Growth of Students with Double Dosing Compared to those without Double Dosing

A Special Project

Presented to

Dr. Robert P. Kraig

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FACULTY APPROVAL

Growth of Students with Double Dosing Compared to

those without Double Dosing

A Master's Special Project

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ABSTRACT

Growth of Students with Double Dosing compared to
those without Double Dosing

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The researcher conducted a quantitative designed study. The purpose of the study was to determine if the direct instruction math program, Corrective Math, was effective in improving math computational fluency scores on the AIMSweb math assessment. Sixty students at Glacier Middle School participated in the study. The control classroom consisted of 30 sixth-grade students, and the experimental group consisted of 30 sixth-grade students. Data was collected two times during the 20 week experiment. The AIMSweb scores collected from the experimental group at the end of the study were not significant enough when compared to the controlled group to support the hypotheses. Therefore the hypothesis was not supported and the null hypothesis was accepted.

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Introduction

Background for the Project

Throughout the past several decades, the United States has observed the need of improved mathematical skills in graduated students if they were to be competitive in the changing global workforce. This importance was hi-lighted in President Reagan's "A Nation at Risk" report, then readdressed in President Bush's "No Child Left Behind" act (NCLB), which was undergoing changes under President Obama's administration.

With continued pressure felt at the state and local levels, school districts looked for effective practices to improve students' math and reading skills. The White River School District (WRSD) was not immune to the raised scrutiny and needed to take a critical look at the levels of success and failure their students had experienced within the institutional walls of academic learning.

As of the 2006-2007 academic school year, through the results of the Washington Assessment of Student Learning test (WASL), Glacier Middle School (GMS) discovered 45% of the 6th graders met or exceeded the 6th grade mathematics state requirements. (www.k12.wa.us WASL 6th Grade, Math Table) This left 55% of the student population in a position to experience future years of failure in the math curricular field. “We know it can be all over by the end of the sixth grade, if a child hasn't mastered the facts and skills of standard pencil-and-paper arithmetic. (http://www.wgquirk.com ¶ 2)   This conflicted with WRSD’s vision statement calling to “Prepare all students for success in high school and beyond.” (WRSD vision statement) Glacier Middle School (GMS) chose to proactively make second order changes to improve learning and seek to avoid any potential consequences from the state and national level since the school had not made Adequate Yearly Progress (AYP).

As noted by Quirk, standard arithmetic must be the foundation to higher level math. (http://www.wgquirk.com ¶ 2) However, through proctoring the AIMSweb assessment, GMS teachers identified multiple students with low standard arithmetic skills. Through Response to Intervention (RTI), GMS implemented Corrective Math as a means to bring direct instruction strategies to struggling learners. The curriculum was rigidly laid out to strategically empower students with math skills that have brought success for high achieving students.

Statement of the Problem

As of 2006-07, 56.2% of 6^{th} graders met or exceeded standard in number sense on the WASL, which coincides with computational fluency. Due to Special Education and Low Income students’ assessment results, GMS had not met AYP and was in improvement at level 2 as of 2009. To help move them out of needing improvement and back to meeting AYP, the WRSD chose to use the Corrective Math curriculum with students struggling in mathematical computational fluency.

Purpose of the Project

The purpose of this study was to determine if the participation in a corrective math course, focused on individual student's needs, improved computational fluency. The tool used to measure student skills was AIMSweb math assessment. The intervention used between the pre and post test was the Corrective Math curriculum published by McGraw-Hill. The curriculum was used to help GMS meet its Learning Improvement Plan (LIP) goal of 80% of the students meeting state standard requirements to pass the math portion of the state assessment.

Delimitations

This project was performed from September, 2010 to February 2011. Sixty students qualified for the study based on their AIMSweb scores. The thirty lowest scoring students determined to be delinquent in computational fluency were placed in two separate intervention classes, in addition to their general education math classes. The other thirty students did not receive additional intervention beyond what their general education teacher could offer. This was due to the limited number of certificated teachers available to teach the intervention classes.

Maturation of the students was a delimitation. The placement test occurred in the spring of 2010 and the post test occurred in February of 2011. Research shows students make cognitive gains over time regardless of instruction. For that reason, an experimental study was performed with a t-test to determine significant impact of the program.

Teacher experience was a delimitation. All the teachers involved in the study had a minimum of nine years of math experience. However, those years were not evenly distributed in grade levels. The intervention teacher was only experienced in 6^{th} grade curriculum, but had 6^{th} through 8^{th} grade students in her intervention class. The two educators teaching the control groups had a majority of their experience working with eighth grade students and working toward building student mastery in the corresponding curriculum.

During the 2010-2011 school year, all general education teachers were required to learn a new curriculum, as the district chose to move from Connected Math to Houghton-Mifflin. The program used for intervention was SRA-McGraw Hill's Corrective Math, which the intervention specialist has taught for one year prior to this study.

Assumptions

During the study, the educator created a safe environment where all students were invited to learn. The assumption was made that all students could and were willing to learn.

The Curriculum Based Measurement (CBM) was administered to every student in the school. The assumption was made that all students performed their best. Teachers' professional judgment was also trusted if they gave input concluding a student qualifying for intervention through the screener really didn't need it.

It was assumed that all students would be held accountable for their learning and attended class as consistently as possible. Students also made reasonable learning goals according to their current cognitive skills and their learning ability. They were expected to take advantage of their double dosing opportunity in a classroom with a maximum enrollment of sixteen students per class period.

Hypothesis

Students who participate in a corrective math course to improve computational fluency will show significant improvement in their corrective math placement test scores when compared to students who do not receive the corrective math course. Students will believe participation in Corrective Math interventions will have a positive impact on their computational fluency abilities and general education math success.

Null Hypothesis

Students who participate in a Corrective Math course will not show a significant improvement in their mathematical computational fluency scores when compared to those who do not receive the additional support. Significance was determined for P greater than or equal to .05, .01, and .001. Students will not believe participation in Corrective Math interventions will have a positive impact on their computational fluency abilities and general education math success.

Significance of the Project

The purpose of this project was to provide a factual base of information regarding the effectiveness of the Corrective Math program as a skills intervention for math computational fluency. The study examined evidence to determine if the use of Corrective Math provided significant gain for students who lack math skills needed in order meet standard on Glacier Middle School's CBM.

Glacier Middle School was placed in improvement from failing to meet AYP. Corrective Math had been used for one year, and they needed to assess if the program enhanced skills needed by students to make significant gains in math success when tested on the MSP.

Procedure

For the purpose of this study, the following procedures were implemented:

1. Permission to conduct research at Glacier Middle School was granted by Principal Andy McGrath (see Appendix A).
2. A review of selected literature was conducted at Heritage University, Glacier Middle School, and through internet search engines. A thorough report of information gathered was reported in Chapter 2 of this project.
3. All middle school students were administered a t-test, AIMSweb math assessment, to determine individual skills. The assessment was given in every math class where all teachers followed the same administering procedures. Students were tested in the library during their math class. Computers were used to administer and score the assessments. The AIMSweb scores were tabulated and students who scored low enough were pulled from elective classes and placed into a double dosing of math. Parents did have the ability to override the schools recommendations, and some pulled their children from the math intervention.

4. The pre-assessment AIMSweb scores were tabulated. (See appendices B and C)
5. A partnership was established between the researcher and math teachers of the randomly selected control group
6. A survey of students' personal perceptions toward math was given to the experimental group. (See appendix D)
7. The results from the perceptions survey were tabulated and graphed. (See appendix E)
8. Students in the experimental group were double dosed in a second math period every day. They received Corrective Math Intervention taught through Direct Instruction.
9. A final t-test, the same AIMSweb assessment given in the fall, was administered to every student in the experimental and control groups. The same assessment procedures were followed in the spring as in the previous fall.
10. The Spring AIMSweb assessment scores were tabulated. (See appendices B and C)
11. Results from the study were examined, evaluated, and conclusions were drawn.

12. A meeting was scheduled and conducted with the principal to discuss the survey results and determine the next steps in Tier 2 and Tier 3 math 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).

Improvement

Schools that miss making Adequate Yearly Progress (AYP) for two years in the same subject area are said to be in Improvement. Schools continue being identified as needing to improve until they make AYP in every category, up to 37, for two consecutive years.

Curriculum Based Measurement

The Curriculum Based Measurement is an assessment used to determine individual student's math fluency.

Adequate Yearly Progress.

Reading and math scores are used to determine Adequate Yearly Progress. It "is the calculation required by the US Department of Education that determines if a school is meeting standard in reading and mathematics. Annual benchmarks are set according to federal rules and are based primarily on expected student performance on statewide assessments." (OSPI)

Computational Fluency.

"Having efficient, flexible and accurate methods for computing" addition, subtraction, multiplication and division equations. (http://www.region10ct.org/regiontenmathpages/region10mathsitefaq/whatiscomputatinalfluency.html ¶1)

Acronyms

AYP. Average Yearly Progress

CMS. Corrective Math Screener

GMS. Glacier Middle School

NCLB. No Child Left Behind

WASL. Washington Assessment of Student Learning

WRSD. White River School District

CHAPTER 2

Review of Selected Literature

Introduction

The researcher studied several topics which have impacted student success in mathematics. Some of the areas researched that directed student achievement were: (a) State and National Standards, (b) Response to Intervention, (c) Curriculum, (d) Direct Instruction, (e) double dosing., and (f) summary.

State and National Standards

In 1983, President Ronald Reagan released “A Nation at Risk”, which exposed shortfalls in the United States educational system, and initiated many changes to Education in the coming years. The report called for the development of what would be referred to in the future as national standards and the pushing of students toward academic excellence.

> We define "excellence" to mean several related things. At the level of the individual learner, it means performing on the boundary of individual ability in ways that test and push back personal limits, in school and in the workplace. Excellence characterizes a school or college that sets high expectations and goals for all learners, and then tries in every way possible to help students reach them. Excellence characterizes a society that has

> adopted these policies, for it will then be prepared through the education and skill of its people to respond to the challenges of a rapidly changing world. (Nation at Risk, 1983)

The report put a lot of responsibility on the states, and several southern progressive governors were the first to see an opportunity to catch the momentum and improve education at a local level.

In 1989, the National Council of Teachers of Mathematics put out the first set of National Standards. This document, "Curriculum and Evaluation Standards for School Mathematics," contained a set of standards to judge the validity of curricula and focus the objectives in mathematical teaching. Having a set of standards has been proven to assist educators in their intentionality of subjects. In fact, former Secretary of Education Diane Ravitch asserts that,

> "just as standards improve the daily lives of Americans, so, too, will they improve the effectiveness of American education: 'Standards can improve achievement by clearly defining what is to be taught and what kind of performance is expected'" (Ravitch, 1995 p. 25)" (McRel, 2010 ¶10)

In 1993, Washington state passed the Basic Education Act which stated students must "Know and apply the core concepts and principles of mathematics…" (OSPI, 2010). This led to the creation of Essential Academic

Learning Requirements (EALR's) from 1995-2004. Students' understanding of these EALR's was assessed through an exam known as the Washington Assessment of Student Learning (WASL), from 1996 to 2009, and was restructured into the Measurement of Student Progress (MSP) in 2010.

In 2002, President George H. W. Bush passed the No Child Left Behind Act to ensure all students gained the essential skills needed to be successful in our changing global economy. States were called to accountability in ensuring students mastered these required skills by high school graduation. Students' levels of understanding were measured by the MSP, and these scores were also used as a measurement of a school's Adequate Yearly Progress (AYP.) If MSP data showed schools failure to make AYP, certain mandates were set in place to guide the school through a restructuring process. The restructuring was put in place to assist schools as they worked to improve student learning.

It has been argued, that in math these essential skills include a solid understanding of addition, subtraction, multiplication, and division. Without mastering those skills, multistep equations take too long and students become bogged down in simplifying process. (Quirk, 2006)

Response to Intervention

Response to Intervention (RTI) was designed to support students who had not made adequate progress through participating in a schools general core curriculum. RTI has contributed to more focused identifications of behavior and learning problems that interfere with cognitive developments. From there, it was intended to provide all students with strategic plans that have promoted success in school. (National Center on Response to Intervention, 2007)
Through periodic screening, students have been identified to be academically below their peers in core areas. The data from the screening was used by multiple educators to determine the level of intervention required, Tier 1, Tier 2, or Tier 3. Tier 1 took place in the general education classroom while Tiers 2 and 3 were implemented in pullout groups to better enable a small group learning environment.

Evidence has shown Tier 2 and 3 students benefit from models and demonstrations, thinkalouds, guided practice, corrective feedback and cumulative review of new learning. (Doing What Works, 2010) Due to various issues in larger classrooms, the application of these strategies has not been effectively implemented with students struggling in computational fluency. Throughout the use of the RTI model, students should have been able to move from the use of concrete manipulatives to a solid understanding of abstract numbers and mathematical processes.

Students in Tiers 2 and 3 received monthly progress monitoring to determine their rate of improvement in computational fluency skills. If current teaching strategies were not appearing to be affective, the teacher modified components of the intervention program while continuing the progress monitoring to determine which strategies are affective.

Students receiving intervention also received individual annual goals and tracked performance toward meeting them.

> “Goal-setting research in school settings shows that students' learning, motivation, and self-regulation can be improved when students pursue goals that are specific, proximal, and moderately difficult, receive feedback on their goal progress, focus their attention on learning processes, and shift their focus to outcome goals as their skills develop.” (Schunk, 2009 ¶23)

<u>Curriculum</u>

Educators and researchers have debated for years over which curricula and teaching strategies have been most effective in the educating students. While some researchers have touted phonics, others claim whole language has been the most effective. Concerning mathematics, the discussions have mostly centered on traditional math concepts versus “Modern,” or new mathematics.

New math was designed to take the place of old (traditional) math which relied on memorization and algorithms. The modern math was celebrated as a major breakthrough. Educators were able to teach math through real world problems with the use of manipulative materials. Throughout the years of its implementation, the expected results have not been seen across the country. This has left some to question its validity leading to Mitchell’s belief that while the use manipulatives didn’t detract from learning, there was little to show it supported the learning of mathematics. (Hattie, 2009)

Conversely, in a study of high school algebra classes, Haas found the greatest effects came when curriculum was used that employed Direct Instruction practices. He found this curriculum, which also used problem solving strategies had an effect size of d=55 and d=52, respectively. (Haas, 2005)

Marzano has claimed, for a school to be highly effective, classroom teachers must have structured their teaching around a guaranteed and viable curriculum. (Marzano, 2001) That means the “curriculum must consist of Power Standards and Power Indicators that fully outline the content, concepts, and skills that are essential within an academic discipline and at each grade level to ensure all students have the opportunity to achieve proficiency." (Keating, 2008 ¶ 1)

The WRSD chose Corrective Math as one curricular tool to meet the needs of students in Tiers 2 and 3. Those are the children who had not gained the skills to achieve proficiency in math. Corrective Math was designed to teach strategies and skills for fact retention, solving column math equations and structuring numerical statements from story problems. (Engelmann & Carnine, 2005)

Direct Instruction

> "You have to have a carefully graduated program or you're just going to overwhelm (the students). We figure that they're all capable of learning if we identify what they don't know and place them appropriately. And then take them a step at a time so they're able to achieve mastery and help them realize their potential." (Engelmann, 2006, video interview)

Direct Instruction (DI) was founded on the premise all students are capable of learning. WRSD has proudly stated that belief, and it was evident in the instructional observations as the teacher interacted with the students. The second core value DI has been built upon, was all teachers have the ability to be successful as longs as they were provided with effective teaching materials and trained in proven presentation techniques. (SRA McGRAW Hill, 2009)

The WRSD researched and assessed various curricula to select one which was laid out in the most strategic manner according to their focus. The Curriculum had to be delineated around the structure of DI. Therefore it needed to promote targeted skill instruction, perform frequent assessment, build classroom routines, and incorporate design, delivery and documentation in order to make it effective for all students.

Students have sometimes performed poorly in general education classes due to the ambiguity of unfocused learning targets. DI required teachers to promote targeted skill instruction as a means to focus student learning. This can be executed with specific learning targets, and as Engelmann stated, no more than ten percent of the content in a lesson can be new information. Otherwise children have been more prone to swim in a sea of to much information without the ability to scaffold new learning with it.

Frequent monitoring was an important component incorporated in the DI model. It has been used to determine if students have made sufficient gains in their cognitive understanding and to determine the rate at which they were on track to meet their goals. From the point an assessment has been taken, teachers and students are able to work together to determine what has benefited or hindered new learning.

Three instructional components: design, delivery and documentation have been proven to make direct instruction effective for all students. They must be woven together with timely feedback that ensures errors have been corrected as soon as they occur. The task should be modeled correctly and all students should be led in toward the correct response with the designated vocabulary. Finally, if the class returned to the beginning of the task together, it puts the feedback into context of the problem. With full class participation in the feedback, it minimizes disruption and promotes student learning.

Double Dosing

As schools have tracked a number of students who failed to meet standards, school districts tried various approaches of intervention that supported students' math skills. One approach increased the amount of instruction and practice time students received each day in their core subjects. Some schools have added the time by exchanging an elective class for another core curricular class. This has become known as double dosing.

The phenomenon of double dosing and adding has gained in popularity as schools began feeling the pressures to meet mandated Adequate Yearly Progress (AYP). A lot of researchers have debated the effects, but several schools have gone ahead with some variation of increased math instruction to student schedules. Sims has supported the approach through research and concluded "extra classroom days are associated with small increases in Math scores." (Sims, 2008, abstract)

Added time to a school day has been an easy consensus for school boards to agree to. A study put out by the Center for American Progress determined that by "adding 30% more time to a school schedule ranged from $287 to $720 per pupil, depending on whether the extra time was staffed with paraprofessionals or with certified employees on a salaried basis." (Gewertz, 2009, p.5).

An alternative to the lengthened school day, which Glacier Middle School (GMS) chose to implement, was replacing elective classes with a remedial math class for students who failed to pass a Classroom Based Measurement (CBM). The class took place during the traditional class day, not costing the school district any additional money than the curriculum needed for the students.

The class period doubled students' daily math instruction from fifty minutes to 100 minutes each day. The structure intentionally kept students in their General or Special Education classes, as much research has gone into doubling regarded to reading. The method of supplementing with additional time focused on reading found "large effect sizes …for Reading Recovery (d=0.96), and it was highest when Reading Recovery was a supplement to, not a substitute for, classroom teaching.” (Hattie, 2009, p. 140)

Summary

The focus of this chapter was to address the available evidence to the topics of (a) State and National Standards, (b) Response to Intervention, (c) Curriculum, (d) Direct Instruction, and (e) Double Dosing. The researcher reviewed numerous pieces of literature related to these topics.

One piece of literature expressed a concern our students had fallen behind the level of mathematical understanding other nations had reached. Plans were made to help teachers focus their teaching in their classrooms. Teachers needed to help students find their limits in learning and push back against them to reach a level of understanding that made students competitive in the future global economy. One strategy developed to help students achieve that goal, was the written State and National Standards, which made teaching more focused in classrooms.

Another piece of literature expressed the effects Response to Intervention has had in classrooms. When implemented effectively, teachers have been able to pinpoint cognitive gaps in student understanding, and placed these students in an appropriate level of intervention. Researched showed after students exited an intervention course, they were more able to compete with their peers within general education classes.

An additional piece of literature reviewed the affects of curriculum on student learning. A concluding point expressed it didn't matter so much which curriculum was taught, rather the strategies teachers used to implement it.

Another piece of literature reviewed the impact of Direct Instruction. The author found evidence showing students made greater progress when Direct Instruction was implemented correctly in the classroom than when Problem Based Learning was used for teaching new concepts.

When reviewing literature about Double Dosing, the author identified some of the benefits and problems with added instructional time to a student's class schedule. While some schools have paid the monetary price, and lengthened the school day, other schools found it effective to replace elective classes with remedial classes. The remedial class needed to be a supplement instead of a replacement to a general education class, which made the intervention most effective.

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.

Beginning in the first quarter of the 2010-2011 school year, the researcher began testing two groups of students to determine if there was a difference in gain between students' rate of progress in computational fluency and their participation in Corrective Math. Students were determined to have low computational fluency skills through the administration of a Corrective Math Screener, a Curriculum Based Measurement (CBM), in the spring of 2010. Two experimental studies were conducted to determine if students who received additional support made greater gains than students not receiving additional support.

Methodology

The researcher performed a quantitative experimental research project on two groups of students. The focus determined if an additional math period of Corrective Math dramatically closed the achievement gap in computational fluency. Students' computational skills were assessed in the spring of 2010. In the spring of 2011, an additional post-test was administered to all students.

Participants

Thirty students were evaluated in this experiment. These students' math levels were determined through the administration of an assessment put out by Corrective Math. Fifteen of the students with low math computational skills were selected to be the control group by using random number selection. They received the general education math curriculum published by Mcgraw Hill, and any standard intervention determined to be necessary by the general education teacher. The fifteen students who scored the lowest in mathematical computational fluency received the same treatment as the control group, plus an additional math class period where they participated in Corrective Math.

The demographics of the participants in the sample groups were reflective of the demographics recorded at OSPI. The exception was the male to female ratio as the majority of students tested were males.

Instruments

A t-test was used to determine the change of t value throughout the academic school year. The test was a CBM given as a pre and post-test. Students were required to answer the questions in sequential order without skipping any problems. These tests were designed to increase in difficulty as students progressed throughout the equations. The students placed in an intensive intervention class received Corrective Math scripted lessons designed to improve computational fluency. The students not placed in the intervention class received research based teaching strategies during the 6th grade general education math period.

Design

The researcher used a pre and post test to determine the mathematical computational growth made between two different groups of students. Corrective Math curriculum was used as a manipulated variable and given to the experimental group between the two tests. Intervention was not given to the control group. Finally, the growth was measured in the 2010-2011 academic school year.

Procedure

For the purpose of this study, the following procedures were implemented:

1. Permission to conduct research at Glacier Middle School was granted by Principal Andy McGrath (see Appendix A).

2. A review of selected literature was conducted at Heritage University, Glacier Middle School, and through internet search engines. A thorough report of information gathered was reported in Chapter 2 of this project.
3. All middle school students were administered a t-test, AIMSweb math assessment, to determine individual skills. The assessment was given in every math class where all teachers followed the same administering procedures. Students were tested in the library during their math class. Computers were used to administer and score the assessments. The AIMSweb scores were tabulated and students who scored low enough were pulled from elective classes and placed into a double dosing of math. Parents did have the ability to override the schools recommendations, and some pulled their children from the math intervention.
4. The Pre assessment AIMSweb scores were tabulated. (See appendices B and C)
5. A partnership was established between the researcher and math teachers of the randomly selected control group
6. A survey of students' personal perceptions toward math was given to the experimental group. (See appendix D)

7. The results from the perceptions survey were tabulated and graphed. (See appendix E)
8. Students in the experimental group were double dosed in a second math period every day. They received Corrective Math Intervention taught through Direct Instruction.
9. A final t-test, the same AIMSweb assessment given in the fall, was administered to every student in the experimental and control groups. The same assessment procedures were followed in the spring as in the previous fall.
10. The spring assessment AIMSweb scores were tabulated. (See appendices B and C)
11. Results from the study were examined, evaluated, and conclusions were drawn.
12. A meeting was scheduled and conducted with the principal to discuss the survey results and determine the next steps in Tier 2 and Tier 3 math intervention.

Treatment of Data

The responses collected from the personal math perceptions were assigned numerical scores of 1 through 4. Students were delineated between male and female which was represented in an excel spreadsheet. Each student's corresponding data was also tabulated and displayed in the same spreadsheet along with some graphs.

The researcher compiled the data from the pre-test and the post test from the treatment group into an excel spreadsheet and graphed it to examine the students' growth. He did the same with the data from the control group and then found the t-scores to determine the direct correlation between students rates of growth correlated to the type of intervention received. The researcher expected to discover a significant difference in the t-score between each group in the fall. In the spring, he still expected there to be a difference, however, the scores should be closer to 0.

Summary

The researcher conducted an experimental research study to track the rate of progress between two groups of students. The experimental group received intensive intervention through an additional math period. They also received best practice instruction combined with weekly opportunities to practice computational fluency. The controlled group received a general math curriculum delivered through best practice instruction. They did not receive the intervention through an additional math period.

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.

Description of the Environment

This project was performed from September, 2010 to February 2011. Sixty students qualified for the study based on their AIMSweb assessment. Thirty of the students determined to be delinquent in computational fluency were split into separate intervention classes in addition to their general education math classes. The other thirty students did not receive additional intervention beyond what their general education teacher could offer.

Maturation of the students was a delimitation. The placement test occurred in the spring of 2010 and the post test occurred in February of 2011. Research shows students make cognitive gains over time regardless of instruction. For that reason, an experimental study was performed with a t-test to determine significant impact of the program.

Teacher experience was a delimitation. All the teachers involved in the study had a minimum of nine years of math experience. However, those years were not evenly distributed in grade levels. The intervention teacher was only experienced in 6^{th} grade curriculum, but had 6^{th} through 8^{th} grade students in her intervention class. The other two teachers with the control groups had a majority of their teaching experience working with eight grade students and building mastery in the corresponding curriculum.

During the 2010-2011 school year all general education teachers were required to learn a new curriculum, as the district chose to move from Connected Math to Houghton-Mifflin. The program used for intervention was SRA-McGraw Hill's Corrective Math, which the intervention specialist has taught for one year prior to this study.

<u>Hypothesis/Research Question</u>

Students who participate in a corrective math course to improve computational fluency will show significant improvement in their corrective math placement test scores when compared to students who do not receive the corrective math course. Students will believe participation in Corrective Math interventions will have a positive impact on their computational fluency abilities and general education math success.

Null Hypothesis

Students who participate in a Corrective Math course will not show a significant improvement in their mathematical computational fluency scores when compared to those who do not receive the additional support. Significance was determined for P greater than or equal to .05, .01, and .001. Students will not believe participation in Corrective Math interventions will have a positive impact on their computational fluency abilities and general education math success.

Results of the Study

The researcher gathered the data from the below benchmark group and compared it to the data collected from the benchmark students during the study. The data was collected and analyzed through Microsoft Excel and the STATPACK programs to identify the sum, mean, mode and t-scores.

Table 1 displays the scores earned by the control group on the AIMSweb math assessments for both September, 2010 and February 2011. Table 1 displayed pre-intervention assessment as well as post-intervention assessment scores for all students who were in the control group. The scores were tabulated to show individual student growth which represented the amount of change in AIMSweb scores from September, 2010 to February, 2011. The growth scores of each student were finally tabulated and a mean of 2.93 was calculated for the control group. That meant, on average, each student who received the basic math instruction through the district mandated curriculum increased their AIMSweb assessment scores by 2.93 points.

Table 1

AIMSweb scores of pre and post tests for Control Group

Student	Gender	Pre	Post	Growth
A	M	5	10	5
B	M	10	11	1
C	M	12	9	-3
D	M	23	25	2
E	M	3	5	2
F	M	4	11	7
G	M	8	20	12
H	M	7	10	3
I	M	10	19	9
J	M	7	7	0
K	M	5	3	-2
L	M	10	16	6
M	M	3	14	11
N	M	10	10	0
O	M	6	13	7
P	F	1	7	6
Q	F	14	11	-3
R	F	5	8	3
S	F	14	25	11
T	F	8	9	1
U	F	10	11	1
V	F	10	10	0
W	F	13	11	-2
X	F	5	9	4
Y	F	8	16	8
Z	F	12	9	-3
AA	F	11	10	-1
BB	F	2	7	5
CC	F	5	6	1
DD	F	12	9	-3
SUM		253	341	88
Mean		8.43	11.37	2.93

Table 2 displayed the scores earned by the experimental group on the AIMSweb math assessments for both September, 2010 and February 2011. Table 2 displayed pre-intervention assessment as well as post-intervention assessment scores for all students who were in the control group. The scores were tabulated to show individual student growth which represented the amount of change in AIMSweb scores from September, 2010 to February, 2011. The growth scores of each student were finally tabulated and a mean of 2.93 was calculated for the control group. That meant, on average, each student who received the basic math instruction through the district mandated curriculum, as well as the intervention through Corrective Math, increased their AIMSweb assessment scores by 3.00 points.

Table 2

AIMSweb scores of pre and post tests for Experimental group

Student	Gender	Pre	Post	Growth
A	M	4	8	4
B	M	8	11	3
C	M	6	12	6
D	M	5	6	1
E	M	7	11	4
F	M	8	12	4
G	M	5	18	13
H	M	7	7	0
I	M	3	4	1
J	M	4	5	1
K	M	3	8	5
L	M	8	11	3
M	M	5	6	1
N	M	8	9	1
O	M	9	9	0
P	F	7	9	2
Q	F	13	15	2
R	F	9	15	6
S	F	10	10	0
T	F	9	9	0
U	F	6	16	10
V	F	12	13	1
W	F	8	12	4
X	F	2	9	7
Y	F	19	13	-3
Z	F	4	12	8
AA	F	7	7	0
BB	F	10	5	-5
CC	F	1	9	8
DD	F	3	6	3
Sum		210	297	90
Mean		7.00	9.90	3.00

Figure 1 represented the difference in mean scores earned by the control and experimental groups on the AIMSweb assessments. The graph showed the mean scores earned in on the pre assessment in September, 2010, and the post assessment in February, 2011.

Figure 1

<u>Mean Scores on AIMSweb Pre and Post Assessments</u>

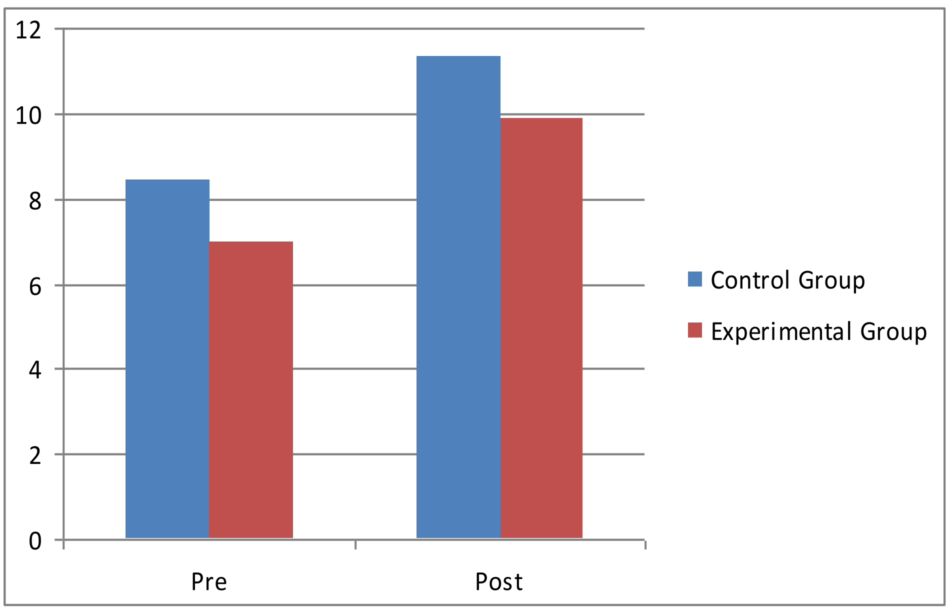
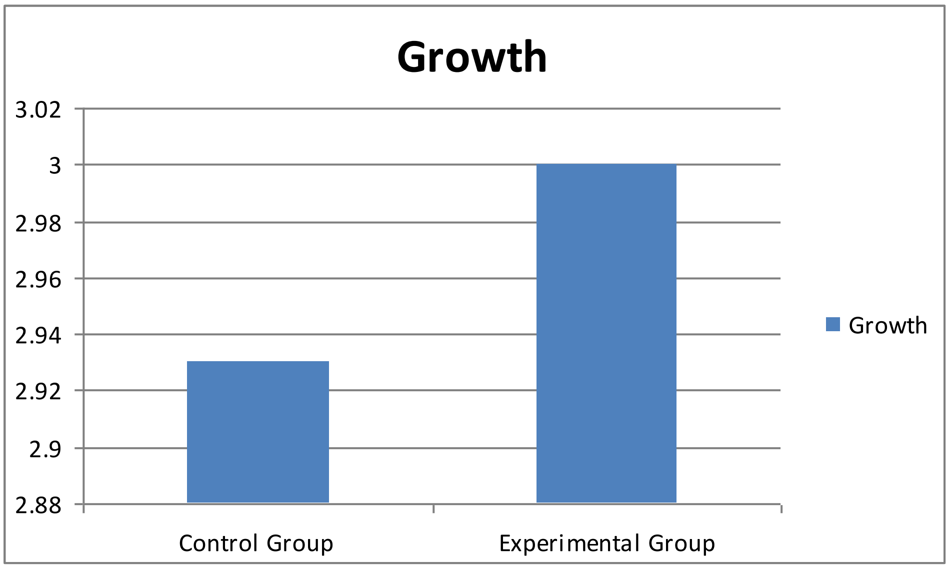


Figure 2 showed the average growth per student in both the experimental and controlled group. The growth was calculated by comparing the pre assessment AIMSweb data from September, 2010 to the post assessment AIMSweb data collected in February, 2011.

Figure 2

Average Growth per Student on AIMSweb Assessment



The author conducted a t-test for the below benchmark scores compared to the scores from the benchmark students. The author subtracted the pretest scores from the posttest scores to calculate the amount of growth made by each student. The results were run through the STATPAK and a t-test was conducted.

From the t-test the author discovered a t-value of -0.29 with 50 degrees of freedom. A t-value of -0.29 was not significant at the .05 level. The growth made compared to the benchmark students was not significant.

Table 3

t-test of Amount of Growth of Below Benchmark and Benchmark Students

Test	N	Mean	Standard Deviation
Below Benchmark	30	3.00	4.48702
Benchmark	30	2.93	3.7692
df=50		t=-0.29	p > .05

A survey was given to students in the controlled group, and the results have been displayed in figure 3. Students responded to each question by circling one of four responses: strongly disagree, disagree, agree, or strongly agree. Numerical values were assigned to each response and the results of the survey were tabulated with a scoring system of 1-4. A score of one represented a survey response of "Strongly Disagree." A score of two represented "Disagree." A score of three represented "Agree." A score of four represented a response of "Strongly Agree."

Figure 3 represented the mean of the responses to all nine questions on the survey given to the controlled group of students.

Figure 3

Student Responses to Survey

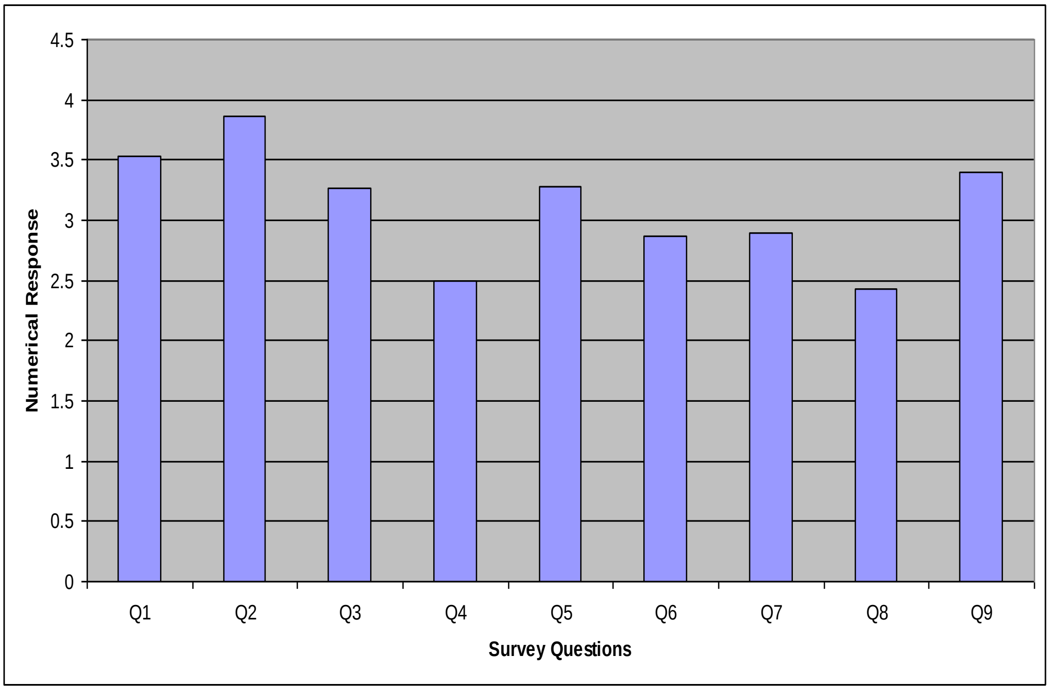
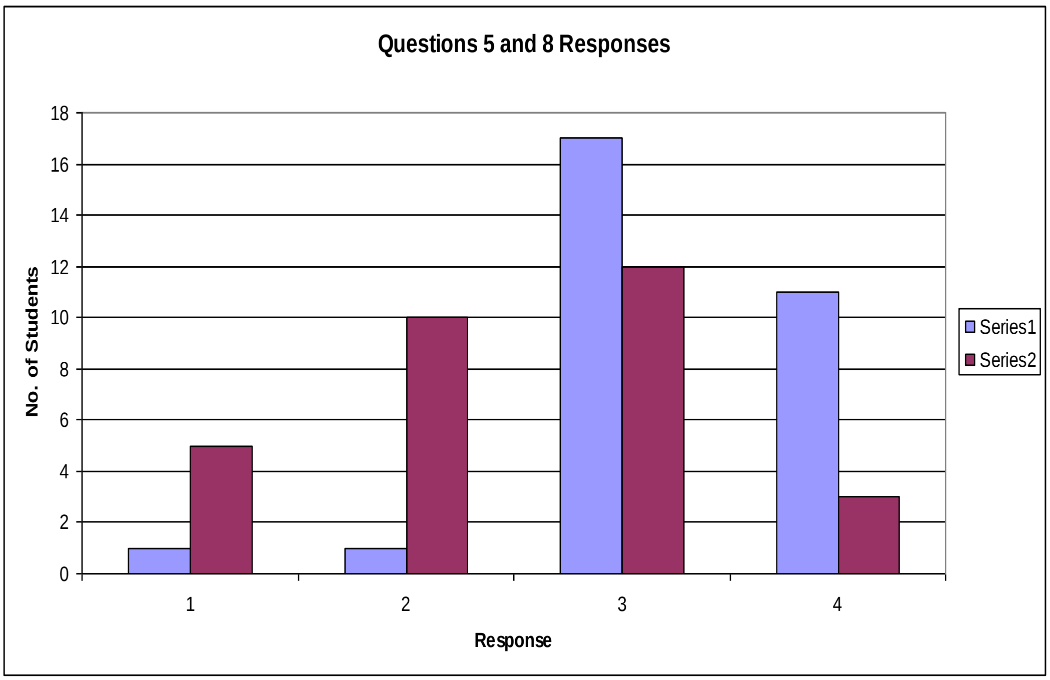


Figure 4 represents student responses to questions 5 and 8. Question 5 asked students to rate their beliefs about the following statement: “Mastering the above skills (addition, subtraction, multiplication and division) will help me be successful in my general education math class.” Question 8 asked students to rate their beliefs about the following statement: “Participating in the Corrective Math Intervention course will help me be more successful in my general education math class.” These two questions gave a significant understanding to two factors: how important do students feel the skills learned in Corrective Math are to their general education classes, compared to whether or not students perceived Corrective Math interventions as a means to improve fluency in these skills. Figure 4 shows the number of students from the controlled group that selected each response to question 5 and 8. Series 1 represented question 5, and series 2 represented question 8.

Figure 4

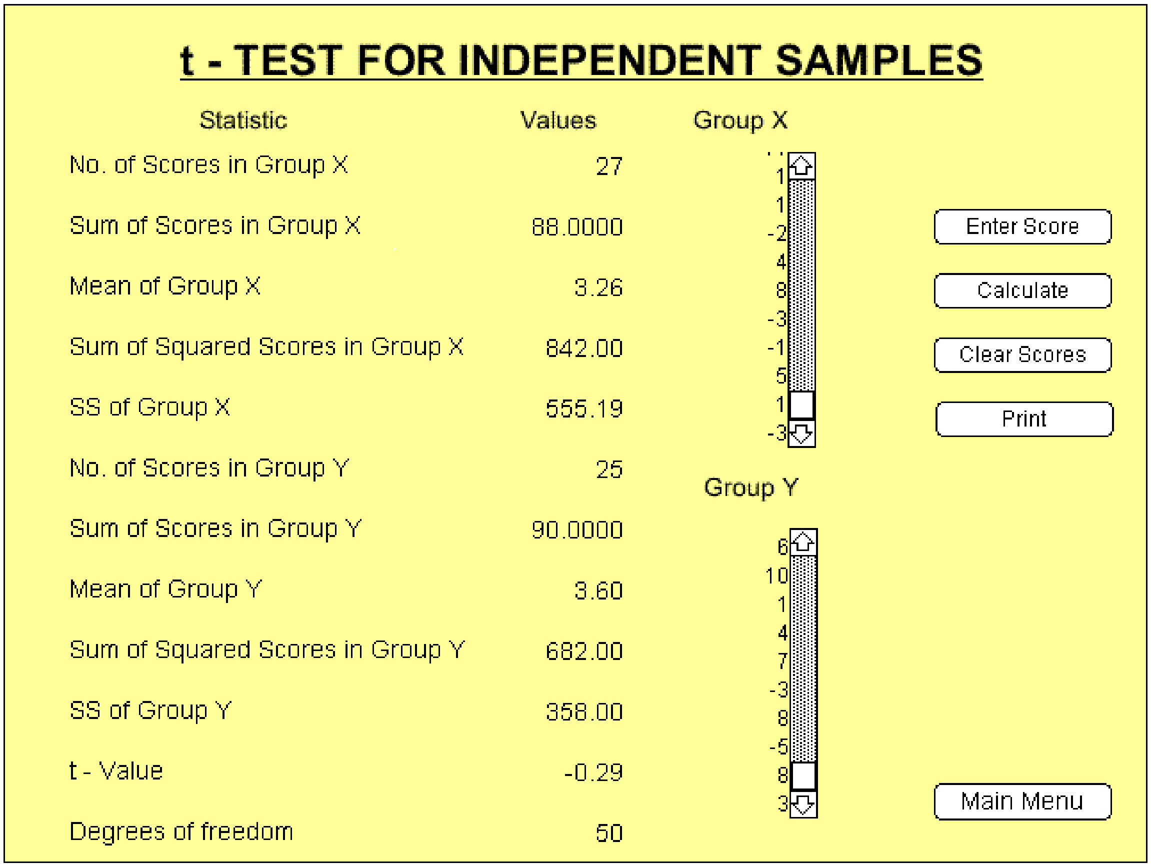


The hypothesis was not supported and the null hypothesis was accepted. When the author compared the data from the below bench mark students to the bench mark students, the hypothesis was not supported. The below benchmark students did not make greater than expected when compared to the bench mark students who did not receive additional support through Corrective Math.

Findings

Table 1 showed the pre and post AIMSweb assessment data for the controlled group. The table displays the fall scores, the spring scores, and the growth made by each student. Table 1 also displayed the average computational fluency growth each student made during the experimental period. Table 2 showed the pre and post AIMSweb assessment data for the experimental group. The table displays the fall scores, the spring scores, and the growth made by each student. Table 2 also displayed the average computational fluency growth each student made during the experimental period. The average growth for the controlled group was 2.93 while the experimental group had a score increase of 3.00. This equated into an increase for the experimental group of 0.07 more than the controlled group. The growth resulted in a t-value of -0.29. The t-value of -0.29 was did not meet the required t-value of -2.01 need to support the hypothesis. The hypothesis, students who participate in a corrective math course to improve computational fluency will show significant improvement in their corrective math placement test scores when compared to students who do not receive the corrective math course, was not supported. The null hypothesis, students who participate in a Corrective Math course will not show a significant improvement in their mathematical computational fluency scores when compared to those who do not receive the additional support, was accepted.

Table 4



t - TEST FOR INDEPENDENT SAMPLES

Statistic	Values
No. of Scores in Group X	27
Sum of Scores in Group X	88.0000
Mean of Group X	3.26
Sum of Squared Scores in Group X	842.00
SS of Group X	555.19
No. of Scores in Group Y	25
Sum of Scores in Group Y	90.0000
Mean of Group Y	3.60
Sum of Squared Scores in Group Y	682.00
SS of Group Y	358.00
t - Value	-0.29
Degrees of freedom	50

The author analyzed the findings from the post intervention surveys and identified certain findings. The findings were:

1. Students feel they have mastered their addition and subtraction facts.

2. Students feel they have room to improve regarding their multiplication and division facts.
3. Students believe mastering addition, subtraction, multiplication and division skills will improve their success in general education math classes.
4. Students do not believe participation in Corrective Math intervention, the course in which addition, subtraction, multiplication and division skills are taught through direct instruction, will have an impact on students' ability in a general education math class.

The findings from the survey results did not prove the hypothesis that students will believe participation in Corrective Math interventions will have a positive impact on their computational fluency abilities and general education math success. The results from the survey were inconclusive.

Discussion

The results of the study were in line with what the author had expected to find. The hypothesis predicted the group receiving Corrective Math intervention would make greater than expected growth when compared to students not receiving the intervention. While the controlled and experimental group both showed progress in their computational skills, the experimental group showed the most improvement. However, the difference between the sets of scores was not significant enough to draw any statistical conclusions.

While the experiment that was conducted did not support the hypothesis, it is possible that if the study were conducted over a longer period of time, the students receiving a double dosing of math may increase their rate of improvement on computational fluency skills. Had the experiment been drawn out over the period of an academic year rather than five months, the experimental group may have improved their skills to a level where they could show greater growth on the AIMSweb assessment then the controlled group. If this had occurred, there may have been data to support the hypothesis.

Summary

This chapter was designed to analyze the data and identify the findings. In the beginning, the author discussed the parameters of the experiment and the delimitations. The author restated the hypothesis and the null hypothesis. The author analyzed the results from the t-test. The author found the most growth per student in the experimental group. However, the author did not find significant growth from the experimental group when they were compared to the controlled group. From the data, the hypothesis was not supported and the Null Hypothesis was accepted. Chapter 5 will contain a summarization of the study, drawn conclusions, and any 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

The author wanted to discover if Glacier Middle School's practice of double dosing students in math was a successful strategy for assisting students as they meet AYP. The author researched literature on the effects of double dosing before selecting two groups of students to study.

The experimental group received the general education curriculum plus another class period of Corrective Math, while the controlled group only received the general education curriculum. The growth of the experimental group was compared to the growth of the controlled group.

The author included a total of sixty students in the experimental study. Each student was assessed in September, 2010. The experimental group received double dosing in math from September to February, 2011. Both the experimental and controlled groups were assessed again in February 2011.

The data from the experiment was treated statistically by processing it through a t-test in the STATPAK. The growth of the fall and winter AIMSweb scores from the experimental and controlled groups was compared. Through the analysis, the other could not find significant difference when the growth of the experimental group was compared to the growth of the controlled group.

Conclusions

The author gathered research, conducted an experiment, collected data, and drew conclusions based on a review of the analyzed results of the experiment. The application of double dosing through Corrective Math did not result in significant gains in students AIMSweb assessment scores.

Table 1 displayed the AIMSweb assessment data for the controlled group. Table 2 displayed the AIMSweb assessment data for the experimental group. Figure 2 showed the average growth per student on the AIMSweb assessment for both the controlled group and the experimental group. The average growth for the experimental group was 3 and the average group for the controlled group was 2.93. The experimental group showed growth 0.07 higher than the controlled group, scoring a t-value of -0.29. This did not reach the t-value of -2.01 needed to support the hypothesis.

Recommendations

Based on the conclusions, the author will give a limited set of recommendations regarding the study. The author suggests the use of double dosing to be an effective strategy to increase the rate at which students improve math skills.

The literature reviewed in the study supported double dosing as an effective means to improved student academic skills. Although the data collected from the author's research did not support the hypothesis, it is recommended that the study be extended to more than a three month time length. Perhaps with the extension to one full academic year, data will support greater than expected growth for students who received double dosing when compared to a controlled group who had not received additional math supports.

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Appendix A

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Letter of Permission to Conduct Research

I, Andy McGrath, give Nathan Oliver, permission to conduct research for his Masters Degree at Heritage University. The research will occur during the 2010-2011 academic school year at Glacier Middle School. Nathan will study the effects of Corrective Math curriculum as an intervention for students who perform below benchmark on the AIMSweb math assessment.

_______________________________   _____________________

Andy McGrath, Glacier Middle School   Date

Appendix B

AIMSweb scores for pre and post tests for Control Group

Student	Gender	Pre	Post	Growth
A	M	5	10	5
B	M	10	11	1
C	M	12	9	-3
D	M	23	25	2
E	M	3	5	2
F	M	4	11	7
G	M	8	20	12
H	M	7	10	3
I	M	10	19	9
J	M	7	7	0
K	M	5	3	-2
L	M	10	16	6
M	M	3	14	11
N	M	10	10	0
O	M	6	13	7
P	F	1	7	6
Q	F	14	11	-3
R	F	5	8	3
S	F	14	25	11
T	F	8	9	1
U	F	10	11	1
V	F	10	10	0
W	F	13	11	-2
X	F	5	9	4
Y	F	8	16	8
Z	F	12	9	-3
AA	F	11	10	-1
BB	F	2	7	5
CC	F	5	6	1
DD	F	12	9	-3
SUM		253	341	88
Mean		8.43	11.37	2.93

Appendix C

AIMSweb scores for pre and post test of Experimental group

Student	Gender	Pre	Post	Growth
A	M	4	8	4
B	M	8	11	3
C	M	6	12	6
D	M	5	6	1
E	M	7	11	4
F	M	8	12	4
G	M	5	18	13
H	M	7	7	0
I	M	3	4	1
J	M	4	5	1
K	M	3	8	5
L	M	8	11	3
M	M	5	6	1
N	M	8	9	1
O	M	9	9	0
P	F	7	9	2
Q	F	13	15	2
R	F	9	15	6
S	F	10	10	0
T	F	9	9	0
U	F	6	16	10
V	F	12	13	1
W	F	8	12	4
X	F	2	9	7
Y	F	19	13	-3
Z	F	4	12	8
AA	F	7	7	0
BB	F	10	5	-5
CC	F	1	9	8
DD	F	3	6	3
Sum		210	297	90
Mean		7.00	9.90	3.00

Appendix D

Math Survey

Circle your gender

male female

Circle your grade level

6 7 8

The purpose of this survey is to find out how you feel about your math skills right now. Read each question carefully and then circle the answer below the question that best shows the way you feel about that question right now. Your choices for answers are as follows:

Strongly Disagree Disagree Agree Strongly Agree

1. I have mastered the following mathematical skills.

a. Subtraction

Strongly Disagree Disagree Agree Strongly Agree

b. Addition

Strongly Disagree Disagree Agree Strongly Agree

c. Multiplication

Strongly Disagree Disagree Agree Strongly Agree

d. Division

Strongly Disagree Disagree Agree Strongly Agree

5. Mastering the above skills will help me be successful in my general education
math class.

Strongly Disagree **Disagree** **Agree** **Strongly Agree**

6. Participating in this class will help me be more successful on my AIMSweb
math assessment.

Strongly Disagree **Disagree** **Agree** **Strongly Agree**

7. Participating in Corrective Math will help me score higher on my MSP test than if I had not taken Corrective Math.

Strongly Disagree **Disagree** **Agree** **Strongly Agree**

8. Participating in the Corrective Math Intervention course will help me be more successful in my general education math class.

Strongly Disagree **Disagree** **Agree** **Strongly Agree**

9. I feel math is important to my academic success.

Strongly Disagree **Disagree** **Agree** **Strongly Agree**

Appendix E
Math Survey Results

Student Name	Student ID #	Male	Female	Student ID #	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9
	1	1		a	4	4	3	3	4	3	3	2	4
	2	1		b	4	4	3	2	3	3	2	2	3
	3	1		c	4	3	3	1	3	1	3	1	3
	4	1		d	4	4	3	1	3	3	3	2	3
	5	1		e	4	4	3	3	3	3	3	2	3
	6	1		f	2	3	2	3	3	3	3	3	3
	7	1		g	4	4	3	3	4	4	3	3	3
	8	1		h	4	4	4	4	3	4	2	4	3
	9	1		i	4	4	4	3	3	3	3	4	3
	10	1		j	2	4	4	1	3	3	3	2	4
	11	1		k	3	4	4	1	3	2	2	1	4
	12	1		l	4	5	2	2	4	3	3	1	4
	13	1		m	4	4	3	3	3	2	3	2	3
	14	1		n	3	4	3	3	3	3	3	4	3
	15		1	o	2	3	1	1	2	2	2	2	2
	16		1	p	4	4	4	4	3	1	1	1	3
	17		1	q	4	4	4	3	4	3	4	3	4
	18		1	r	3	3	3	2	4	4	4	3	4
	19		1	s	4	3	3	3	4	3	3	3	4
	20		1	t	4	4	3	2	3	3	3	3	3
	21		1	u	3	4	4	3	1	1	2	1	3
	22		1	v	4	4	4	3	4	4	3	3	3
	23		1	w	3	4	3	2	3	3	2	2	3
	24		1	x	3	4	4	3	4	3	3	3	3
	25		1	y	4	4	4	3	4	3	4	3	4
	26		1	z	4	4	3	3	3	3	3	3	4
	27		1	aa	2	4	3	2	4	4	4	3	4
	28		1	bb	4	4	4	3	4	3	3	2	4
	29		1	cc	4	4	4	3	4	3	3	3	4
	30		1	dd	4	4	3	2	3	3	4	2	4
Totals					106	116	98	75	99	86	87	73	102
Averages					3.53333	3.86667	3.26667	2.5	3.3	2.86667	2.9	2.43333	3.4