was a significant difference in those students' scores who used Math Facts in a Flash thirty minutes per week. Scores on a two-minute timed assessment and Math STAR assessment increased significantly.

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CHAPTER 1

Introduction

Raquel Sanchez

Background for the Project

Accountability has long been a concern for schools throughout the nation. For that reason standardized tests scores had become increasingly important in formulating decisions in order to meet the demands of the No Child Left Behind Act of 2001 (NCLB). This act was created to ensure schools at all levels were providing students with the best education possible to prepare them for their future as well as develop individuals who can compete in the global market.

In order to meet the demands of NCLB, Washington State developed the Washington Assessment of Student Learning (WASL). This common assessment was administered statewide to students' grades third through eighth as well as to tenth graders. All students were tested in reading and math at each grade level. In addition, students in fourth, seventh, and tenth grade were tested in writing and students in fifth, eighth, and tenth grade were tested in science. (OSPI www.k12.wa.assessment/default.aspx)

Student achievement on the third grade Math WASL was the inspiration for this study. The 2008 third grade Math WASL scores of Bridgeport Elementary were analyzed in order to determine an area of focus for a grade level goal. After reviewing the literature the area of number sense was chosen as the topic for this study. Dissecting the data even further the conclusion was made to focus on developing basic math fact skills in order to increase students' level of mathematical operations thus increasing their scores on the STAR Math Test and ultimately the Math WASL.

Statement of the Problem

After studying the WASL results for the 2008-2009 school year it was made clear that Math was an area of concern not only for Bridgeport Elementary as a whole, but for the 2008-2009 third grade class. The WASL scores on the Math WASL had been on a steady decline. In 2006-2007 third graders meeting or exceeding standard was at 51.1%, dropped to 48.3% in 2007-2008, and then dropped to 32.8% in 2008-2009. As a result the 2009-2010 third grade students of Bridgeport Elementary needed additional help in board math skills to break the current downward trend of Math WASL scores. In view of the fact that third grade is the first year students participate in the WASL, focus was also given into looking over students' STAR Math scores from previous years to help determine areas of instructional focus. The goal was then set to improve students third grade Math WASL scores to 37.6% meeting or exceeding standard in the Measurement of Student Progress (MSP).

The focus of this study was then aimed at ways to improve basic number sense because the 3rd graders at Bridgeport Elementary consistently scored low on the Math WASL in the area of number sense. With the use of instructional computer games in conjunction with Mastering Math Facts, the belief is that their basic understanding of number sense would in turn build the foundation to understanding of more complex math ideas. By giving the students more opportunity to practice basic math facts, they would improve their basic computation math proficiency to a degree that they would be able to focus on more intricate computation problems.

Purpose of the Project

The purpose of this study was to see if the use of a computerized intervention program increases student achievement on the STAR Math Assessment and ultimately in the MSP. Students' scores on Two Minute Timing on Math Facts were also evaluated for improvement.

Delimitations

This project was delaminated to one third grade class at Bridgeport Elementary School in the Bridgeport School District, located in Bridgeport, Washington. There twenty-four students in the experimental class. The study was conducted during the 2009-2010 school year. The enrollment at Bridgeport Elementary while the study was conducted was 366 students. The ethnic make-up of Bridgeport Elementary School is as follows: American Indian/Alaskan Native 1.3%, Black 0.3%, Hispanic 86.2%, and White 12.0%. The population of students who qualify for free or reduced lunch is 84.7%.

The assessment tool used to gather data was the STAR Math Assessment and the Two-Minute Timing in Math Facts. Each student was individually assessed during the initial assessment as well as the post intervention assessment.

Assumptions

In this study the assumption was made that all students put forth their best effort on the STAR Math Assessment and Two Minute Timings, during both the initial assessment and the post assessment. Additionally the assumption was made that students completed the computerized intervention program with their best effort. The final assumption made was that along with the computerized intervention program the students also continued to use Mastering Math Facts on paper a minimum of four times per week.

Hypothesis

Third grade students who use a computerized math intervention program that focuses on basic subtraction computation skills thirty minutes per week will complete more subtraction problems on their two minute timing and additionally score higher on the STAR Math Assessment than third grade students who do not use the computer intervention program. Students who utilize the computer intervention program will feel more confident in their overall math abilities and will complete more problems on their two minute subtraction timing and score “at grade level” or higher on the STAR Math Assessment than students who do not utilize the computer intervention program.

Null Hypothesis

Third grade students who use a computerized math intervention program that focuses on basic subtraction computation skills thirty minutes per week will not complete more subtraction problems on a two minute timing or score higher on the STAR Math Assessment than third grade students who do not use the computer intervention program. The confidence level of the students utilizing the computerized intervention program will be the same as the students not participating in the program.

Significance of the Project

The purpose of this project was to provide a factual base of evidence regarding the effectiveness of adding a computerized math intervention program *Math Facts in a Flash* as a basic math fact intervention. The study analyzed evidence collected to determine if the use of *Math Facts in a Flash* increased the number of problems completed on subtraction two-minute timing and the students’ STAR Math scores a considerable amount.

Math Facts in a Flash has been used by teachers as an incentive program to give students time on the computer but not necessarily as a math tool. With the cost of technology so high, making the program and computers available for all students needed to be justified by the significant increase on their two minute timing and their STAR Math scores. The results of this study were used to determine whether the program and programs like it should be made available for all students in the third grade.

Procedure

For the purpose of this project the following procedures were implemented:

1. Permission to conduct research at Bridgeport Elementary was granted by Principal Michael Porter (see Appendix A).
2. A review of selected literature was conducted at Bridgeport Elementary School, Heritage University, and internet search engines.
3. Permission to use the math intervention, *Math Facts in a Flash* was given by Bridgeport Elementary School Principal Michael Porter (see Appendix B).
4. Students were given a two-minute timed assessment during the first semester of the 2009-2010 school year not having used MFF. (see Appendix C).

5. Scores from the two minute timed assessment were tabulated (see Appendix D).
6. The STAR Math assessment was given to each student on September 15, 2009.
7. The scores from the STAR Math assessment were tabulated (see Appendix E.)
8. All students practiced traditional math fact instruction.
9. Students were given a two-minute timed assessment at the end of the first semester without using MFF.
10. Scores from the two-minute timed assessment were tabulated and disaggregated by gender (see Appendix F).
11. The *Math Facts in a Flash* for math intervention was implemented once a week for thirty minutes.
12. The two-minute timed assessment was given to students on March 19, 2010.
13. The scores from the two-minute timed assessment were tabulated (see appendix G).
14. A post intervention survey of student confidence levels was given to all 24 students (see Appendix H).
15. Results from the survey were charted and graphed (see Appendix I).

16. Results from the study was evaluated and conclusions drawn.
17. A meeting was held to discuss the findings and make a decision about the possibility of implementing *Math Facts is a Flash* as an intervention.

Definition of Terms

For the purpose of this study, the following words are defined:

Washington Assessment of Student Learning. A state level assessment that "requires students to both select and create answers to demonstrate their knowledge, skills, and understanding in each of the Essential Academic Learning Requirements (EALR's)" (OSPI www.k12.wa.us/assessments/WASL).

Essential Academic Learning Requirements. "Describe the learning standards for grades K-10 at three benchmark levels; elementary, middle, and high school (OSPI www.k12.wa.us/CurriculumInstruct/EALR_GLE.aspx).

STAR Math Assessment. STAR Math is a standardized, computer-adaptive RTI progress monitoring tool that immediately generates informative reports to guide teachers in placing students in specific programs and is also used to monitor students' growth, inform instruction, and track student progress over time and across grades. (Renaissance Learning http://www.renlearn.com/sm/).

Response to Intervention. Response to Intervention (RTI) is a multi-level prevention system to maximize student achievement and to reduce behavior problems. This process has schools identify students at risk for poor learning outcomes, monitor student progress, provide evidence-based interventions and adjust the intensity and nature of those interventions depending on a student's responsiveness, and identify students with learning disabilities.

Acronym

NCLB. No Child Left Behind Act

WASL. Washington Assessment of Student Learning

EALR's. Essential Academic Learning Requirements

GLE's. Grade Level Expectations

STAR. STAR Math Assessment

BES. Bridgeport Elementary School

MMF. Mastering Math Facts

AYP. Adequate Yearly Progress

MFF. *Math Facts in a Flash*

CHAPTER 2

Review of Selected Literature

Introduction

This chapter has been organized around the following topics: (a) No Child Left Behind Act (NCLB), (b) STAR Math Assessment, (c) Math Instruction, (d) Computerized Instruction, (e) Summary.

No Child Left Behind

The NCLB Act was created to form the foundation for a national education reform. The act was based on stronger accountability for results, increased state and community freedom, proven educational methods and to give parents more choices when schools fail to educate their children. (U.S. Department of Education, 2004) “The NCLB Act has set several important goals. They are as follows: 1. Closing the achievement gap between subgroups of students, which include minority students, special education students English language learners and White students. 2. Improving teacher quality. 3. achieving 100% proficiency for all students in mathematics and English language by 2014.” (Shirvani, 2009 P. 50)

One fundamental aspect of NCLB was it’s expectation that all students achieve the higher standard that was set fourth for them. As the nation’s schools began to expect more from students, they were meeting this challenge by increasing their math, reading, writing, and history scores on their respective state assessments. (U. S. Department of Education, 2009) These state assessments were put into place individually by each state with certain federal stipulations. Each state was required to test their students once a year in grades three though eight and once during their high school years in reading and mathematics. States were granted the freedom to choose their own assessments; however, the assessment would need to provide adequate data showing proficenty by all students. (U.S. Department of Education, 2004)

States were responsible for demonstrating that all students were meeting Adequate Yearly Progress (AYP) on which ever assessment was choosen. AYP, was defined as: " A manner that 1) results in continuous and substantial yearly improvement of each school and local education agency sufficient to achieve the goal of all children … meeting the state's proficient and advanced levels of achievement; [and] 2) is sufficiently rigorous to achieve the goal within an appropriate timeframe." (Defining Adequate Yearly Progress (AYP), 2005) Washington State chose to utilize the Washington Assessment of Student Learning (WASL) as their asessment and to use its results as their measure of meeting AYP.

Failing to meet AYP in two consecutive years would require the school district to construct a School Improvement Plan and also required the schools to notify parents of students in the district of their option to transfer to a different school. According to an OSPI website document, “The law specifies consequences for schools and districts receiving Title I, Part A funds which do not meet the AYP targets for two or more years in a row. After two consecutive years of not meeting AYP targets, a school enters Step 1 and is subject to the related consequences. If AYP is met the next year the school or district stays at Step 1, if AYP is not met, it moves to Step 2. If AYP is met for two consecutive years, the school exits school improvement.” (OSPI) The article continued to illustrate the various consequences for failing to meet AYP which ranged from paying to transport students to a non-district school to a complete restructuring of the school district by replacing most or all of the districts personnel.

<u>STAR Math Assessment</u>

The STAR Math Assessment was an assessment tool used to assure that teachers, students, and parents received results immedatley. The STAR Math Assessment tool was used to assess students’ math level, report norm-reference math scores, determine appropiate challenge level, predict results on national standarized tests, save money, and track students’ growth in math achievement. (Renaissance Learning, Inc., 2009)

Additionally, STAR Math had an RTI Screening Report, which could be used by schools to organize time and resources in order to provide extra help to students who needed it most. The report showed which students were responding well to Tier One Instruction and also showed which students should be considered for intervention. (Renaissance Learning, Inc., 2009)

However the most useful aspect of the STAR Math Test was the results of the assessment which provide reccomendations about a students' math instructional level that can also help determine what Tier 2 intervnetions should be put into place. "Results from STAR Math can be used for instructional planning and intervention decisions. The Diagnostic Report shows a student's level of proficiency within numeration and computation objectives as well as a recommended starting point in Accelerated Math." (Renaissance Learning, Inc., 2009)

Math Instruction

Math instruction has long been associated with countless theories of implementation. Of such theories the most common and conflicting were the Constructivist and Behaviorist Theories. Each theory maintained a very dissimilar belief about the acquisition of mathematical learning.

"The behaviorist belief is that knowledge exists outside of people and independently of them, and that the major goal of a good education is to instill in students an accepted body of information and skills previously established by others." (Scheurman, 1998) This theory held to the belief that reinforecement and punishment helped shape learning by encouraging the correct or proper response.

Furthermore, the behaviorist theory viewed math as a progression of previous learning; "Behaviorism promotes learning a fixed set of skills in order" (Reys, Lindquist, Lambdin, Smith, & Suydam, 2004, pg 19). For example, if subtraction had been identified as a backward form of addition, then the concept of addition must have been mastered before moving on to the concept of subtraction.

In contrast, the Constructivist Theory believed that mathematics was acquired through construction of knowledge and not received by an external source. Constructivism is defined as "the theory according to which each child builds his own knowledge from the inside, through his own mental activity, in interaction with the environment." Constructivist learning included an importance on process, the exchange of differing points of view, and an emphasis on problem solving. (Brewer & Daane, 2002)

"Educators and cognitive scientists agree that the ability to recall basic math facts fluently is necessary for students to attain higher-order math skills" (Math Fluency, 2009). Regardless of which theory is favored during instruction, research showed the importance of learning basic math facts.

Furthermore, “the implication for mathematics is that some of the sub-processes, particularly basic facts, need to be developed to the point that they are done automatically. If this fluent retrieval does not develop then the development of higher-order mathematics skills — such as multiple-digit addition and subtraction, long division, and fractions — may be severely impaired” (Math Fluency, 2009). These studies also suggested that the lack of basic math fact retrieval could hinder a student’s participation in class discussions, problem solving activities, and had even been linked to be a strong predictor of performance on mathematics achievement tests.

Computerized Instruction

According to the National Council of Teachers of Mathematics, “Mathematics instructional programs should use technology to help all students understand mathematics and should prepare them to use mathematics in an increasingly technological world.”Along with the National Council of Teachers of Mathematics, Bitter and Hatfield indorsed the use of technology for mathematics instruction in the middle elementary grades and state, “the use of technology for mathematics instruction enhances mathematical thinking, student and teacher discourse, and higher-order thinking by providing the tools for exploration and discovery.” (p. 39).

Since the early 1960's, computerized technologies had changed dramatically the way in which children interact with information. According to Pekka Räsänen (2009), "They read more from computer and mobile phone screens than from printed books and play more computer games than watch television." (p. 453). Furthermore, "when facing a number problem in everyday life, they pick up their mobile phone calculator instead of calculating in their heads." (p. 453). This trend continued to increase as technology became more readily available to students and schools across the nation in a variety of forms.

One such way of incorporating technology in the elementary classroom is to incorporate drill and practice software. Drill programs were designed for students to practice pre taught skills. The appeal of such programs included the ability to track individual student progress, give immediate feedback, and set a course for continued improvement. Additionally, the drill and practice software had a game like format that made them appealing to children thus motivating them to continue their usage.

Research showed that *Math Facts in a Flash* is an effective drill and practice software program that promotes the mastery of basic math facts. Additionally, its use had been linked to higher grade gains on the STAR Math assessment. According to Ysseldyke, J.E., Thill, T., Pohl, J., & Bolt, D. (2005), "*Math Facts in a Flash* software is designed to improve computational fluency by providing practice on addition, subtraction, multiplication, and division facts, as well as on squares and fraction/decimal conversion. Timed tests measure students' practice and mastery, while identifying the problems students are struggling with the most." (P. 61)

Summary

The focus of this chapter was to address the available evidence to the topics of (a) No Child Left Behind Act (NCLB), (b) STAR Math Assessment, (c) Math Instruction, and (d) Computerized Instruction. The methodology and treatment of the data were reported in Chapter 3.

The focus of No Child Left Behind was to develop a system of establishing a baseline of student proficiency and a method of assessment. Targeted groups included low income and English language learners which had traditionally been left out. Bridgeport Elementary had a large percentage of low income and English Language Learners that did not meet AYP on the mathematics WASL. Failing to meet AYP on the mathematics WASL two years in a row, the school was placed on Step 2 which required them to construct a School Improvement Plan and also give parents various options in regards to their child's educational choices.

The Star Math Assessment was utilized to assess students' math level, report norm-reference math scores, determine appropiate challenge level, predict results on national standarized tests, save money, and track students' growth in math achievement. With BES not meeting AYP on the mathematics WASL, the STAR Math Assesesment was used as part of the school improvement plan required by No Child Left Behind Act. Additionally, STAR Math had an RTI Screening Report, which could be used by schools to organize time and resources in order to provide extra help to students who needed it most.

Math instruction has long been associated with countless theories of implementation. Theories most common were the Constructivist and Behaviorist Theories. Each theory maintained a very dissimilar belief about the acquisition of mathematical learning. Constructivists believed in the construction of knowledge by the individual while behaviorist viewed mathematical learning as a progression of previous learning in which certain concepts could not be learned until others had been mastered.

Technology provided an additional tool in children's education. Computerized instruction had taken on an important role in classrooms throughout elementary schools in the United States. Such instruction provided students with an opportunity to use drill and practice software to improve their mathematics skills.

Once such program was *Math Facts in a Flash* which gave students a chance to practice basic math facts, give immediate feedback, and provide additional practice in needed areas. *Math Facts in a Flash* also required students to master each level before moving on to the next level. The game like appearance of *Math*

Facts in a Flash helped keep students motivated to continue using the program. Students were also able to keep track of their progress because the program gave immediate feedback after each timed practice session and test.

CHAPTER 3

Methodology and Treatment of the Data

Introduction

This chapter has been organized around the following topics: (a) Methodology, (b) Participants, (c) Instruments, (d) Design, (e) Procedure, (f) Treatment of Data, (g) Summary. Bridgeport Elementary used *Math Facts in a Flash* as a tool to increase students' automaticity in basic math computation. The researcher sought to find out if this program helped improve the number of correctly answered facts on two minute timings. Additionally, the researcher sought to find out if there was a connection between the number of facts completed on the two minute timing to the score on the STAR Math Assessment compared to the scores of students not using the *Math Facts in a Flash* Program. In the data analysis, a *t* test was used to determine statistical and educational significance.

Methodology

The researcher chose to do an action/quasi-experimental project and administered a descriptive survey at the end of the project. The researcher sought to determine if the use of drill and practice software for computational fluency increased students' achievement on Math Facts two minute timings and increase students' scores on the STAR Math Assessment.

The researcher collected data during the first and second semesters of the 2009-2010 academic year. At the beginning of the first semester students were given a pre-test on math fact fluency and at the end of that semester were given the same assessment. Students also took the STAR Math Assessment at the same time. The process was repeated during the second semester with the addition of the *Math Facts in a Flash* computerized program. The students were also given a descriptive survey at the end of the intervention to measure student perception on math skills after the intervention. The data from both the survey and assessments were entered into the spreadsheet program, Excel, for simplicity in data analysis. Graphs were created to represent both survey and assessment data.

Finally, the collected data was entered into a statistical calculator (Stat Pak) and a t-chart was used for non-independent samples to determine significance. The results of the t-score were then compared to distribution of t table to determine if the intervention created a significant change in student skills.

Participants

The researcher selected one of the third grade classes at Bridgeport Elementary during the 2009-2010 school year. The students were from lower to middle class families who live in the rural community of Bridgeport. The majority of the students, both male and female, spent most of their time playing sports. The family culture consisted of two-parent, single parent, and family structures in which the children lived with grandparents and/or aunts and uncles.

During the second quarter of the 2009-2010 school year, the group consisted of twenty-five students. The ethnic diversity of the population was 99% Hispanic decent and 1% Caucasian decent. Of the twenty-five students 100% qualified for free lunch. During the third quarter of the 2009-2010 school year the group consisted of twenty-six students. The ethnic diversity of the population did not change from the second quarter.

<u>Instruments</u>

Data was gathered from the Mastering Math Facts two-minute timings, which is a program used to help students build automaticity in basic math facts. The researcher also gathered data from *Math Facts in a Flash* reports. *Math Facts in a Flash* is a computerized program that also worked on improving the automaticity of basic math facts.

Once the data was gathered the researcher entered it into a Windows Excel program. Microsoft Office Excel is a spreadsheet-application written and distributed by Microsoft. Microsoft first released Excel in 1985 but was not widely used until 1988. The program included many features such as calculation, graphing tools, pivot tables, and a macro programming language called VBA (Visual Basic for Applications). About every two years Microsoft released a new version and the current version is Microsoft Office Excel 2007. Excel was the first program to include features such as choosing fonts, character attributes and cell appearance. Excel also introduced intelligent cell recomputation, where only cells dependent on the cell being modified are updated. Excel also contained extensive graphing capabilities and the ability to export Excel data into other Microsoft Office programs.

Statistic calculator was used to test for significance. The Statistics Calculator lets one use summary data to perform a wide variety of statistical significance tests and sample size estimation.

Design

This study was designed to evaluate the effectiveness the *Math Facts in a Flash* computer program had on the amount of problems students complete on Mastering Math Facts two-minute timing. The same group of students participated in a one-group pretest-posttest design. Students used the computerized program *Math Facts in a Flash* once a week for thirty minutes along with the Mastering Math Facts paper pencil program daily. The scores in the two-minute timings were calculated and recorded for the second and third quarter. A survey was conducted to gather students' perception on the helpfulness of *Math Facts in a Flash*.

Procedure

For this study the researcher sought to gather as much information on the effectiveness of the computerized program *Math Facts in a Flash* to the number of basic math facts students could complete in two-minutes. The researcher asked for and received permission to conduct research at Bridgeport Elementary from building Principal Michael Porter. Many articles were reviewed through the Bridgeport Library, internet and the Heritage Online Library Database. The researcher collected and analyzed data from the second and third quarter of the 2009-2010 school year. The data was entered into an Excel spreadsheet. During the second and third quarter the researcher administered the two-minute timings and recorded each student's scores. At the end of each quarter the scores were entered into an Excel spreadsheet and graphs were created to show findings.

The figures were then entered into the statistical calculator to test for significance. A table was then created from the calculation results.

The researcher developed a student survey and the survey was administered. The answers were then given numerical values and entered into an Excel spreadsheet. Using the data entered into the Excel spreadsheets, the data were analyzed.

Once completed, the findings were then shared with building and district staff members.

Treatment of Data

Raw data from the pre and post test were calculated using Excel to find the differences. Those differences were then entered into stat pack to compute the mean for those scores. Finally the t-test was used to find the level of significance at 0.5.

Summary

This chapter was designed to review the methodology and treatment of data related to the study to determine if students who received instruction using a computerized math-fact program, *Math Facts is a Flash,* in conjunction with regular math-fact instruction would correctly complete more problems on a two minute timed assessment than students who received regular instruction only. Additionally, data was also used to determine if students who used Math Facts in a Flash scored significantly higher on the STAR Math Assessment than students who did not. The analysis of data and findings from this study were reported in Chapter 4.

CHAPTER 4

Analysis of the Data

Introduction

Chapter 4 has been organized around the following topics: (a) Description of Environment, (b) Hypothesis, (c) Results of the Study, (d) Findings, and (e) Summary. The purpose of this study was to determine if the use of *Math Facts in a Flash* increased students' scores on a two minute timing and the STAR Math assessment. The study would also be used to show if using *Math Facts in a Flash* increased students' confidence level in mathematics.

Description of the Environment

This project was delaminated to a third grade class at Bridgeport Elementary School in the Bridgeport School District, located in Bridgeport, Washington. There were 24 students in the experimental class. The study was conducted during the 2009-2010 school year. The enrollment at Bridgeport Elementary while the study was conducted was 366 students. The ethnic make-up of Bridgeport Elementary School is as follows: American Indian/Alaskan Native 1.3%, Black 0.3%, Hispanic 86.2%, and White 12.0%. The population of students who qualify for free or reduced lunch is 84.7%.

The assessment tool used to gather data was the STAR Math Assessment and the Two-Minute Timing in Math Facts. Each student was individually assessed during the initial assessment as well as the post intervention assessment.

Hypothesis/Research Question

Third grade students who use a computerized math intervention program that focuses on basic subtraction computation skills thirty minutes per week will complete more subtraction problems on their two minute timing and additionally score higher on the STAR Math Assessment than third grade students who do not use the computer intervention program. Students who utilize the computer intervention program will feel more confident in their overall math abilities and will complete more problems on their two minute subtraction timing and score "at grade level" or higher on the STAR Math Assessment than students who do not utilize the computer intervention program.

Null Hypothesis

Third grade students who use a computerized math intervention program that focuses on basic subtraction computation skills thirty minutes per week will not complete more subtraction problems on a two minute timing or score higher on the STAR Math Assessment than third grade students who do not use the computer intervention program. The confidence level of the students utilizing the computerized intervention program will be the same as the students not participating in the program.

Results of the Study

The mean scores on the two minute timing of students who participated in the computerized program *Math Facts in a Flash* increased an average of 4 more problems completed over students who only used the traditional math fact instruction. During the 2009-2010 school year, twenty-four students participated in the study. Of those twenty-four students 23 (96 %) showed improvement from pre and post assessments after using *Math Facts in a Flash.* One (4%) student showed no increase. None of the students' computational fluency declined after participation in the study.

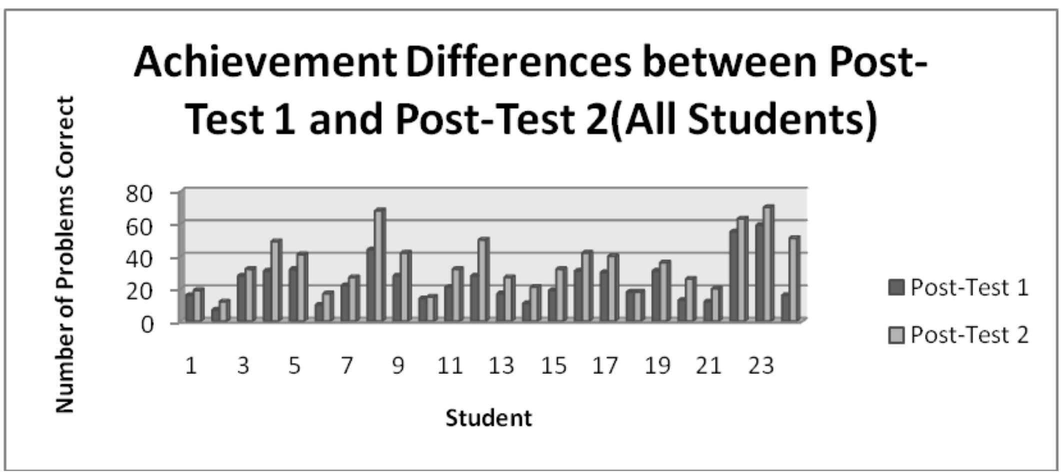

Figure 1

The data was then disaggregated by gender. Of the fifteen boys in the class, all fifteen (100%) showed an increase in their overall performance on the two-minute timing. Zero boys showed no increase or decline in their scores after using *Math Facts in a Flash*. The mean increase of scores was 22.73 problems prior to the treatment period and 33.67 problems after treatment. The overall increase in the number of problems correct on the two minute timing was 10.93 problems after the use of *Math Facts in a Flash*. The data revealed that 100% of the boys benefited from using the program.

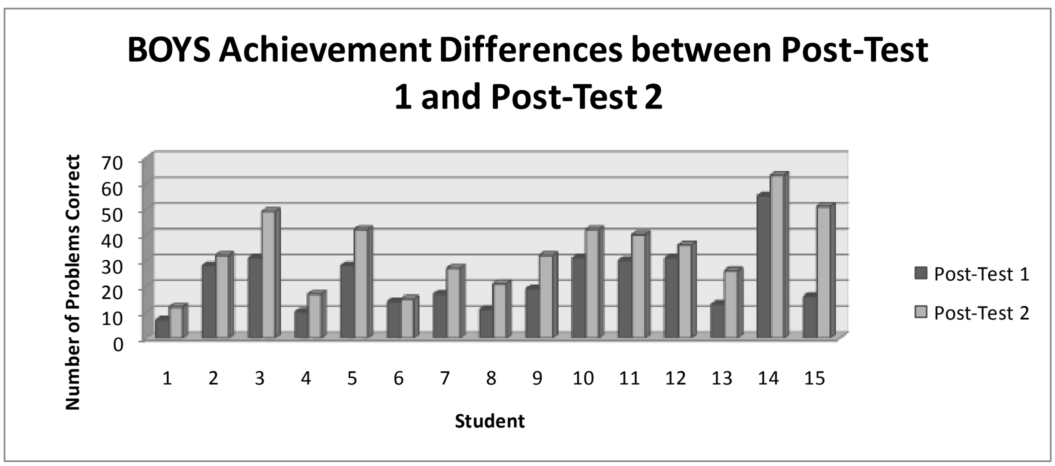

Figure 2

Nine girls participated in the study. Eight girls (89%) showed growth on their two minute timings. One girl (11%) showed no growth on her two minute timing; however, she showed no decline in the amount of problems completed on the two minute timing. The mean increase of scores was 28.00 problems prior to the treatment period and 38.33 problems after treatment. The overall increase in the number of problems correct on the two minute timing was 10.33 problems after the use of *Math Facts in a Flash*. The data demonstrated that fewer girls (89%) than boys (100%) benefited from the use of *Math Facts in a Flash* as an intervention tool.

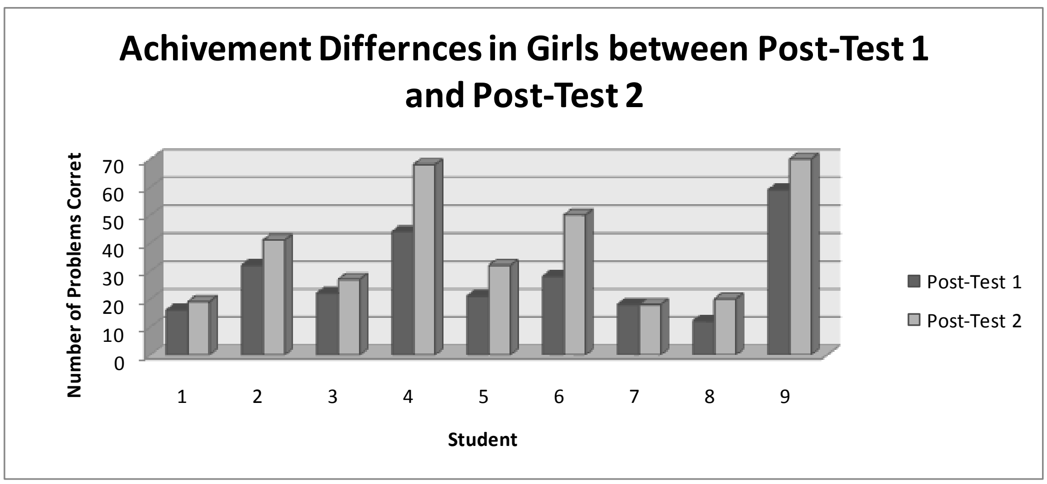

Figure 3

The data was entered into a statistical calculator and a t test was conducted to determine significance. The t value was 6.86 and the degree of freedom was 23. A required t-score of 2.069 was needed to demonstrate a significant change and the results were 6.86. A t-score of 6.86 met the criteria needed to show significant change at 0.5. The sum of the data was 247.00 and the mean increase of correct problems for students that participated in the study was 10.29.

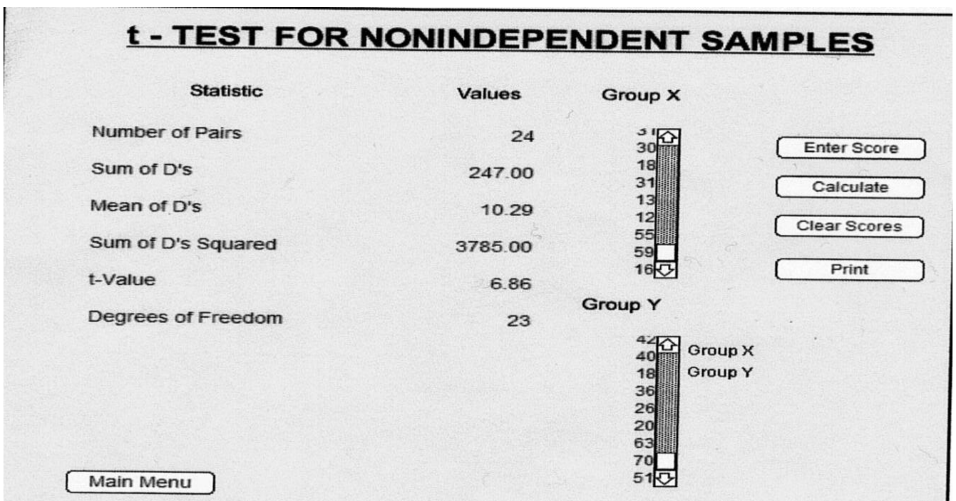

Figure 4

A student survey was administered to the students who participated in the study in April 2010. The survey showed that most students felt *Math Facts in a Flash* helped them learn their subtraction facts and also improve their scores on their STAR Math assessment. Twenty-four students took the survey, fifteen males and nine females. Students were asked, "*Math Facts in a Flash* helped me learn subtraction." Ten students said "A Lot", nine students said "Sometimes", four students said, "Not Really", and only one student said, "Not at All". Seventy-nine percent of students surveyed believed that *Math Facts in a Flash* helped them learn their subtraction facts.

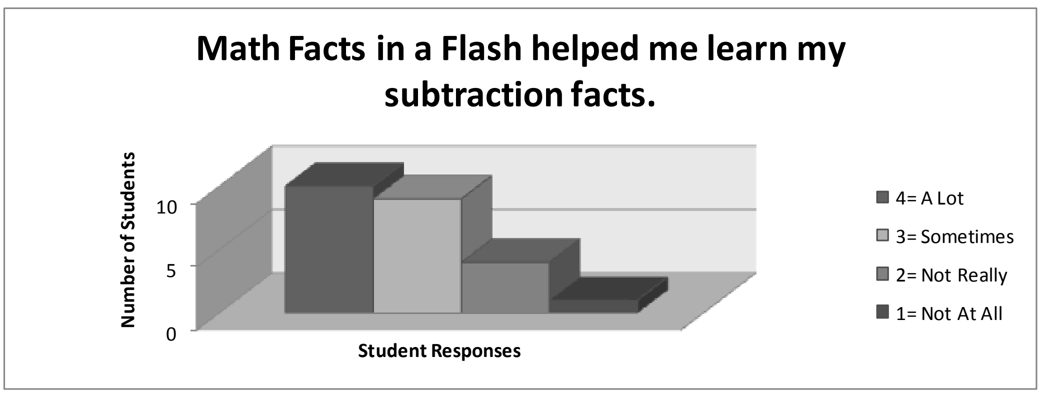

Figure 5

When asked if *Math Facts in a Flash* helped them complete more subtraction problems on a two minute timing, five students said, "A Lot" and twelve students said, "Sometimes". Six students felt that *Math Facts in a Flash* didn't really help them complete more problems, and one student felt it didn't help at all. Seventy-one percent of students surveyed felt that the use of *Math Facts in a Flash* was beneficial to the overall number of subtraction problems completed on their two minute timings.

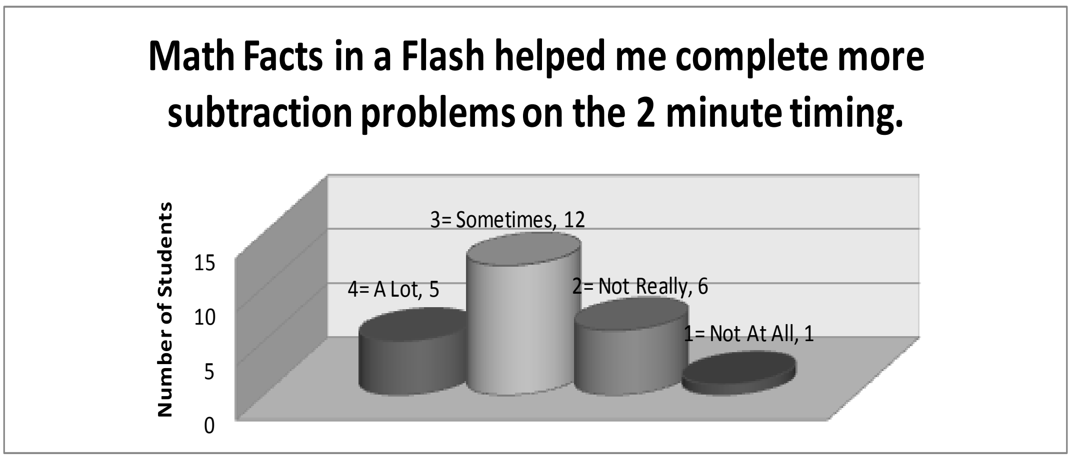

Figure 6

Additionally students were asked wether they felt *Math Facts in a Flash* helped them score higher on their STAR Math assessment. Eight students felt it helped a lot, nine felt it helped somewhat, five felt it didn't help much, and only two felt it didn't help at all. Seventy-one percent of the students surveyed felt that *Math Facts in a Flash* helped them score higher on the STAR Math assessement.

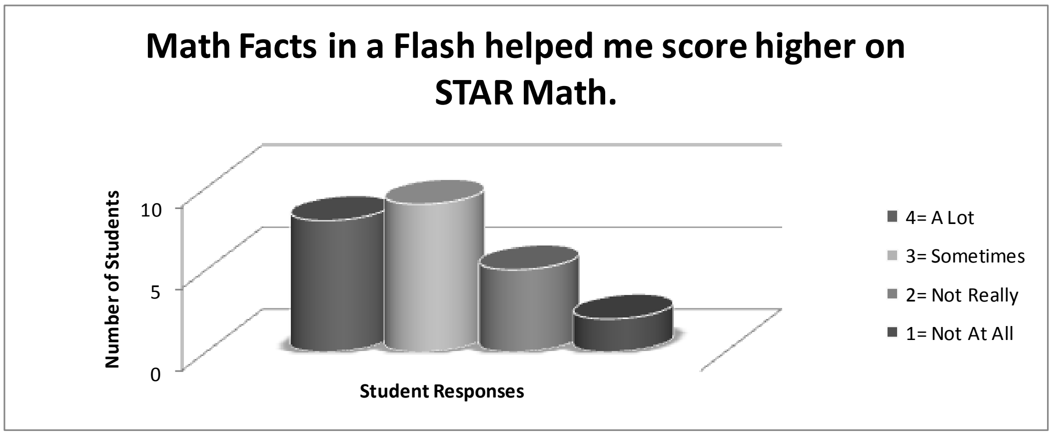

Figure 7

The mean scores on the STAR Math assessment of the students who participated in the computerized program *Math Facts in a Flash* increased an average of 0.57 grade level over students who only used the traditional math fact instruction. During the 2009-2010 school year, twenty-four students participated in the study. Of those twenty-four students, 100% showed improvement from pre and post assessments after using *Math Facts in a Flash.* None of the students' grade level score declined after participation in the study.

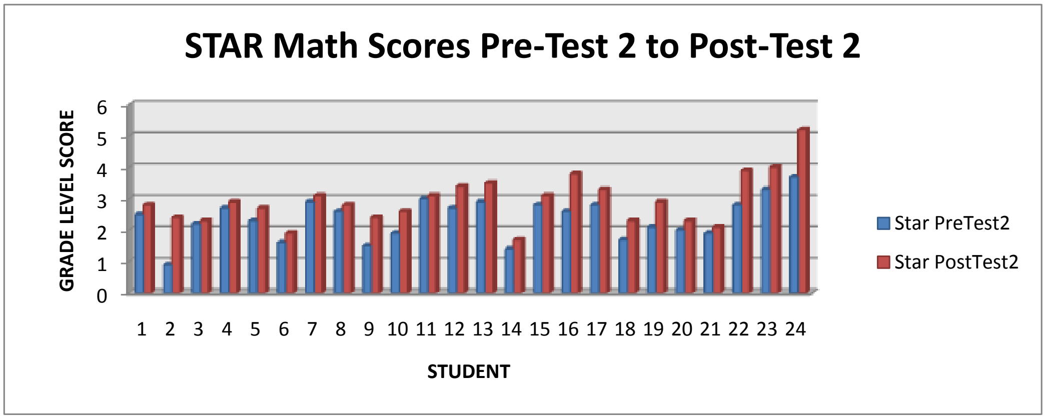

Figure 8

<u>Findings</u>

The hypothesis for this study stated that "Third grade students who use a computerized math intervention program that focuses on basic subtraction computation skills thirty minutes per week will complete more subtraction problems on their two minute timing and additionally score higher on the STAR Math Assessment than third grade students who do not use the computer intervention program. Students who utilize the computer intervention program will feel more confident in their overall math abilities and will complete more problems on their two minute subtraction timing and score “at grade level” or higher on the STAR Math Assessment than students who do not utilize the computer intervention program.” Given the analysis of the data and the testing of the hypothesis, a number of findings became apparent.

After analyzing the data, the researcher found that the use of *Math Facts in a Flash* significantly improved the number of problems answered by the students on the two-minute timing. One-hundred percent of the boys showed improvement, while eighty-nine percent of the girls also showed improvement on their two-minute timings. The other eleven percent of the girls showed no improvement, but at the same time did not show a decline in the number of problems correct per minute. With a t-score of 6.86 the researcher was able to accept the first part of the hypothesis.

Additional data analysis of the STAR Math assessment scores showed that all twenty-four students (100%) showed a significant increase in their grade level score. With a t-score of 2.069 needed, the researcher was able to document a t-score of 2.16 with a degree of freedom of 23 and a mean score of .32. The researcher was therefore able to accept the second part of the hypothesis which stated that students who used *Math Facts in a Flash* would show greater gains on the STAR Math assessment.

Furthermore, the analysis of the survey results showed that students did in fact feel more confident in mathematics. Students overall favorably agreed or strongly agreed to each of the seven statements that were on the student survey for mathematics. The researcher was therefore able to accept the third part of the hypothesis which stated that students who used *Math Facts in a Flash* will feel more confident in their overall math abilities and will complete more problems on their two minute subtraction timing and score “at grade level” or higher on the STAR Math Assessment.

Summary

This chapter was designed to analyze the data and identify the findings. From the data, the hypothesis was supported and the Null Hypothesis was rejected. The researcher was able to show through analysis of the data that using *Math Facts in a Flash* showed a significance increase in the number of problems completed by each student on their two-minute timing. The researcher furthermore, showed a significant increase in student achievement on the STAR Math assessment after student participation in the study. Chapter 5 will summarize the study, draw conclusions, and make recommendations.

CHAPTER 5

Summary, Conclusions and Recommendations

Introduction

This chapter has been organized around the following topic: (a) Introduction, (b) Summary, (c) Conclusions, and (d) Recommendations. The purpose and nature of the research project was to show a connection between the use of *Math Facts in a Flash* and student achievement on a two-minute subtraction timed assessment as well as the STAR Math assessment.

Summary

Student achievement on the third grade Math WASL was the inspiration for this study. The 2008 third grade Math WASL scores of Bridgeport Elementary were analyzed in order to determine an area of focus for a grade level goal. The purpose of this study was to determine if the use of a computer math intervention program would increase the number of problems students completed on a two-minute timed assessment and furthermore increase students' grade level scores on the STAR Math assessment a significant amount. Students were also given a survey about mathematics to determine if the use of the computer intervention program would increase their confidence levels.

Selected literature relating to the problem was reviewed, and the same group of students participated in a one-group pretest-posttest design and the research study was conducted according to the study's purpose. After test results and survey responses were gathered, the researcher concluded that there was a significant difference overall in the amount of problems completed on the two-minute timing during the time the students participated in the study. Furthermore, their STAR Math scores increased a significant amount as well. The researcher was also able to provide data to support an increase in students' confidence levels after the use of *Math Facts in a Flash.*

Conclusions

According to the National Council of Teachers of Mathematics, "Mathematics instructional programs should use technology to help all students understand mathematics and should prepare them to use mathematics in an increasingly technological world." The review of literature demonstrated to the researcher how the use of technology is becoming a necessity to students in today's world especially in mathematics.

Furthermore, the literature discussed how valuable mathematics software programs can be to students and one such program was *Math Facts in a Flash.* According to Ysseldyke, J.E., Thill, T., Pohl, J., & Bolt, D. (2005), "*Math Facts in a Flash* software is designed to improve computational fluency by providing practice on addition, subtraction, multiplication, and division facts, as well as on squares and fraction/decimal conversion. Timed tests measure students' practice and mastery, while identifying the problems students are struggling with the most." The researcher was able to show through data analysis that the use of *Math Facts in a Flash* significantly improved the number of subtraction problems completed on a two-minute timed assessment. Student achievement on the STAR Math assessment was also documented and showed significant gains in student scores.

The researcher shared the results of the study with the administration and staff at BES. The researcher was able to show through data and graphs the significant increase in student scores on the two-minute timed assessment as well as the STAR Math assessment. With a t-score of 2.069 needed and the study showing t-scores of 2.16 on the STAR Math and 6.86 for two-minute timed assessment the conclusion was made that third grade students will utilize *Math Facts in a Flash* during the upcoming school year.

Recommendations

The results of this study suggest that *Math Facts in a Flash* helped increase the number of problems completed on a two-minute timed assessment thus increasing students computational fluency in subtraction. Additionally, the researcher found that students' STAR Math scores also increased while using the computer based program. Based on the conclusions, the researcher recommends using *Math Facts in a Flash* in all classrooms a minimum of thirty minutes a week per student. The researcher further recommends that traditional math fact instruction be continued as was done so throughout this study. Finally, the researcher recommends that the use of *Math Facts in a Flash* be monitored and its effectiveness reviewed periodically to ensure students are taking full advantage of its capabilities.

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Yesseldyke, Jim, T., Thill, J., Pohl, D. Bolt. (2005). Using *Math Facts in a Flash* to Enhance Computational Fluency. Journal of evidence-based practices for schools, 6 (1), pg 58-89.

APPENDICES

Permission to Conduct Research/Use Students' Test Data....................................A

Permission to use Math Facts in a Flash Intervention..B

Sample Two-Minute Timed Assessment...C

Two-Minute Timed Assessment Pre-Test1 Tabulated Scores................................D

STAR Math Scores (Excel)...E

Two-Minute Timed Assessment Data: Disaggregated by Gender..........................F

Two-Minute Timed Assessment Data: Pre and Post Scores..................................G

Student Math Survey...H

Student Math Survey Results..I

Stat Pak t-Test Results..J

APPENDIX A

PERMISSION TO CONDUCT RESEARCH/USE STUDENTS' TEST DATA

I, Michael Porter, hereby irrevocably consent and authorize Raquel Sanchez to conduct research at Bridgeport Elementary. Additionally, any data gathered through such research project can be used by Raquel Sanchez.

____, Author

____, Date

APPENDIX B

PERMISSION TO USE MATH FACTS IN A FLASH INTERVENTION

I, Michael Porter, hereby irrevocably consent and authorize Raquel Sanchez to use the Math Facts in a Flash Intervention at Bridgeport Elementary once a week for thirty minutes.

____, Author

____, Date

APPENDIX I

Math Survey Questions and Results by Answer

Survey Question	4= A Lot	3= Sometimes	2= Not Really	1= Not At All	Total
I Like Math	12	5	4	3	24
Math is Hard	7	5	7	5	24
I like using a computer to practice math.	9	10	3	2	24
Math Facts in a Flash helped me learn my subtraction facts.	10	9	4	1	24
Math Facts in a Flash helped me score higher on STAR Math.	8	9	5	2	24
Math Facts in a Flash helped me complete more subtraction problems on the 2 minute timing.	5	12	6	1	24
Using Math Facts in a Flash made math easier.	8	8	8	0	24

Appendix H

Student Survey for Math

I am doing a survey about math. Your thoughts are important to me. Please answer the following.

4= A lot 3= Sometimes 2= Not Really 1= Not At All

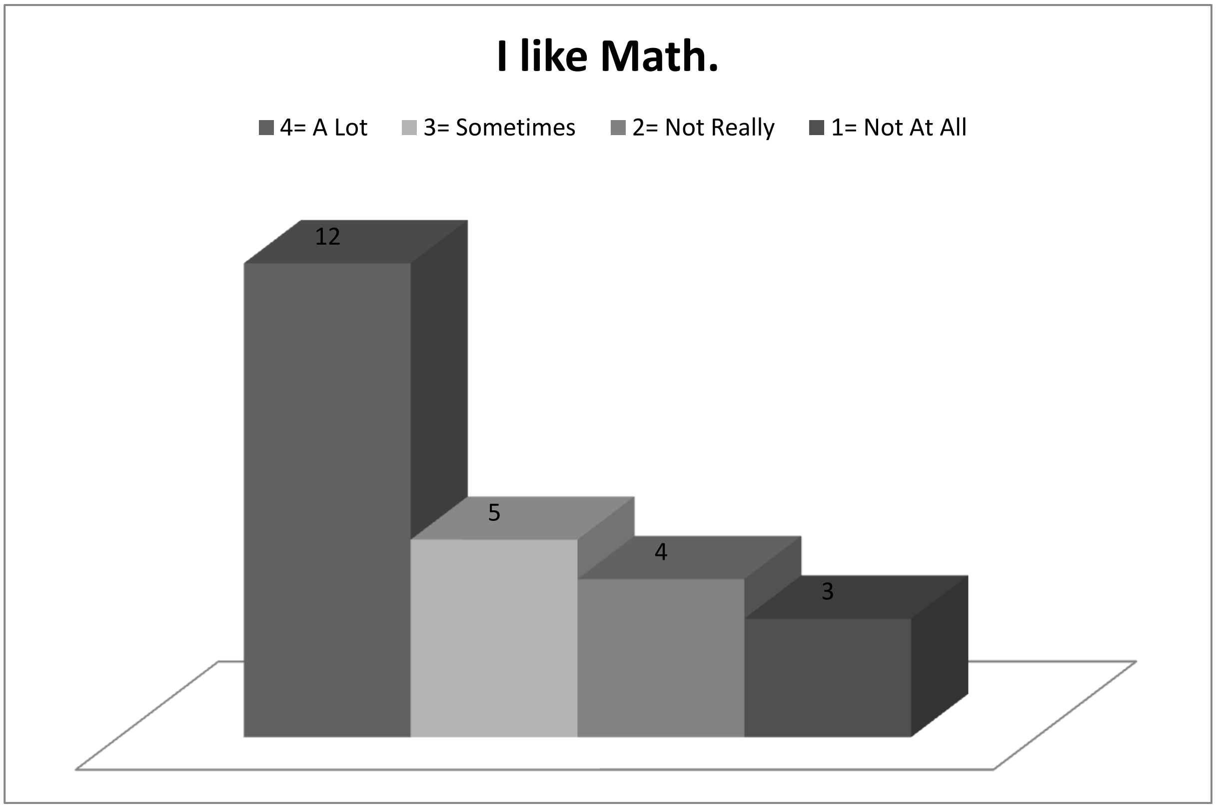
1. I like math.	**4**	**3**	**2**	**1**
2. Math is hard.	**4**	**3**	**2**	**1**
3. I like using a computer to practice math.	**4**	**3**	**2**	**1**
4. MFF helped me learn subtraction.	**4**	**3**	**2**	**1**

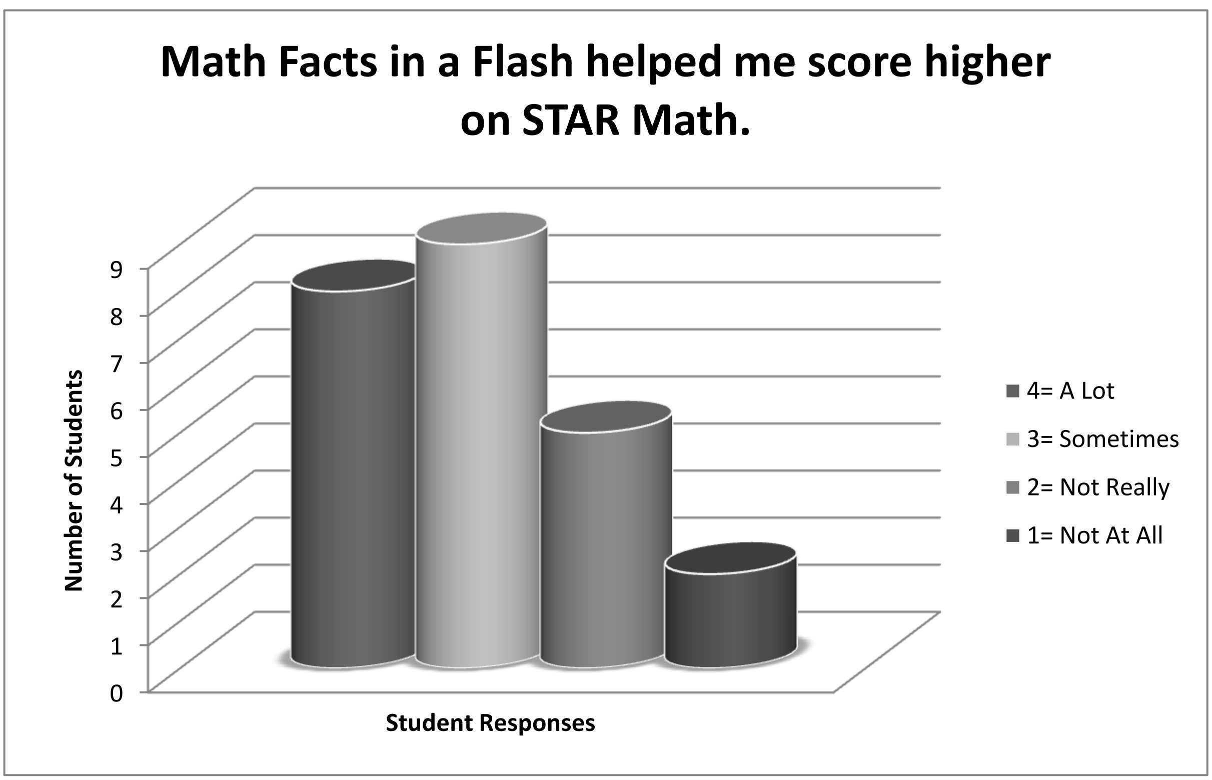
4= A lot 3= Sometimes 2= Not Really 1= Not At All

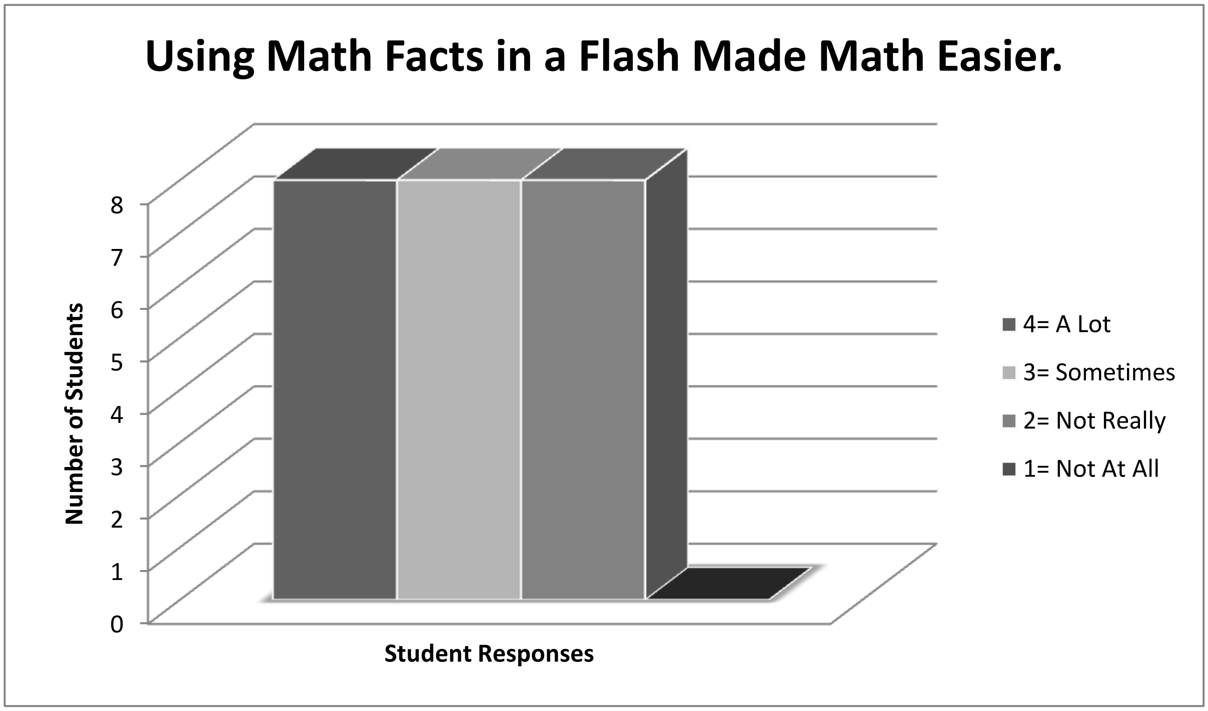
5. MFF helped me do better on STAR Math.	**4**	**3**	**2**	**1**
6. MFF helped me complete more problems on the 2 minute timing.	**4**	**3**	**2**	**1**
7. Using MFF made math easier.	**4**	**3**	**2**	**1**

Math Survey Results by Student

Student Name	I.D.	Male	Female	Q1	Q2	Q3	Q4	Q5	Q6	Q7
Alfaro, Helen	1		X	3	3	3	4	4	3	4
Bravo, Jesus	2	X		1	3	1	2	3	3	2
Campos, Luis	3	X		4	3	3	1	1	3	3
Cervantes, Luis	4	X		2	1	4	4	3	3	2
Cruz, Angelica	5		X	4	2	4	4	3	4	3
Espinoza, Natlie	7		X	4	4	3	3	2	3	3
Gomez, Carmen	8		X	1	4	2	4	4	3	4
Gomez, Elvis	9	X		2	2	2	2	2	3	2
Gomez, Oscar	10	X		2	4	3	3	3	2	2
Gonzalez, Katie	11		X	1	4	1	4	4	4	4
Jildo, Stephanie	12		X	4	2	4	4	4	3	4
Lopez, Cristanto	13	X		3	2	4	3	3	4	3
Medina, Eduardo	14	X		3	4	4	4	4	4	2
Morales, Adrian	15	X		3	2	4	3	3	3	3
Oregon, Kobe	16	X		3	1	3	3	4	3	4
Orozco, Osvaldo	17	X		4	2	4	3	3	2	3
Osorio, Chasity	18		X	4	2	4	3	3	2	2
Perez, Christian	19	X		4	3	4	3	2	2	3
Sandoval, Armando	20	X		4	3	3	2	2	3	3
Terrero, Micxi	21		X	4	4	2	2	2	2	2
Torres, Victor	22	X		4	1	3	4	4	2	4
Trejo, Anayeli	23		X	4	1	3	3	3	1	4
Trejo, Juan	24	X		4	1	3	4	4	3	4
AVERAGE				3.13	2.52	3.09	3.13	3.04	2.83	3.04

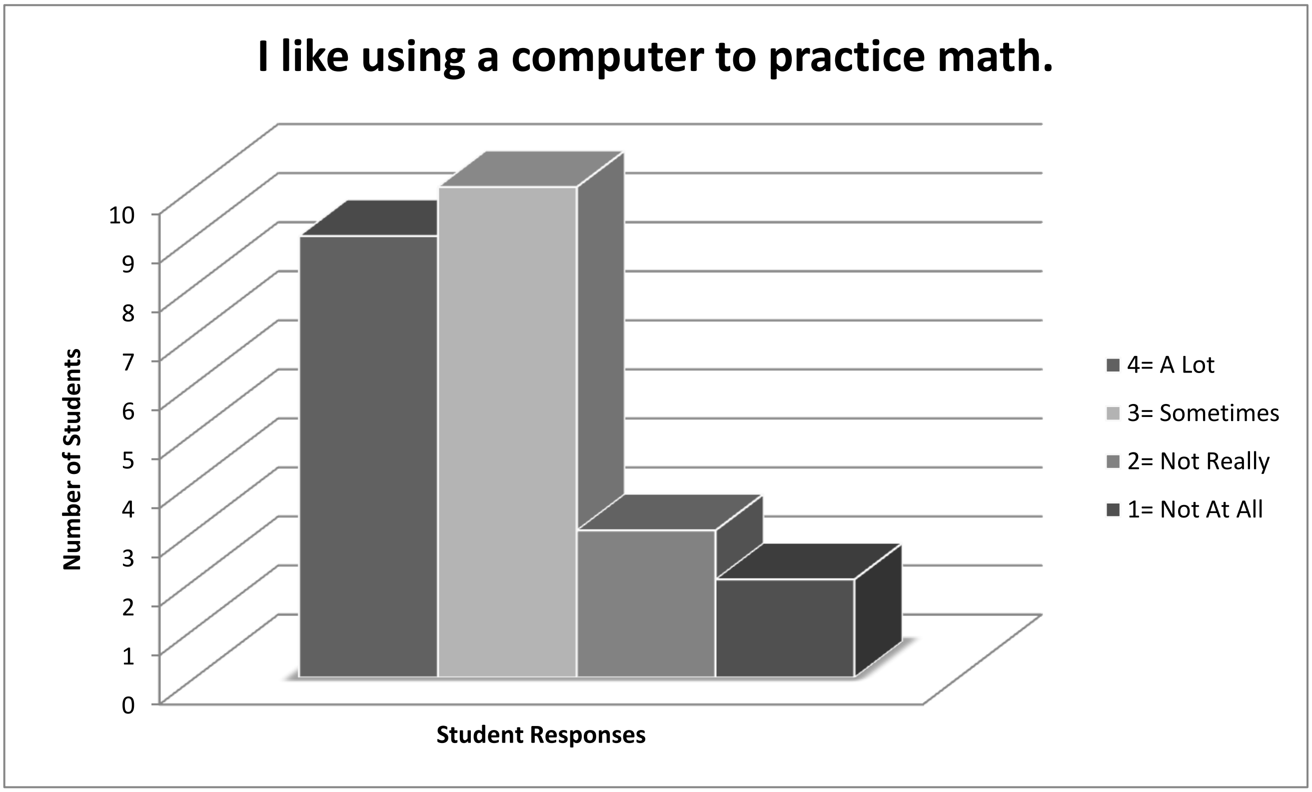

I like Math.
4= A Lot
3= Sometimes
2= Not Really
1= Not At All
12
5
4
3

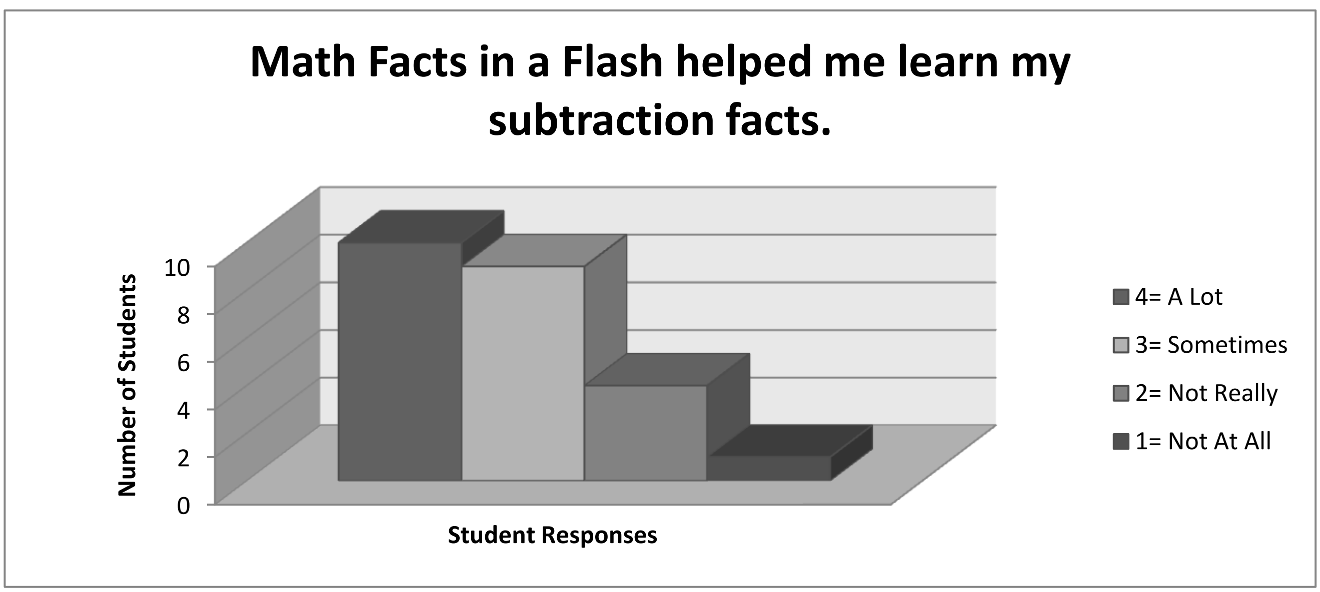

Math Facts in a Flash helped me score higher on STAR Math.
Number of Students
0
1
2
3
4
5
6
7
8
9
Student Responses
4= A Lot
3= Sometimes
2= Not Really
1= Not At All


Using Math Facts in a Flash Made Math Easier.
Number of Students
8
7
6
5
4
3
2
1
0
Student Responses
4= A Lot
3= Sometimes
2= Not Really
1= Not At All

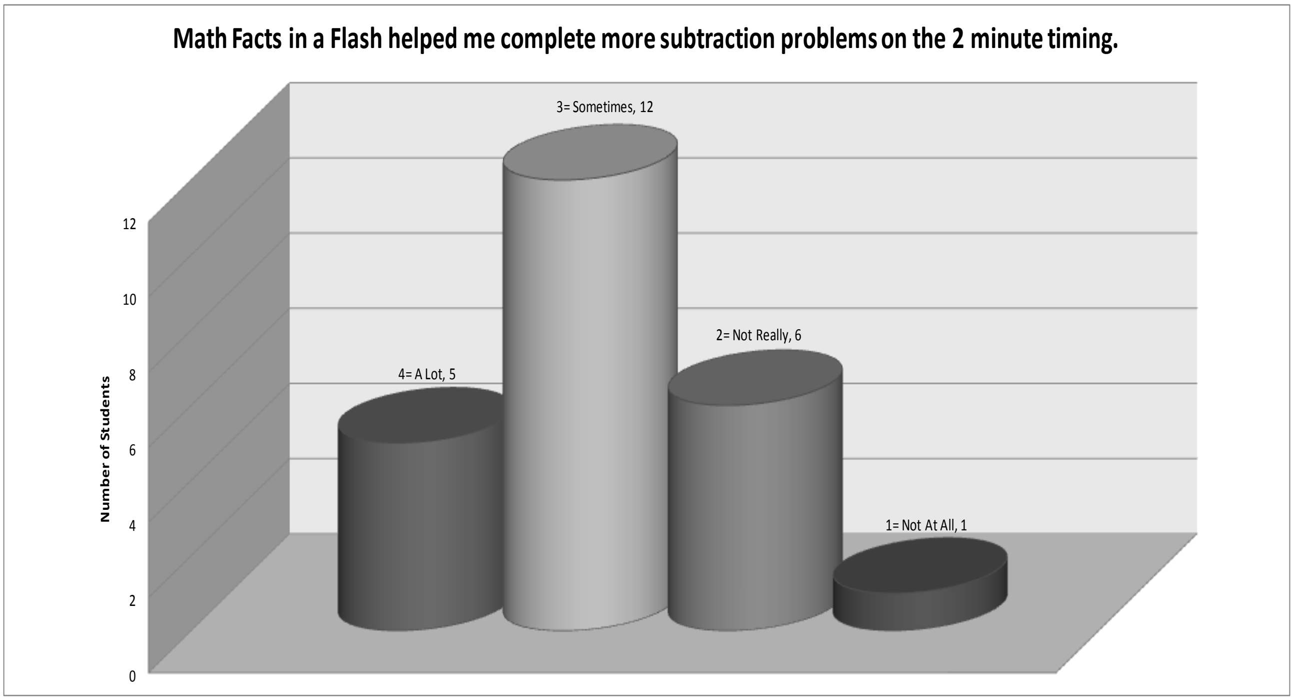
Survey Questions and Number Per Response

Survey Question	4= A Lot	3= Sometimes	2= Not Really	1= Not At All	Total
I Like Math	12	5	4	3	24
Math is Hard	7	5	7	5	24
I like using a computer to practice math.	9	10	3	2	24
Math Facts in a Flash helped me learn my subtraction facts.	10	9	4	1	24
Math Facts in a Flash helped me score higher on STAR Math.	8	9	5	2	24
Math Facts in a Flash helped me complete more subtraction problems on the 2 minute timing.	5	12	6	1	24
Using Math Facts in a Flash made math easier.	8	8	8	0	24


I like using a computer to practice math.
Number of Students
10
9
8
7
6
5
4
3
2
1
0
Student Responses
4= A Lot
3= Sometimes
2= Not Really
1= Not At All


Math Facts in a Flash helped me learn my subtraction facts.
Number of Students
10
8
6
4
2
0
Student Responses
4= A Lot
3= Sometimes
2= Not Really
1= Not At All

Appendix I


Math Facts in a Flash helped me complete more subtraction problems on the 2 minute timing.
Number of Students
0
2
4
6
8
10
12
4= A Lot, 5
3= Sometimes, 12
2= Not Really, 6
1= Not At All, 1