Increasing Computational Fluency with Math Facts in a Flash

A Special Project

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Dr. Robert P. Kraig

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FACULTY APPROVAL

Increasing Computational Fluency with Math Facts in a Flash

A Master's Special Project

by

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ABSTRACT

Increasing Computational Fluency with Math Facts in a Flash

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This study was conducted over two semesters at Bridgeport Elementary School, a rural school, located in Bridgeport, Washington. Research suggested that technology was effective for helping students obtain, practice and transfer math concepts. The purpose of this study was to determine if students who used a computerized math-fact program, *Math Facts in a Flash*, along with traditional math-fact instruction would correctly complete more problems on a timed assessment. Thirty 4th grade students received traditional worksheets for the first semester and Math *Facts in a Flash* was added for the second semester. Mean scores of students who participated in the computerized math-fact program increased by 4.5 over students whose only instruction was traditional math fact instruction

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CHAPTER 1

Introduction

Background for the Project

The No Child Left Behind Act (NCLB) signed by President George W. Bush in 2001 was designed to hold schools accountable so all students were receiving quality instruction from highly qualified educators and were able to attain mastery in reading and math.

As a result of increased accountability Washington State created the Washington Assessment of Student Learning (WASL). According to the Office of Superintendent of Public Instruction (2009) the WASL was given as the state's primary assessment from spring 1997 to summer 2009 and was replaced by the grades 3-8 Measurement of Student Progress (MSP) and the High School Proficiency Exam (HSPE). The WASL was administered to students statewide in grades 3-8, and again in 10th grade. The WASL consisted of assessments in reading, writing, math, and science.

The decline of scores for the fourth grade Math WASL brought about the desire for this study. There were no interventions offered in math during the regular school day and limited help in homework helpers after school for a select few students at Bridgeport Elementary. After looking critically into what students

needed to be successful in math, it was decided math-fact (addition, subtraction, mulitiplication and division of numerals 0-12) was a skill students needed to gain proficiency in and become better equipped at solving higher level math problems.

Statement of the Problem

Bridgeport Elementary school examined the Washington Assessment of Student Learning (WASL) scores for the 2008-2009 academic year and it became evident that math was an area of concern for the 2009-2010 fourth grade class at Bridgeport Elementary. Bridgeport Elementary School (BES) had continually dropped scores in mathematics. In 2008-2009 only 25.9% of fourth grade students met standard of the Math WASL down from 33.3% in 2007-2008.

As a result of declining test results BES had been placed on Step 2 for failure to meet adequate yearly progress (AYP) as required by the federal legislation NCLB. OPSI reported that being placed on Step 2 required the school to notify parents of its status, parents were provided the opportunity to transfer their child to another public school within the district, pay transportation costs if a transfer was requested, and that a school improvement plan was created (What is AYP, 2009). BES had set a goal to improve the number of students meeting standard in math on the state assessment to 37.6%. After review of the WASL

data students demonstrated difficulty with mathematical content; included in that strand was number sense and number theory, numeration and computation.

The community demographics had changed drastically over the past decade, once an Anglo community had transformed itself into a largely Hispanic community. According to the State Report from OSPI three hundred thirty-one students at BES were Hispanic, or 86.2% (2009). The district was under increased pressure to raise standardized scores of English Language Learners (ELL) and poverty level students.

With intensified demands coming from the state the district had looked at numerous ways to meet the needs of its diverse population, including hiring more bilingual teachers, providing instruction in the students' native language and offering parental involvement trainings. The elementary school had not met state mandated AYP, in math and reading in numerous categories including; all students, Hispanic and low income students and was on Step 2 and remained in school improvement until AYP was made for two consecutive years.

The issue of poverty was a major concern for the district. The number of free and reduced meals was 84.7 % district wide. The school provided free breakfast and lunch to all students, as well as, a free breakfast and lunch program to students during the summer. The money was just not there to provide all the

extras larger districts had the opportunity to provide. With most money focused on smaller class sizes, full day kindergarten, and salaries there was little money left for staff development or extra classes or clubs, such as; drama, chess clubs, and multiple foreign languages.

The district had limited access to community resources. That had forced the district to construct outside partnerships with neighboring counties and state resources to provide the patrons with the support services needed; access to adequate medical and mental services, counseling, and birth to three services.

The focus of this study was to determine if students that received instruction using a computerized math-fact program in conjunction with regular math-fact instruction would increase their computational fluency and overall math achievement. *Math Facts in a Flash* (MFF) was chosen as the software program to assist students in acquiring and practicing their multiplication tables.

Purpose of the Project

The purpose of this study was to determine if using a computerized math-fact program *(Math Facts in a Flash)* increased student performance on a two-minute timed assessment. The study would also show if using *Math Facts in a Flash* increased student confidence levels.

Delimitations

This study was delimitated to one fourth grade class over two semesters at Bridgeport Elementary School in the Bridgeport School District, located in Bridgeport, Washington. The project was conducted during the 2009-2010 school year with 30 students. BES had an enrollment for 398 for the May 2009 child count. The ethnicity of BES was: American Indian/Alaskan Native 1.3%, Black 0.3%, Hispanic 86.2%, and White 12.0%. The number of students that qualified for the Transitional Bilingual Program was 56.8%.

A two minute timed multiplication assessment, consisting of random multiplication problems, was the assessment instrument chosen to measure student success. Each student was assessed three times during the course of the study, once in the initial stages, again at end of the first semester and finally after the intervention period.

Assumptions

For this study an assumption was made that all students gave full attention and worked hard during math fact instruction. Another assumption was that all students answered the post intervention survey honestly. A third assumption was that the MFF intervention program was at an appropriate instructional level for the students. It was assumed that the two minute test was appropriate.

Hypothesis

Students who receive instruction using a computerized math-fact program, *Math Facts in a Flash,* in conjunction with regular math-fact instruction will correctly complete more problems on a 2 minute timed assessment than students who receive regular instruction only. After using a computerized math-fact program students will feel more confident about taking their 2 minute timed assessment.

Null Hypothesis

Students who receive instruction using a computerized math-fact program, *Math Facts in a Flash,* in conjunction with regular math-fact instruction will show no difference in the number of correct problems on a 2 minute timed assessment than students who receive regular instruction only. After using a computerized math-fact program students will feel the same about taking their 2 minute timed assessment

Significance of Project

The purpose of this study was to determine the effectiveness of MFF at increasing students' computational fluency and use as a math intervention. All grades 1-5 had access to MFF, but its use was sporadic and varied among individual teachers; before dedicating time for all classes to implement the

program the benefits needed to be determined. The results of this study were presented to staff and administration in order to determine increased implementation of MFF in all classrooms at BES.

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 BES Principal Michael Porter (see Appendix B).
4. All students were given a two minute timed assessment during the first semester without using MFF on October 2, 2009 (see Appendix C).
5. Scores from the two minute timed assessment were tabulated (see Appendix D).
6. All students practiced traditional math fact instruction.
7. All students were given a two minute timed assessment during the first semester without using MFF.

8. Scores from the two minute timed assessment were tabulated and disaggregated by gender (see Appendix E).

9. *Math Facts is a Flash* intervention was implemented for each student in the class.

10. The two minute timed assessment was given to all students on March 12, 2010.

11. Scores from the two minute timed assessment were tabulated (see Appendix F).

12. A post intervention survey was given to all 30 students (see Appendix G).

13. Data from survey was tabulated and graphed (see Appendix H).

14. Results from the study was evaluated and conclusions drawn.

15. A meeting was held to discuss findings and make a decision about the implementation of *Math Facts is a Flash* as an intervention.

Definition of Terms

Adequate Yearly Progress. The yearly measurement of student progress as measured by the WASL.

Computational Fluency. The ability to compute in an efficient, flexible and accurate manner.

Math Facts. The addition, subtraction, mulitiplication and division of numerals 0-12.

Washington Assessment of Student Learning. A state assessment to measure student's levels of proficiency in reading, writing, math, and science.

Acronym

AYP. Annual Yearly Progress.

BES. Bridgeport Elementary School.

ELL. English Language Learner.

HSPE. High School Proficiency Exam.

MSP. Measurement of Student Performance.

OSPI. Office of Superintendent of Public Instruction.

WASL. Washington Assessment of Student Learning.

CHAPTER 2

Review of Selected Literature

Introduction

This chapter has been organized around the following topics: (a) High Stakes Testing, (b) Math Instruction, (c) Computerized Instruction, (d) Theories of Learning, and (e) Summary.

High Stakes Testing

According to the United States Department of Education, the focus of No Child Left Behind was directed toward targeted groups of students that traditionally had been left out (low-income, English Language Learners (ELL). NCLB enacted in the theory of standards-based education reform, which was founded in the assumption that setting high standards and creating measurable goals would increase individual student achievement (2009)

Under NCLB expectations 100% of students must have achieved academic proficiency by 2014. However states were granted leeway in a number of variables. The states had the ability to create their own academic standards, design their assessments, and define proficiency in reading and math. Secondly the states were able to establish their own annual targets (Cronin, Dahlin, Xiang, McCahon, 2009).

The primary measure of student achievement was Adequate Yearly Progress (AYP). One of the requirements of NCLB was that states develop a baseline for students to achieve proficiency. According to the OSPI document *What Adequate Yearly Progress Is* (2009) each year the state was required to increase the rate until all students are proficient in each subject area

Washington State prepared two documents to help teachers align what was taught at each grade level to state and national standards; all this in hopes of creating students that were well equipped to pass the Washington State Assessment of Student Learning.

The Essential Academic Learning Requirements (EALR) was the foundation that the grade level expectations were built on. OSPI's Reading Standards stated (2009) there were EALRs in eight curriculum and instruction areas, including reading, communication, art, health and math. The EALRs acted on the continuum where as, for example, the EALR 1.0 in reading stated: "The student understands and uses different skills and strategies to read (Reading, 2009)." That EALR did not change as the student continued through out the educational process. "Each grade-level expectation assumed the student was reading at grade level. Since reading was a process, some grade-level indicators and evidence of learning applied to multiple grade-levels. What changed was the

text complexity as students moved through the grade levels (Reading, 2009)." For a student in kindergarten the expectation was —"identify front cover, back cover, and title of books (Reading, 2009)." While in 6th grade the expectation was to "use dictionaries, thesauruses, and glossaries to find or confirm word meanings…"(Reading, 2009).

Teaching standards had been implemented to assure that teachers were competent. Among these standards were "performance-based standard for teacher preparation at the residency and professional certificate levels (Endorsement Competencies, 2009)." Washington also required a basic skills assessment for admission to a teacher preparation program or for out-of-state teachers. "Washington State has embarked on an initiative to develop sets of teacher competencies - what teachers are expected to know and be able to do - in each of the endorsement areas (Endorsement Competencies, 2009)."

Math Instruction

The way in which children receive math instruction was based upon how teachers believed that children learn. There were two divergent theories of learning, behaviorism and constructivism. Behaviorism focused on external and observable behaviors; that reinforcement and punishment shaped learning by encouraging the proper response. Behaviorist viewed math as being linearly

sequenced; “behaviorism promotes learning a fixed set of skills in order” (Reys, Lindquist, Lambdin, Smith, & Suydam, 2004, pg 19). For example, if multiplication had been identified as a form of repeated addition then the concept of addition must have been mastered before moving onto the concept of multiplication.

Constructivists have believed making learning meaningful enhanced mathematical knowledge. Founded in the belief that knowledge was not received but rather it was created, many constructivist viewed math as a system of ideas, principles and processes. Connections made among math concepts should be created to challenge the learner’s intelligence not memory. According to Reys (2004), Piaget suggested that “mathematics understanding is made (constructed) by children, not found like a rock nor received from others as a gift” (pg.21).

Mathematical knowledge can be broken into two categories; declarative and procedural knowledge. Fundamental to both categories was number sense, which can be defined as “an awareness of number names, values, and relationships” (Math Fluency, 2009).

Declarative knowledge was stored knowledge of basic facts and their answers were recalled for memory. Procedural knowledge was strategies students used to find answers for problems that did not have pre-stored answers.

The mastery of basic math-facts was fundamental to developing students that were successful in higher level mathematic courses. Just like with reading, students who struggled with fluency had a difficult time with comprehension; students that had not reached automaticity with math-facts struggled with mastery of mathematical procedures and concrete understanding.

Students that had accuracy and automaticity with basic facts also had simplified mental calculations; as a result, students developed the skills needed to reason numerically. According to Donald Crawford, Ph.D. difficult problems were less overwhelming for students when basic math skills themselves were not a trial (2003).

Drill and practice was a strategy that related to the memorization of small tacks of spelling or vocabulary words or math-facts. Drill and practice involved repetition of specific skills and to be meaningful to students needed to be used as building blocks to more meaningful learning. Drill and practice was used to increase acquisition of basic skills.

Computerized Instruction

Technology has had a large impact on teaching and learning. Computers had shown potential for improving and enhancing the education process for all learners. Because many new technologies were interactive it was easier to create

an environment in which students could learn by doing, receive feedback, and continually refine their understanding and build new knowledge (National Research Council, (2000).

Most instructional software was designed to imitate student interaction similar to the textbook or teacher. Software implemented into a curriculum should have contributed to the objectives of the lesson or unit and not be used as an add-on to more accessible approaches (Van de Walle, 2004).

Drill programs were designed to practice pre taught skills. Drill programs had the capability of evaluating student responses immediately. Some programs offered tracking features which enabled teachers to track individual student progress. Although these programs offered repeated drill and practice many were designed in an arcade or game like format that made them exciting for students. The game like format gave these programs an advantage to add motivation to an otherwise boring drill (Van de Walle, 2004).

National Council of Teachers of Mathematics Number and Operation Standard stated, "Knowing basic number combinations-the single-digit addition and mulitiplication pairs and their counterparts for subtraction and division-is essential. Equally essential is computational fluency-having and using efficient and accurate methods for computing" (NCTM, 2000). Ysseldyke, Thill, Pohl and

Bolt (2005) stated, *Math Facts in a Flash* was a software program that allowed teachers to "give students at all skill levels valuable practice on their addition, subtraction, multiplication, division, squares and fraction-decimal conversions facts" (pg 63). Students were tested on basic facts, organized into forty-four levels, that increased the level of difficulty and matched the student's skill level. Students received immediate feedback after each practice or test session and teachers had the ability to track individual student progress.

Ysseldyke, et al., (2005) reported research "showed that one minute on a 40-item test was benchmark for mastering math-facts at the elementary level" (pg. 64). *Math Facts in a Flash* allowed for a two minute test time for a forty problem assessment. Students advanced to the next level of difficulty upon the mastery of one level, viewed any missed items, and students worked at their skill level.

According to Ysseldyke, et al., (2005) *Math Facts in a Flas*h provided practice opportunities for students. Students received feedback immediately and saw improvement instantly, which increased motivation and success. Furthermore Ysseldyke, et al., believed that students received more benefit in the fact that teachers with reduced paperwork had more time to work with students in need of

additional and/or small group instruction based on the zone of proximal development (2005).

Theories of Learning

There were several issues that surrounded theories of learning; one was the nature vs. nurture controversy. That discussion revolved around the question, was development predetermined at birth and through hereditary factors or did experience and environmental factors affect an individual's development. Many developmental psychologists believed both nature and nurture combined to influence development.

According to Slavin, "Jean Piaget divided the cognitive development of children and adolescents into four stages: sensorimotor, preoperational, concrete operational and formal operational. He believed that all children pass through these stages in this order and that no child can skip a stage, although different children pass through the stages at somewhat different rates" (2003, pg 32). An essential point to recognize about these levels was that they were qualitatively different. Each consecutive stage was not a matter of doing something better, but of doing something different.

As reported by Slavin, (2003) Lev Vygotsky felt language was a critical tool that influenced children's cognitive development. He noted three different

stages in the development and use of language. Initially, language was used for communication with others (social speech). Next, children began to use private speech to regulate their own thinking; they talked to themselves or whispered to adjust their own thinking. In the final stage of language growth, children used verbal thoughts to guide their thoughts and actions.

"The most important contribution of Vygotsky's theory is an emphasis on the socio-cultural nature of learning. He believed that learning takes place when children are working within their zone of proximal development" (Slavin, pg. 44). The zone of proximal development referred to the difference between what children did on their own and with the assistance of others. If an adult or peer provided an appropriate level of support and guidance, children performed on higher levels than they did individually. Those interactions with adults and peers in the zone of proximal development helped children progress to higher levels of cognitive functioning.

Vygotsky's and Piaget's theories laid the psychological foundations for the constructivist views of both teaching and learning. Constructivists believed that students created their own understanding of the world; adults helped to guide this knowledge with structure and support.

The theory of multiple intelligences was developed as a psychological theory. Howard Gardner proposed the existence of seven separate intelligences; "linguistic, logical, musical, spatial, bodily kinesthetic, interpersonal, and intrapersonal" (National Research Council, 2000, pg 101). Of the intelligences, linguistic and logical have been those primarily targeted on test and most desired in schools.

Anonymous (2005) stated Gardener defined the seven intelligences as: logical, the ability of detect patterns, and reason; linguistic involved the ability to express one with language; spatial intelligence was the ability to create mental pictures to solve problems; musical intelligence was the skill to identify and create pitch, tones and rhythms, body kinesthetic allowed individuals to control their body movements, and finally personal intelligence, both interpersonal and intrapersonal, contained the encompassed understanding one's own feelings and inspiration. Gardener had proposed that there was an eighth intelligence, "naturalistic" (National Research Council, 2000).

Gardener (2000) believed "teachers should fashion teaching and learning so that all students have the chance to learn and to demonstrate what they have learned – not just those students who happen to be gifted with words and numbers" (pg. 32). Gardener's theory of multiple intelligences held several

implications for classroom instruction. First that all intelligences are "equally important and needed in a productive society to operate, and secondly that learning should be taught and assessed in a broader manner that insured students successfully participated in meaningful educational opportunities" (Anonymous, 2005, pg 13).

Summary

The focus of this chapter was to address the available evidence to the topics of (a) High Stakes Testing, (b) Math Instruction, (c) Computerized Assisted Instruction, (d) Theories of Learning, and (e) Summary. The purpose of the summary was to highlight computerized instruction on student performance and state and national standards. The methodology and treatment of the data are reported in Chapter 3.

The focus of NCLB was directed toward targeted groups of students that traditionally had been left out (low-income, English Language Learners (ELL). Washington State was required under NCLB to develop a baseline for all students to achieve proficiency. BES had a large number of low-income and ELL student that did not make AYP on the Math WASL. Student achievement did not increase at the required yearly rate determined by the State of Washington. As a

result of NCLB the Bridgeport Elementary School had been placed on Step 2 and was required to notify parents of those consequences.

Behaviorist viewed math as being linearly sequenced. Multiplication had been seen as a form of repeated addition, so in order for multiplication to be mastered, basic addition facts must be mastered first. According to Donald Crawford, Ph.D. difficult problems were less overwhelming for students when basic math skills themselves were not a trial (2003). *MFF* required students to develop automaticity with a set of basic fasts before they moved to the next level. Drill and practice was the repetition of specific skills. Drill and practice was used to increase the acquisition of basic facts.

Computerized instruction provided an environment where students received immediate feedback, and refine understanding while building knowledge (National Research Council, 2000). Using a software program that featured drill and practice gave an arcade or game like experience that made them more exciting to students. Van De Walle, stated that those programs added motivation to a boring drill. According to Ysseldyke, et al., (2005) *Math Facts in a Flas*h provided practice opportunities for students. Students received feedback immediately and saw improvement instantly, which increased motivation and success.

Theories of learning discussed ways in which children learned. Not all children received and retained information in the same manner. There were numerous areas in which a child could have a high intelligence. According to Gardener there were seven different intelligences (Anonymous, 2005)

Vygotsky believed that "learning takes place when children are working within their zone of proximal development" (Slavin, pg. 44). Ysseldyke, et al., believed that students received more benefit from using *Math Facts in a Flash* because the program provided teachers with less paperwork and those teachers had more time to work with students in need of additional and/or small group instruction based on the zone of proximal development (2005).

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 School had *Math Facts in a Flash* installed district wide prior to the 2008-2009 school year. The researcher sought to determine if students who received instruction using a computerized math-fact program in conjunction with regular math-fact instruction would correctly complete more problems on a 2 minute timed assessment than students who only received regular instruction.

Methodology

The researcher chose to do an action/quasi-experimental project and gave a descriptive survey at the end of the project. The researcher sought to determine if a new approach to computational fluency could be applied directly to the classroom setting.

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. The process was repeated during the second semester with the addition of *Math Facts in a Flash a* computerized program. The students were also given a descriptive survey at the end of treatment to measure student perception of math skills after treatment. 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-test was used for non-independent samples to determine significance. The results of the t-test were then compared to the distribution of t-table to ascertain if the treatment did create a significant change in student skills.

Participants

The researcher selected the class of 2018 who were fourth graders for the 2009-2010 school year. The students were from lower and middle class families in rural North Central Washington. The majority of families were employed in agricultural fields.

This group contained 30 students of which 30 participated in this study. The study group contained 10 girls (33%) and 20 boys (77%), the ethnicity of the class was 20% Caucasian and 80% were of Hispanic decent. From that population 84.7% of students qualified for free and/or reduced lunch, but due to the large

number of students qualified the district provided free lunch to all enrolled students.

Instruments

A two minute timed assessment was the tool used to gather data about the student's computational fluency rate. This test was given three times during the course of this project. *Math Facts in a Flash* was the instrument used to administer the supplemental dose of math-facts instruction to students.

After the data was gathered the researcher entered it into the spreadsheet program, Excel. Excel was a software program written and distributed by Microsoft. Once the data was entered the researcher used the program to tabulate the results of the timed assessment, as well as, the descriptive survey. Excel was also used to create graphs and charts. Statpak was the statistical calculator used to determine significance of the data results.

Design

The same group of students participated in a one-group pretest-posttest design. According to Gay, Mills and Airasian, "the one-group design consisted of a single group that was pretested, exposed to treatment and then retested; the success or failure of the treatment was determined using the pre and post assessment data" (2009, pg 253). A descriptive survey was given to participants at the conclusion

of the treatment to investigate individual and subgroup attitudes. Gay, et al. concluded that a survey could "provide possible explanation for attitudes and behaviors" (2009, pg. 186). It provided data on student perceptions about the effectiveness of *Math Facts in a Flash* and their academic achievement.

Procedure

The researcher wanted to determine if computerized math-facts instruction would increase individual student's rate of computational fluency. The researcher began by reviewing articles from internet sources, online and at local libraries.

The researcher gathered data about student achievement using a two-minute timed assessment given twice (pre and post assessments) during the first semester of the 2009-2010 academic year. The supplemental software program, *Math Facts in a Flash* was implemented. Students used the program 20 minutes daily, four days a week for the second semester. A final assessment was given at the end of the second semester. A descriptive survey was developed and given to each participate at the end of the research project to determine student's perceptions of math and the instructional strategies used in the study.

The data from the assessments and the survey was entered into an Excel program. Results were tabulated and graphs created. The differences between post assessment scores from each semester were entered into the statistical

calculator to test for significance and create a table. The answers from the survey were tallied, entered into Excel, and analyzed. Results from the study were evaluated and conclusions drawn. A meeting was held to discuss findings and make a decision about the implementation of *Math Facts is a Flash* as an effective intervention tool.

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. The analysis of data and findings from this study are 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 using a *Math Facts in a Flash* increased student performance on a two-minute timed assessment. The study would also show if using *Math Facts in a Flash* increased student confidence levels in mathematics.

Description of the Environment

This study was delimitated to one fourth grade class over two semesters at Bridgeport Elementary School in the Bridgeport School District, located in Bridgeport, Washington. The project was conducted during the 2009-2010 school year with 30 students. BES had an enrollment for 398 for the May 2009 child count. The class consisted of 10 females and 20 males. The population was 33% Caucasian and 77% Hispanic. Three students qualified to receive specially designed instruction, or an individualized educational program. One student received services in English language acquisition.

A two minute timed multiplication assessment, consisting of random multiplication problems, was the instrument chosen to measure student achievement. Each student was assessed three times during the course of the study, once in the initial stages, again at end of the first semester and finally after the intervention period. The intervention period consisted of students using a computerized assisted instructional program, *Math Facts in a Flash.*

Hypothesis

Students who receive instruction using a computerized math-fact program, *Math Facts in a Flash,* in conjunction with regular math-fact instruction will correctly complete more problems on a 2 minute timed assessment than students who received regular instruction only. After using a computerized math-fact program students will feel more confident about taking their 2 minute timed assessment.

Null Hypothesis

Students who receive instruction using a computerized math-fact program, *Math Facts in a Flash,* in conjunction with regular math-fact instruction will show no difference in the number of correct problems on a 2 minute timed assessment than students who receive regular instruction only. After using a computerized

math-fact program students will feel the same about taking their 2 minute timed assessment.

Results of the Study

Mean scores of students who participated in the computerized math-fact program increased by 4.5 over students whose only instruction was traditional math fact instruction. During the 2009-2010 school year thirty students participated in the study. Of those thirty students 17 (57 %) showed improvement from pre and post assessments after using *Math Facts in a Flash.* Thirteen (43%) students showed no increase or their computational fluency declined after participation in the study.

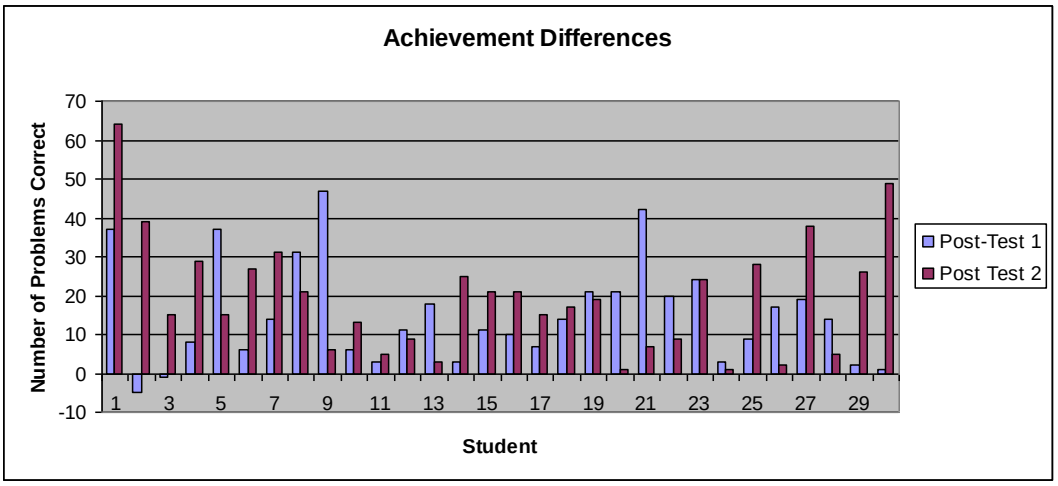

Figure 1

The data was then disaggregated by gender. Of the twenty boys in the class 11 showed an increase in their overall performance on the two-minute timed assessment. Nine boys showed no increase or their scores declined after using *Math Facts in a Flash.* The mean increase of scores was 9.97 problems prior to the treatment period and 13.33 problems after treatment. The overall increase in the number of problems correct on a two-minute assessment was 3.36. That data revealed that 55% of boys benefited and showed improvement in computational fluency; while 45% of the male population scores remained unchanged or declined.

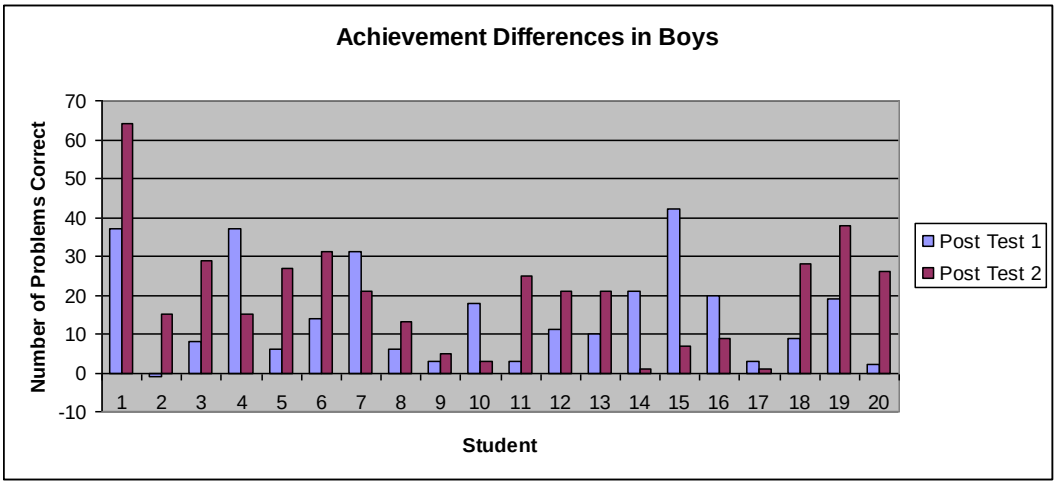

Figure 2

Ten girls participated in the research project. Four girls (40%) showed growth in their computational fluency scores. Six girls (60%) showed no increase or their

scores declined after using *Math Facts in a Flash.* The mean increase of problems correct was 5.03 prior to treatment and 6.17 after the intervention. The data illustrated that fewer girls (40%) than boys (55%) benefited from the use of *Math Facts in a Flash* as a tool to increase computational fluency. The overall increase in the number of problems correct on a two-minute assessment was 1.14 problems.

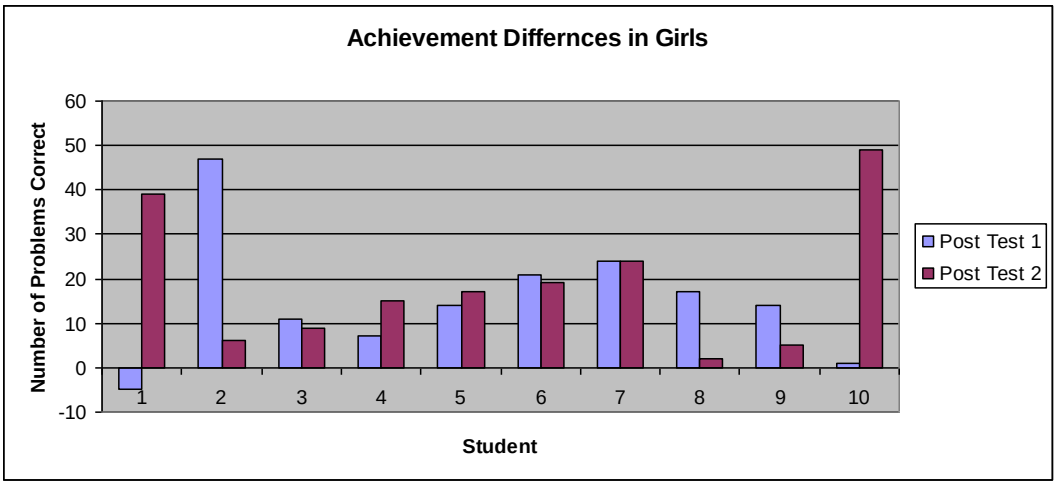

Figure 3

The data was entered into a statistical calculator and a t-test was conducted to determine significance. The t-value was 1.19 and the degree of freedom was 29. A required t-score of 2.045 was needed to demonstrate a significant change, however the results were 1.19. A t-score of 1.19 failed to meet the criteria needed

to show significant change at 0.5. The sum of the data was 135.00 and the mean increase of correct problems for students that participated in the study was 4.50.

A student survey was conducted in March, 2010 and showed that most students felt *Math Facts in a Flash* helped them to learn their multiplication tables. Thirty students took the survey, twenty males and ten females. Students were asked if *Math Facts in a Flash* helped them to learn their multiplication tables. Eighteen students strongly agreed, eight students agreed, 2 students disagreed, and 2 students strongly disagreed. Eighty-seven percent of students surveyed strongly agreed or agreed that MFF was beneficial in the memorization of multiplication facts.

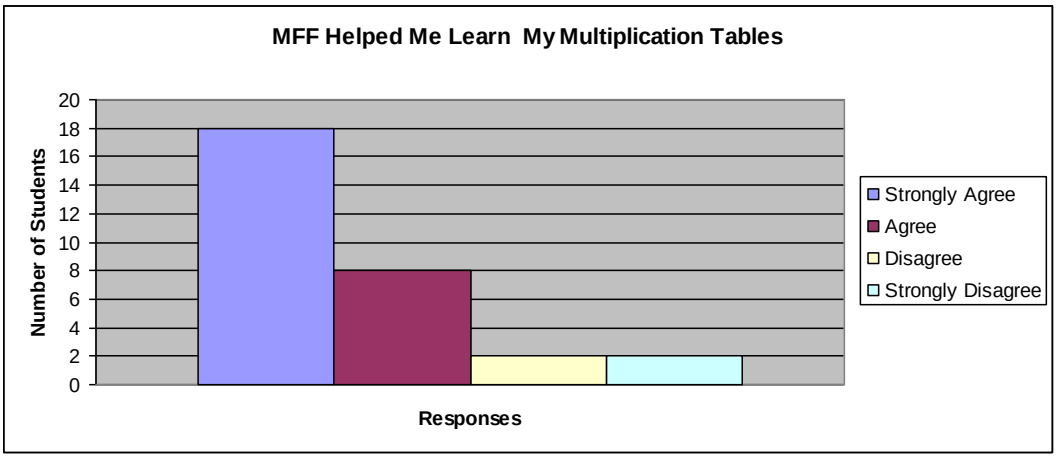

Figure 4

When asked if *Math Facts in a Flash* would help students pass the Washington Assessment of Student Learning 13 students strongly agreed and 11

students agreed that *MFF* would in fact help them to pass the WASL. Four students disagreed and 2 students strongly disagreed that the use of MFF would increase their achievement on the WASL. Eighty-percent of students surveyed felt that the used of MFF was beneficial as a tool to increase success on the WASL.

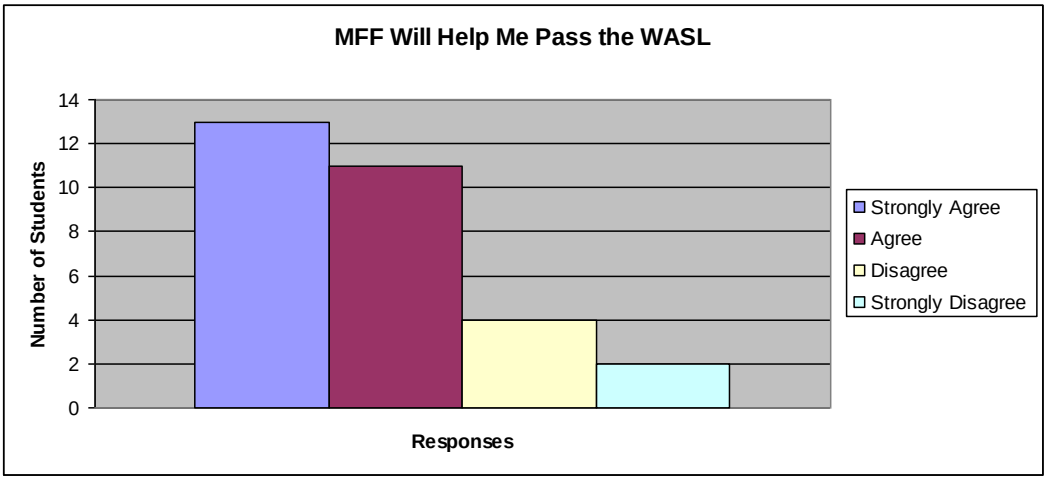

Figure 5

Findings

The researcher used a t-test for dependent variables to determine the level of significance the implementation of *Math Facts in a Flash* had upon student's level of computational fluency. The researcher analyzed the data with the degree of freedom at 29. The required t-score of 2.045 was needed to demonstrate a significant change, however the results were 1.19. A t-value of 1.19 failed to

meet the criteria needed to show significant change at 0.5. The sum of the data was 135.00 and the mean increase of correct problems for students that participated in the study was 4.50. The sum of the D's squared was 13079.00.

The hypothesis, students who receive instruction using a computerized math-fact program, *Math Facts in a Flash,* in conjunction with regular math-fact instruction will correctly complete more problems on a 2 minute timed assessment than students who received regular instruction only was rejected by the researcher.

The null hypothesis, students who receive instruction using a computerized math-fact program, *Math Facts in a Flash,* in conjunction with regular math-fact instruction will show no difference in the number of correct problems on a 2 minute timed assessment than students who receive regular instruction only was accepted by the researcher.

Discussion

This study was delimitated to one fourth grade class over two semesters at Bridgeport Elementary School in the Bridgeport School District, located in Bridgeport, Washington. The project was conducted during the 2009-2010 school year with 30 students. BES had an enrollment for 398 for the May 2009 child count. The ethnicity of BES was: American Indian/Alaskan Native 1.3%, Black

0.3%, Hispanic 86.2%, and White 12.0%. The number of students that qualified for the Transitional Bilingual Program was 56.8%.

A two minute timed multiplication assessment, consisting of random multiplication problems, was the assessment instrument chosen to measure student success. Each student was assessed three times during the course of the study, once in the initial stages, again at end of the first semester and finally after the intervention period.

The study investigated to effects of using *Math Facts in a Flash* to increase computational fluency. The results showed support for the use of computerized instruction as a tool to increase students' ability to recall math-facts. Although the test for significance did not show a significant change at .5 students did demonstrate growth at .3. The data supported that approximately 70% of students would either increase or maintain their computational fluency skills. Prior to intervention the mean score for problems correct on a timed assessment was 44.23. After *Math Facts in a Flash* was implemented the mean scores for students who participated in the study was 63.73. Overall students increased their average scores by 19.5 problems.

This study had limitations including small sample size and limited duration of the treatment period. A larger sample size may have showen that the

effects of using *Math Facts in a Flash* and increased computational fluency were more generalizable across students with a higher degree of significance than expressed in this study.

Math Facts in a Flash was implemented for the second semester of the 2009-2010 academic year. The limited exposure to the program and the slow rate of gain for some students may have impacted the degree of significance. The data showed that 57% of participants either maintained or increased their current level of fluency. Given an extended period of time and more exposure to the program students' rate of gain may have increased. The results of this study suggest that *Math Facts in a Flash* helped to increase students' computational fluency for multiplication math-facts.

Summary

This chapter was designed to analyze the data and identify the findings. From the data, the hypothesis was not supported and the null hypothesis was accepted. 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, (d) Recommendations.

Summary

After the decline of WASL Math scores placed Bridgeport Elementary on Step 2 for failure to meet Adequate Yearly Progress, BES looked critically into what students needed to be successful in math. Math-facts was a skill educators felt was an area of weakness for the students at BES. The researcher sought to determine if using a computerized math-fact program, *Math Facts in a Flash*, would be effective at increasing students' computational fluency skills. If implementation of *Math Facts in a Flash* significantly increased the number of problems students correctly answered on a timed assessment then intervention was successful. However, if there was not a significant change then implementation of the program school wide would need to be reevaluated.

Numerous articles were reviewed by the researcher to gather needed information about student learning, computerized and math instruction, and background knowledge was obtained to assist the researcher in understanding the

importance of computational fluency for student success in mathematics. Upon visually inspecting the graphs and analyzing the t-test, it was determined there was not a significant change after implementation of *Math Facts in a Flash.*

Conclusions

Multiplication had been seen as a form of repeated addition, so in order for multiplication to be mastered, basic addition facts must be mastered first. According to Donald Crawford, Ph.D., difficult problems were less overwhelming for students when basic math skills themselves were not a trial (2003). *MFF* required students to develop automaticity with a set of basic fasts before they moved to the next level. Drill and practice was the repetition of specific skills and used to increase the acquisition of basic facts.

Computerized instruction provided an environment where students received immediate feedback, and refined understanding while building knowledge (National Research Council, 2000). Using a software program that featured drill and practice gave an arcade or game like experience that made them more exciting to students. Van De Walle stated that those programs added motivation to a boring drill. According to Ysseldyke, et al., (2005) *Math Facts in a Flas*h provided practice opportunities for students. Students received feedback immediately and saw improvement instantly, which increased motivation and

success. On the student survey, 80% of students felt that *Math Facts in a Flash* would help them be more successful on the Math portion of the WASL, which could be attributed to increased motivation and practice opportunities.

Not all children received and retained information in the same manner. There were numerous areas in which a child could have a high intelligence. According to Gardener there were seven different intelligences (Anonymous, 2005). Using *Math Facts in a Flash* students were receiving information in several manners; visually and kinesthetically. As stated by Anonymous, 'all intelligences are equally important and learning should be taught and assessed in a broader matter that insured students successfully participated in meaningful educational opportunities" (2005, pg 13).

Vygotsky believed that "learning takes place when children are working within their zone of proximal development" (Slavin, pg. 44). Ysseldyke, et al., believed that students received more benefit from using *Math Facts in a Flash* because the program provide teachers with less paperwork and those teachers had more time to work with students in need of additional and/or small group instruction based on the zone of proximal development (2005).

The researcher shared the results of this study with administration and staff. Although there was not a significant change in the mean scores of the students who participated in this study, most students did show growth. Eighty-seven percent of students surveyed strongly agreed or agreed that MFF was beneficial in the memorization of multiplication facts. The results of this study suggested that *Math Facts in a Flash* helped to increase students' computational fluency for multiplication math-facts.

In order for this study to be more meaningful at Bridgeport Elementary School the effectiveness of *Math Facts in a Flash* could have been evaluated for longer periods of time, both prior to and after implementation of the program; as well as, having a larger sample size.

Recommendations

The results of this study suggest that *Math Facts in a Flash* helped to increase students' computational fluency for multiplication math-facts. Based on that information the recommendation of the researcher was that *Math Facts in a Flash* was an effective tool to help students increase computational fluency skills. The researcher recommends that the use of *Math Facts in a Flash,* in conjunction with traditional math-fact instruction, be put into practice on a school-wide level for the following school year. The researcher also recommends that the

effectiveness of the program continue to be closely monitored and implementation and maintenance be reviewed as needed.

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