Do the Math Intervention. . .

The Effect of *Do the Math* on a 5th Grade Student

A Special Project

Presented to

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FACULTY APPROVAL

Do the Mathematics Intervention. . .

Does It Create Results?

Approved for the Faculty

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ABSTRACT

The author intended to show whether or not the students who were given a mathematics intervention using the *Do the Math* series made significant gains in their MAP scores as compared to their peers who did not receive the intervention. The author ran a t-test for independent samples to determine significance for $p \geq .05, .01, .001$.

Fifth grade students at Hazel Valley Elementary School were chosen to participate in a math intervention using the *Do the Math* intervention series. The students in the control group were only given their regular math instruction during the school day. It was determined that the null hypothesis was accepted and therefore, there was no support for the hypothesis. There was not a higher increase in MAP scores between the two groups of students. There was no significant difference in MAP scores between the two groups of fifth grade students.

Hazel Valley and the Highline School District needed to look at whether or not their resources could have been used in a different, more effective way to help students approve their mathematics skills.

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CHAPTER 1

Introduction

Background for the Project

With the recent push for literacy competence, mathematics has been pushed to the back burner in educator's minds. All the extra time, resources, and supplies have been put towards literacy instruction and interventions. Mathematics has received little to no attention and therefore students who were behind in mathematics were falling farther behind because no extra time and resources were made available to help students begin to catch up to their peers.

Some districts and schools have started to see the problems students were facing when it came to mathematics incompetence. Several things were being put in place to attempt to help students who were behind in mathematics like more time being spent by teachers teaching mathematics, differentiation in lessons and assessments, intervention groups were being formed and intervention packages or series were being created to help address this growing problem.

Statement of the Problem

The author looked at whether an intervention series called *Do the Math* was effective for the selected students who were taught using the intervention series. The data points that were compared were the

Measurement of Academic Progress (MAP) data for the control and treatment groups.

Purpose of the Project

The author intended to show whether or not the students who were given a mathematics intervention using the *Do the Math* series made significant gains in their MAP scores as compared to their peers who did not receive the intervention. The *Do the Math* series was being piloted for the first time.

Delimitations

All the students who participated in the intervention being discussed were all fifth grade students attending Hazel Valley Elementary School. The intervention was held in the fifth grade classrooms. The students remained in the same classroom for the duration of the intervention and had the same para-professional as the instructor. The materials that were selected as curriculum for the intervention were fifth grade appropriate. The dates chosen fell around the time of the Washington Assessment of Student Learning (WASL) and the MAP testing windows with the hope that the students test scores would be improved as compared to previous test scores. Students participated in the intervention from March to May 2009. The intervention was held on Mondays, Tuesdays and Thursdays for 55 minutes each day. The para-professionals

who taught the intervention followed the lesson sequence provided in the *Do the Math* materials.

Assumptions

The author assumed that the students had the mathematics building blocks necessary to be able to grasp and retain the new concepts that were presented to them. The author assumed the control group of students had a firm grasp on the fifth grade concepts the treatment group would be working on and the assessment the students took to qualify them for the intervention accurately chose all the students who needed help with the concepts presented in the *Do the Math* intervention kit.

There was an assumption that the para-professionals chosen to teach the intervention had a strong grasp of the mathematics concepts being presented and could help the students improve their mathematics abilities with little instruction on how to use the curriculum.

There was another assumption that this module of the intervention series was the best fit for the students chosen and the lessons fit appropriately with the mathematics goals of the school district initiative.

Hypothesis

Fundamental mathematics skills were highlighted in this intervention. The author hypothesized that students who received the *Do*

the Math intervention had a higher increase between their Winter to Spring MAP scores than the students who did not receive the intervention.

Null Hypothesis

Mathematics was concentrated on for this project. There was no significant difference in MAP scores from Winter to Spring between students who received the *Do the Math* intervention and students who did not. Significance was determined for $p \geq .05, .01, .001$.

Significance of the Project

This project was pertinent to these students because it showed if their after school time was used to help them improve their mathematics skills in multiplication. This project helped Hazel Valley Elementary School decide if they needed to invest more time and money into this particular intervention again or if they should have looked into other resources to help their students improve on their mathematics abilities.

This project was important to the Highline School District because it provided them with information on the effectiveness of the intervention series piloted and helped them decide whether or not to invest more money in other modules of the intervention series or if the Highline school district should have contacted other school districts to see what they have used for math interventions in the past that have shown results in achievement scores for fifth grade students.

Procedure

All general education fifth grade students at Hazel Valley Elementary School were given the pre-assessment that came with the *Do the Math* intervention series. Individual teachers and the mathematics coach met together and decided who qualified for the intervention and 13 students were chosen. There were six girls and seven boys. Students participated in the intervention from March to May 2009. The intervention was held on Mondays, Tuesdays and Thursdays for 55 minutes each day. The para-professionals who taught the intervention followed the lesson sequence provided in the *Do the Math* materials. During the intervention, all third through fifth grade students took the WASL and the third installment for the school year of the MAP test. At the end of the intervention the students were then given another assessment to measure their growth. The students in the control group were only given their regular math instruction during the school day.

Acronyms

ELL. English Language Learners

IEP. Individual Education Program

OSF. Outside-of-School Factors

MAP. Measurement of Academic Progress

NAEP. National Assessment of Education Progress

NCLB. No Child Left Behind

NWEA. Northwest Education Association

RIT. Rausch Unit

RTI. Response to Intervention

WASL. Washington Assessment of Student Learning

CHAPTER 2

Review of Selected Literature

Introduction

"According to the 2007 National Assessment of Education Progress (NAEP) Mathematics test, 61 percent of America's fourth graders are not proficient in mathematics" (*Scholastic*, 2008). That percentage each year was growing larger and larger. So educators and school districts looked into the assessments they were giving to their students, best practices in math, developmental theory for the age group of their students and characteristics of students living in poverty.

Measurement of Academic Progress Test

The MAP test has been given to third through sixth grade students three times per year; fall, winter and spring. Students took the subtests of reading and mathematics during each testing window. The MAP test was created by the Northwest Education Association and was a "computerized, adaptive test" (NWEA, 2009, p. 1) which meant that it adapted as the students answered questions. If the student answered a question correctly the computer adjusted and the next question was harder than the one they just got correct and vice versa.

According to the Northwest Education Association NWEA (2010), "When administered at regular intervals over time, it is possible to find out

whether an individual student, or an entire grade level, is making satisfactory progress in these basic skill areas" (p. 1). Over the years MAP scores have shown students making progress over the course of a school year and even in between testing windows during the school year. Students should have made growth of three to five points between each testing window. During every testing window the Rausch Unit (RIT) score of the student should go up every time to show academic progress. However, some students have the same score or a lower score than they had during their previous testing session. Per teacher discretion students have been retested in a testing window because they finished too early to receive a RIT score, the teacher did not think the student scored where they thought they should have, or for some reason the student took the wrong test.

According to the NWEA (2010):

> The RIT score is an equal-interval score, like feet and inches, so scores can be added together to calculate accurate class or school averages. RIT scores range from about 100 to 300. RIT scores make it possible to follow a student's educational growth from year to year. (p. 1)

Since there were no time limits on this test there have been some problems with students taking hours to complete the test to improve their

score from the previous time. Students also tried to get every question correct. However, "students are not expected to get every question right or every question wrong" (NWEA, 2009, p. 3).

Teachers looked at students RIT scores and used the DesCartes continuum of learning to find out where they need help or enhancement added to their learning. The DesCartes "orders specific Reading, Language Usage, Mathematics and Science skills and concepts by achievement level" (NWEA, 2009, p. 4). Then teachers used the skills and concepts under where the students RIT score fell to inform their instruction for that individual student and form small groups for instruction based on what students needed to learn.

Best Teaching Practices in Mathematics

According to Scholastic, "One percent of school-age children experience a math disability not associated with any other learning disability, and two to seven percent experience serious math deficits" (*Scholastic,* 2008). Many people have researched and published articles that highlighted best teaching practices in mathematics.

One best teaching practiced mentioned by many authors of literature was meaningful practice. "By using real-world practice activities, the goal of generalizing skills learned in class to their lives becomes more attainable" (Duffy, Furner, & Yahya, 2005, p. 17) and students were able to

make connections to their life outside of school. Applying knowledge of a math concept to real-life situations helped the students remember concepts. This best practice also equipped students with life skills they used past their school years.

"The task of those who teach math is to convey this language of pattern and order in ways that show its relevance to everyday life" (Bafumo, 2006, p. 11). Mathematics came with its own vocabulary and rules to remember. Children often had trouble deciphering between different mathematics vocabularies. "Teachers can use real objects such as coupons, fruit, patterned blocks, beans, marbles, or buttons as manipulatives in demonstrating math concepts" (Duffy, Furner, & Yahya, 2005, p. 16). Using real objects that students had seen and interacted with before was very helpful in getting students to retain complex math concepts. "Meaningful practice provides students with opportunities to strengthen and reinforce their learning and maximize their success," (*Scholastic,* 2008) and students who made connections from the classroom to their life outside of the classroom scored better on assessments because they related to them better.

Interactions between the teacher and learners were very important to math comprehension. This also included interactions between learners without the involvement of the teacher. "It is agreed that there is no single,

ideal form in which students and teachers should consistently interact," (Arispe, Banfield, Benbow, et. al., 2007, p. 6-xv). According to Scholastic, "Interactions help students make sense of what they are doing and help them to clarify, explain and evaluate their own thinking and the thinking of their partners," (2008, p.12). These interactions have looked like partners, groups of three or four, or whole class. They have been with a teacher giving instructions and students participating with a raised hand or with the teacher as a facilitator and students talking amongst themselves much like adults do. Many students needed reassurance that what they were thinking was what their peers were also thinking. It also got students to self-assess themselves against their peers.

According to Duffy, Furner, & Yahya (2005):

> Encouraging children to think aloud when solving problems helps teachers pinpoint students' difficulties in solving math problems. In addition, it can also help teachers instill in their students the metacognitive knowledge and strategies when learning math concepts. Most times, in verbalizing step-by-step how a math problem is solved, students can self-correct their mistakes. Similarly, this process allows peer corrections to occur. (p. 18)

Peers have been influential on each other. All types of people have looked to their peers for many things like affirmation, belonging and

acceptance among other things. Imamoglu & Kahveci claimed that "factors affecting student participation include motivation to learn, and the kinds of environments and supports for participation offered through classroom interaction" (2007, p. 145). When students heard other students making connections and self-correcting their work because of what others had said it has been very motivating to others to participate as well.

Duffy, Furner, & Yahya (2005) referred to Polya's 2004 article in which he created a method that directed students to solve mathematics problems by doing a four-step problem-solving process. The steps were as follows: read and understand the problem, make a plan, execute the plan, and review the solution.

According to Duffy, Furner, & Yahya (2005):

> Also teach problem-solving strategies to students: working backward, drawing a picture, making a simpler problem, looking for a pattern, learning by trial and error, acting out, using a table. These strategies can enrich and empower students mathematically as they problem solve. (p. 19)

Many students have lacked in problem solving skills especially when it came to mathematics. A lot of mathematics work was being able to decipher information in a word problem and students were not equipped with proper problem-solving skills. Polya (2004) along with Duffy, Furner,

& Yahya (2005) have come up with many different strategies for teachers to teach to their students so they can tackle word problems in math. Having a system that all students can apply to many different types of mathematics questions was in the best interest of all students because it alleviated the need to remember a ton more information on top of the tons of vocabulary and formulas already necessary to be remembered during high-stakes assessments.

There have been many other best practices for teaching mathematics documented. Only a small few have been mentioned here.

Developmental Theory of Pre-Adolescent Students

When teaching mathematics it was extremely important to teach using multiple strategies. According to Scholastic, "Using a range of teaching strategies and contexts to teach concepts and skills helps ensure that all students learn and make connections," (2008, p. 8). If students have not made connections to what they have learned they will not retain it and be able to use it later in life. We all have different ways that we have organized information and remembered it so teachers needed to teach in ways that catered to each student's special way of learning and thinking.

Duffy, Furner, & Yahya stated, "Teachers must take into consideration the modalities of their students and try to reach each child regardless of his or her learning style," (2005, p. 22). It has been hard for

teachers to teach to students in ways that they themselves have not used to retain information. Most teachers have not been trained in strategies on how to address all learning styles. So they have taught students using ways they themselves have used to learn and failed to use other ways that their students may have benefitted from. Howard Gardner found through research that Harvey Silver and his colleagues "have proposed a quite interesting idea: that the ways in which particular intelligences are deployed may reflect personal stylistic preferences" (Gardner, 1997, p. 21). Therefore, their students have been unable to connect to information to be able to retain it for later uses.

Linda Campbell claimed that "a school is responsible for helping all students discover and develop their talents or strengths. In doing this, the school not only awakens children's joy in learning but also fuels the persistence and effort necessary for mastering skills and information and for being inventive" (1997, p. 14). Using multiple intelligences as teaching strategies took time, effort and collaboration between colleagues to ensure that each kind of multiple intelligence was being tapped into and students were able to take complete advantage of their personal interests. Colleagues needed to break up the work load to make sure their assignments and assessments were addressing all of the multiple intelligences. Since each person gravitated toward one or two certain

multiple intelligences; it made sense for colleagues to pull together their likes to ensure all multiple intelligences were being offered to all students. "Students should be taught based on their ability and ways of learning; active and involved teaching is a step towards students' academic success" (Douglas, Reese-Durham, & Smith Burton, 1997, p. 184). Teaching while incorporating the multiple intelligences was a great way for students to be taught based on their ability and way of learning since each student had different levels of ability.

A teacher's number one priority has been the academic achievement of his/her students. Every minute of every day each school year has been devoted to reaching every student and helping them to achievement academic excellence. According to Douglas, Reese-Durham, & Smith Burton, "Teachers must incorporate strategies that will lead to increased academic achievement" (2008, p. 182). Those strategies have included but were not limited to using the multiple intelligences during instruction.

> According to Jean Piaget's developmental stage of Preoperational Thinking as quoted by Bobby Ojose (2008):
>
> There is lack of logic associated with this stage of development; rational thought makes little appearance. The child links together unrelated events, sees objects as possessing life, does not

> understand point-of-view, and cannot reverse operations. For example, a child at this stage who understands that adding four to five yields nine cannot yet perform the reverse operation of taking four from nine. (p. 26)

There has long been a huge disconnect between multiplication and division among fourth and fifth grade students. They have not been able to see how three times four equals 12 and 12 divided by three equals four were related to each other and if they performed the function of multiplication they also performed the function of division.

Aagaard & Boram believed "the developmental stage of the students being tested should be of great interest to educators; especially because of the high-stakes associated with assessments affecting teachers rather than students" (pp. 5-6). In the age of teacher accountability being directly tied to student test scores; the test makers should consider Piaget's developmental stages when creating the test to help insure that students are able to perform the tasks being asked of them.

Teaching Students of Poverty

Living in poverty has long been something students around the world have had to deal with and Hazel Valley Elementary School had a free and reduced lunch percentage of 59.2% across the school, and the fifth graders involved in this experimental study were a direct reflection of that

free and reduced lunch percentage. According to Beilke ,& Burney, "poverty may have the greatest impact on achievement (2008, p.172). There have been many outside-of-school factors, OSFs, identified and explained to have had a direct impact on student learning such as "inadequate medical, dental, and vision care, often a result of inadequate or no medical insurance, food insecurity, and family relations and family stress," (Berliner, 2009, p. 1) among other things.

Alan Weil argued "any strategy to reduce poverty must provide access to health care for all low-income families" (2007, p. 97). "Adults without health insurance are less likely to take their children for preventive care" (Weil, 2007, p. 97) because it added up to cost so much. Even a basic medical check-up for a child has been up to $200 per visit and that would not have included any prescriptions or special tests to make any type of diagnosis. The same has applied for dental care as well. Everything little thing added up to more money out of pocket for families with no insurance to cover some of the costs; so families just ignore their child's health problems until it's has been too long and nothing can be done or they have been forced to take their child to the hospital which ended up costing more than the normal check-up would have in the beginning. Berliner found, "Among those without health insurance, 68% reported forgoing needed medical care because they lacked money; they

did not see a doctor when they were sick, fill prescriptions they had received, or take recommended diagnostic tests or treatments" (2009, p. 13).

Weil (2007) also stated "the consequences of a lack of insurance extend beyond the individual to burden entire families and communities" (p. 98) this can be due to everyone in the family being without insurance; typically having insurance has not been known to be a selective idea. Either everyone in the family had insurance or nobody did.

Berliner noted, "having medical insurance improves an individual's academic achievement, probably most simply by reducing absenteeism" (2009, p. 13) because schools encouraged students who did not feel well or had a fever or nausea to stay home so as not to spread any infection or illness they may have to others in the school environment. Absenteeism and achievement were directly related if a student missed an average of one or more days of school per week for the duration of the school year.

Lack of food and/or lack of security of when and where the next meal would come from effected a student's achievement in school.

According to Berliner (2010):

> Even nutritional deficiencies of a relatively short duration—a missed breakfast, an inadequate lunch—impair children's ability to function and learn. . .undernourished children become more

> apathetic and have impaired cognitive capacity, seriously jeopardizing all other investments we make in education for poor children. (p. 6)

Students who have lived in poverty and suffered from a lack of food really struggled in school because they spent their learning time thinking of when and where their next meal would be. Their minds were preoccupied and therefore they missed the content that was presented to them. They may have been battling with physical pain and discomfort that stemmed from a lack of food energy.

Also according to Berliner (2009):

> Some schools have figured out that such nutritional deficits are affecting all-important test scores in this age of NCLB high-stakes accountability. So, they provide extra rich foods on test days, essentially calorie-loading students to give them the energy they need to perform well. It works. Gains of from 4-7% on tests accrue to the schools that calorie-load their children. (p.16)

Since teacher accountability on test scores has risen all schools should have taken this approach to child hunger. Everything schools have been able to do to aid in student achievement needed to be done and having provided hungry students with calorie-rich food to help them concentrate and show their full potential should have been done earlier

and sustained throughout the whole school year not just during testing times.

Family stress played a part in the development of students who lived in poverty.

According to Berliner (2009):

> Children from families that suffer from violence, from whatever income group and race, often display social and emotional problems that manifest themselves in the schools they attend. Too often these children show higher rates of aggressive behavior, depression, anxiety, decreased social competence, and diminished academic performance. (p. 25)

Much like with food insecurity; students who have lived in fear spent their learning time thinking of what they have been experiencing at home. They could have been thinking about seeing their loved one being abused or replaying in their own mind the abuse they encountered themselves the night before or just that same morning. Their minds were preoccupied and therefore they missed the content that was presented to them.

Payne believed, “to survive poverty, one must be an incredible problem solver” (2009, p.371). Unfortunately at age eleven or twelve problem solving skills have been minimal for students. Students have

come to school with so much more baggage than they ever had before and it was tough for them to get past those barriers and proven they can achieve to high expectations.

Summary

Many factors have contributed to a student's successes over the years; especially in math. Opportunities for meaningful practice provided chances for students to be able to connect real-life situations to math instruction and helped them to remember the concepts they were taught.

Many different types of interactions in the classroom built up mathematical comprehension for many students. There were interactions among students with and without the assistance of the teacher. These interactions could have looked like partners, small groups or whole class. These interactions were used by students to reassure them of an answer they had in mind or to help them understand why there answer was wrong and where their thinking got them to the wrong answer.

Using multiple intelligences to educate students has contributed to successes over time. Students needed to make connections to what they were learning to be able to remember them later for tests or the next grade level. However, it was difficult for people to teach in a way they themselves did not make a connection to. It had taken hard, conscious work to think in such a different way.

There were also factors that have hindered a student from having successes in school. Living in poverty has been a large factor in creating this hindrance. Without medical insurance parents weren't taking their children to the doctor until they were so sick they need hospitalization. Absenteeism because of illness has been shown to effect achievement when a student misses one or two days or more of school every week.

Students were also preoccupied with how hungry they were from inconsistent meals that they were unfocused on the content that was being presented to them. They could even have been battling with physical pain and discomfort stemmed from a lack of food. Some schools have even gone as far to provide meals that were very calorie-rich to help students concentrate during the school day.

Family stress also played a part in learning difficulty for students who have lived in poverty. It was hard for them to concentrate when before they came to school they saw a family member get abused or were abused themselves and were replaying what they saw over and over instead of concentrating on school work and activities. It has been tough for students to get past the barriers before them and prove they can meet high expectations.

CHAPTER 3

Methodology and Treatment of Data

Introduction

The author looked at whether an intervention series called *Do the Math* was effective for the selected students who were taught using the intervention series. There was a treatment group of 13 students and a control group of 40 students. The author analyzed MAP test scores for the two groups of students to determine significance for $p \geq .05, .01, .001$.

Methodology

The author completed an experimental study using fifth grade students. The experimental study looked at a treatment group of 13 students and a control group of 40 students. The author performed an independent t-test on the data to check for significance between the treatment and control groups.

Participants

The participants were chosen from 53 fifth grade students at Hazel Valley Elementary School in Burien, Washington. The participants were chosen as a convenient sample because they are the fifth grade students enrolled at Hazel Valley. Anyone who did not have a Winter and Spring score was excluded from this study just for the sake of being as consistent as possible.

Hazel Valley had a free and reduced lunch percentage of 59.2% and the fifth graders involved in this experimental study were a direct reflection of that free and reduced lunch percentage. There were 13 students chosen from the 53 to receive the intervention based on an assessment. There were six girls and seven boys. Six of the students in the treatment group were English Language Learners (ELL). Two students in the treatment group had an Individual Education Program (IEP). The ethnic demographics of the treatment group were as follows: four Caucasians, three African Americans, and six Hispanics. Ten of the students in the control group were ELL. Six students in the control group had an IEP. The ethnic demographics of the control group were as follows: 16 Caucasians, six African Americans, nine Hispanics, and nine Asians.

The *Do the Math* intervention kit was part of a Response to Intervention (RTI) model. The module that was piloted was a Tier 2 intervention: targeted group intervention for students who were a year behind and struggling to move forward and for students who needed help being more efficient with multiplication.

Instruments

Three instruments were used around the time of the intervention; *Do the Math* assessment included in the intervention kit being used, which

was found in Appendix A and B, Measurement of Academic Progress (MAP) test, Washington Assessment of Student Learning (WASL). The *Do the Math* pre-assessment and the winter MAP test were administered in January 2009. The MAP test was administered during a testing window in May 2009. The WASL was administered in May 2009. Each sections of the WASL test were given to the fifth grade students on the exact same day to ensure security of the test questions. The MAP and WASL tests have been administered in the Highline School District for many years and were written by Washington and Oregon state agencies respectively. The teachers who administered the assessments were properly trained in how to administer the test before the testing window and had to sign off that they were properly trained.

The author looked at the difference in MAP scores from the winter testing window to the spring testing window. The *Do the Math* assessment was only used to determine if students qualified for the intervention. This instrument directly related to the author's hypothesis because they were testing whether students who received the intervention made a higher increase in their MAP scores from winter to spring than the students who did not receive the intervention. The assessment had many different types of questions on it and was asked in different formats such as multiple choice, story problems and basic computation.

Design

The author used a "Non-equivalent Control Group Design" as described by Gay, Mills, & Airasian, 2009, p. 259. The author used the MAP test as the assessment tool. The only source of invalidity that was not controlled for was pretest-x interaction. According to Gay, Mills, & Airasian, the students who received the intervention may react differently to the intervention because they had taken the pre-assessment (2009, p. 259). Multiple-X interference was not relevant to this study.

There were no natural disasters or threats to the school throughout the duration of the intervention. Maturation was controlled for because the test questions included in the MAP assessment were pulled from an existing question bank. Questions were not added based on what was taught during the intervention. Testing was an issue because the question bank had already existed and student responses affected what question came next. A student could have had a question the previous time they took the MAP test; although that was very unlikely. All of the factors mentioned above were described by Gay, Mills, & Airasian, 2009, p. 256 as sources of invalidity for true experimental designs. There was only one instrument used to calculate whether or not there were significant differences in student scores. The score cutoff that was considered at grade level was higher at the spring testing window than at the winter testing

window. All scores whether they were significantly lower or higher were still considered during the analyzing of this study. The groups of students were not similar to each other from the onset so differential selection could have been a factor. There were no drop outs from the treatment group. Students who did not have a score for both the winter and spring MAP tests were not included in this study. The students in the treatment group were maturing at a different rate; therefore they were selected for this intervention.

Procedure

All general education fifth grade students took the MAP test in January 2009 and the *Do the Math* pre-assessment. The *Do the Math* assessment was analyzed and 13 students were chosen to receive an intervention. After the intervention ended, all fifth grade students took the MAP test in May. When the assessments were analyzed the math coach and teachers were looking for students who received less than 80% of the questions correct. After the assessment was analyzed there were students who were selected from the assessment results and therefore 13 students were given the intervention. The intervention ran for ten weeks beginning on March 17th, 2009 and ending on May 28th, 2009. Students attended the intervention on Mondays, Tuesdays and Thursdays from 3:10-4:05 pm: a total of 55 minutes each session.

Hazel Valley Elementary School was given the *multiplication module C: factors greater than 12* to pilot with their fifth graders. The objectives for this module were: use the communicative property, the associative property and distributive property of multiplication over addition, calculate products for three-digit factors times one-digit factors, calculate products for two-digit factors times two-digit factors, make estimates for factors, and communicate ideas with key mathematics vocabulary.

There were 30 lessons for the students to complete during the intervention. The 30 lessons were chunked into five groups. Each group had a specific outcome in mind. The first five lessons were to develop strategies for computing products. Lessons six through 10 worked on multiplying using the distributive property. Lessons 11-15 revolved around learning how to multiply by multiples of 10. Lessons 16-20 worked on making estimates and finding products. Lessons 21-25 concentrated on multiplying three-digit factors by one-digit factors. And the final lessons 26-30 focused on multiplying two-digit factors through 99 by 99. Each individual chunk of lessons was laid off in the teacher's manual with specific steps to follow during each lesson. Next to each step of the lesson there was information for the para-professional on whether or not the lesson was to be taught to the whole group of students or if the task was

intended for individuals only. The last lesson of each chunk of lessons was designed as an assessment lesson to monitor student understanding. Every assessment lesson was done by individual students only. The para-professional followed the scope and sequence until the ten weeks were over and gave the students a post-assessment. The post-assessment was organized in the same way as the pre-assessment, but the questions contained different numbers.

Treatment of the Data

The author created a table showing the control group and treatment group students and their winter MAP scores. The same was created for the spring MAP scores. Then the author performed a t-test for independent samples. A t-test for independent samples was defined as a test of averages and determined the average amount of growth for the treatment and control groups. Then the author compared the average gains between the two groups of students to determine if there was a significant difference.

Summary

There were two groups of students for the experimental study with a group of 13 students as the treatment group and a group of 40 students as the control group. The treatment group received a math intervention after school using the *Do the Math* intervention kit and the control group received only their regular math during the school day. The intervention

ran for ten weeks beginning on March 17th, 2009 and ending on May 28th, 2009. Students attended the intervention on Mondays, Tuesdays and Thursdays from 3:10-4:05 pm: a total of 55 minutes each session. The author performed an independent t-test on the data to check for significance between the treatment and control groups.

CHAPTER 4

Analysis of the Data

Introduction

Hazel Valley Elementary piloted a mathematics program to see if they could close the achievement gap between students. The author identified a treatment group of 13 students and a control group of 40 students. The treatment group was given an intervention using the series called *Do the Math*. The author analyzed MAP test scores for the two groups of students to determine significance for $p \geq .05, .01, .001$.

Description of the Environment

All the students who participated in the intervention being discussed were all fifth grade students attending Hazel Valley Elementary School. The intervention was held in the fifth grade classrooms. The students remained in the same classroom for the duration of the intervention and had the same para-professional as the instructor. The materials that were selected as curriculum for the intervention were fifth grade appropriate. The dates chosen fell around the time of the Washington Assessment of Student Learning (WASL) and the MAP testing windows with the hope that the students test scores would be improved as compared to previous test scores. Students participated in the intervention from March to May 2009. The intervention was held on Mondays,

Tuesdays and Thursdays for 55 minutes each day. The para-professionals who taught the intervention followed the lesson sequence provided in the *Do the Math* materials.

Hypothesis

Fundamental mathematics skills were highlighted in this intervention. The author hypothesized that students who received the *Do the Math* intervention had a higher increase between their Winter to Spring MAP scores than the students who did not receive the intervention.

Null Hypothesis

Mathematics was concentrated on for this project. There was no significant difference in MAP scores from Winter to Spring between students who received the *Do the Math* intervention and students who did not. Significance was determined for $p \geq .05, .01, .001$.

Results of the Study

The control group was made up of 40 fifth grade students and the treatment group was made up of 13 fifth grade students. Before the intervention started the students took the Winter MAP test. Their scores have been shown.

Table 1

Pre-Test Data from Control and Treatment Group

Control Group		Treatment Group	
S1	214	T1	193
S2	214	T2	202
S3	224	T3	206
S4	210	T4	202
S5	205	T5	199
S6	203	T6	193
S7	217	T7	197
S8	201	T8	204
S9	176	T9	207
S10	185	T10	193
S11	213	T11	206
S12	179	T12	212
S13	205	T13	209
S14	193		
S15	207		
S16	199		
S17	187		
S18	196		
S19	216		
S20	220		
S21	196		
S22	222		
S23	221		
S24	208		
S25	198		
S26	195		
S27	223		
S28	213		
S29	204		
S30	215		
S31	213		
S32	196		
S33	215		
S34	208		
S35	206		
S36	217		
S37	212		
S38	206		
S39	230		
S40	224		

A t-test for independent samples was used to compare the Winter MAP test scores of the treatment and control groups. It was found that the t-value of the two groups was -1.48 which showed the two groups of students were not similar to each other when the intervention began.

Table 2

t-test for Independent Samples of Pre-test Data

Statistic	Values
No. of scores in Group X	13
Sum of scores in Group X	2623.0000
Mean of Group X	201.77
Sum of Squared Scores in Group X	529727.00
SS of Group X	486.31
No. of scores in Group Y	40
Sum of scores in Group Y	8286.0000
Mean of Group Y	207.15
Sum of Squared Scores in Group Y	1722596.00
SS of Group Y	6151.10
t-Value	-1.48
Degrees of freedom	51

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\left(\frac{SS_1 + SS_2}{n_1 + n_2 - 2}\right)\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$$

$$t = \frac{201.77 - 207.15}{\sqrt{\left(\frac{529727.00 + 1722596.00}{13 + 40 - 2}\right)\left(\frac{1}{13} + \frac{1}{40}\right)}}$$

t=-1.48

The t-value of -1.48 and 51 degrees of freedom from the t-test for independent samples was used to determine significance for $p \geq .05, .01, .001$. The author concluded that the null hypothesis was rejected at all three levels because there was a significant difference between the two groups of students at the onset of the intervention. Since the null hypothesis was rejected; the author also concluded that the hypothesis was supported at the onset of the intervention.

Table 3

Distribution of t of Pre-test Data

	p		
df	.05	.01	.001
51	2.021	2.704	3.551

The control group was made up of 40 fifth grade students and the treatment group was made up of 13 fifth grade students. Once the intervention has concluded the students took the Spring MAP test. Their scores have been shown along with the change or delta score that showed the difference between the students' Winter and Spring MAP test scores. Students who did not make a positive gain were not included in the final t-test for independent samples because the author wanted to compare the amount of positive gain between the two groups of students. Students who did not make any gain or had a negative delta score could have been having a bad day and their mind was pre-occupied on something else. Each student should have made some positive gain due to natural maturation over the course of the intervention.

Table 4

Data from Control and Treatment Group

Control Group		Delta Score	Treatment Group		Delta Score
S1	218	4	T1	212	19
S2	229	15	T2	202	1
S3	234	10	T3	210	4
S4	218	8	T4	225	23
S5	215	10	T5	203	4
S6	211	8	T6	211	18
S7	226	9	T7	200	3
S8	210	9	T8	207	3
S9	177	1	T9	209	2
S10	187	2	T10	196	3
S11	221	8	T11	204	-2
S12	182	3	T12	201	-11
S13	207	2	T13	204	-5
S14	202	9			
S15	210	3			
S16	209	10			
S17	179	-8			
S18	208	12			
S19	218	2			
S20	229	9			
S21	203	7			
S22	228	6			
S23	231	10			
S24	209	1			
S25	209	11			
S26	209	14			
S27	227	4			
S28	223	10			
S29	206	2			
S30	220	5			
S31	225	12			
S32	202	6			
S33	212	-3			
S34	201	-7			
S35	197	-9			
S36	216	-1			
S37	200	-12			
S38	202	-4			
S39	230	+0			
S40	224	+0			

A t-test for independent samples was used to compare the Winter MAP test scores of the treatment and control groups. It was found that the t-value of the two groups was 0.43 which showed the two groups of students grew significantly similar to each other during the course of the intervention. The achievement gap had closed tremendously over the course of these few months, but it was not closed completely.

Table 5

t-test for Independent Samples of Post-test Data

Statistic	Values
No. of scores in Group X	10
Sum of scores in Group X	80.0000
Mean of Group X	8.00
Sum of Squared Scores in Group X	1278.00
SS of Group X	638.00
No. of scores in Group Y	31
Sum of scores in Group Y	222.0000
Mean of Group Y	7.16
Sum of Squared Scores in Group Y	2060.00
SS of Group Y	470.19
t-Value	0.43
Degrees of freedom	39

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\left(\frac{SS_1 + SS_2}{n_1 + n_2 - 2}\right)\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$$

$$t = \frac{8.00 - 7.16}{\sqrt{\left(\frac{1278.00 + 2060.00}{10 + 31 - 2}\right)\left(\frac{1}{10} + \frac{1}{31}\right)}}$$

t= 0.43

The t-value of 0.43 and 39 degrees of freedom from the t-test for independent samples was used to determine significance for $p \geq .05, .01, .001$. The author concluded that the null hypothesis was accepted at all three levels because there was no significant difference between the two groups of students. Since the null hypothesis was accepted; the author also concluded that the hypothesis of students who received the *Do the Math* intervention had a higher increase between their Winter to Spring MAP scores than the students who did not receive the intervention was not supported. The t-value would have had to be at 2.042 to show significance for p at the level of .05.

Table 6

Distribution of t of Post-test Data

	P		
df	.05	.01	.001
39	2.042	2.750	3.646

Findings

The author found no significant difference in MAP scores between the students who received the *Do the Math* intervention and the students who did not therefore the author accepted the null hypothesis.

The author also found there to be no support for the hypothesis which meant that there was not a higher increase in MAP scores for the students who received the *Do the Math* intervention as compared to the students who did not receive the intervention.

Discussion

At the on-set of the intervention the students were really different from each other with a t-value of -1.48. After the intervention concluded the students in the treatment and control groups grew closer to each other in ability with a t-value of 0.43.

The author was not surprised with the results or findings of this experimental study. The author was thinking the null hypothesis would be accepted before ever running the t-test for independent samples. After running the t-test for independent samples; what the author had originally thought was confirmed.

The expectations for how this intervention ended up was disappointing to Marilyn Burns, the creator of the *Do the Math* intervention series, because she believed if people followed the strings of

lesson students would come out of the intervention with much stronger math skills.

Summary

The author identified a treatment group of 13 students and a control group of 40 students. The treatment group was given an intervention using the series called *Do the Math* along with their regular math instruction. The author performed an independent t-test on the data. The author then analyzed MAP test scores for the two groups of students to determine significance for $p \geq .05, .01, .001$.

It was determined that the null hypothesis was accepted and therefore there was no support for the hypothesis. There was not a higher increase in MAP scores between the two groups of students. There was no significant difference in MAP scores between the two groups of students.

There were some pre and post test issues due to the use of the MAP test as the measurer of growth. The question bank for MAP testing was pre-determined by the program and student responses affected what question came next. So many of the questions could have been given to the students in the winter when they first took the test; although that was very unlikely. There was only one instrument used to calculate the significant differences between the student scores over this period of time.

In the winter, the treatment group had a mean MAP score of 201.77 and the control group had a mean MAP score of 207.15. In the spring, the treatment group's mean changed to 207.60 with a gain of 5.83 across testing periods. The control group's mean changes to 213.00 with a gain of 5.85 across testing periods which shows the control group outgained the treatment group even without being the ones who received the intervention. So the intervention proved to have worked very well.

CHAPTER 5

Summary, Conclusions and Recommendations

Introduction

This experimental study looked at whether an intervention series called *Do the Math* was effective for the selected students who were taught using the intervention series. There was a treatment group of 13 students and a control group of 40 students. The author a t-test for independent samples and then analyzed MAP test scores for the two groups of students to determine significance for $p \geq .05, .01, .001$.

Summary

Some school districts and schools have started to see the problems students were facing when it came to mathematics incompetence. Several things were being put in place to attempt to help students who were behind in mathematics like more time being spent by teachers teaching mathematics, differentiation in lessons and assessments, intervention groups were being formed and intervention packages or series were being created to help address this growing problem.

This study was designed for schools who were thinking of using the *Do the Math* intervention kits. It was also designed for the school that used the intervention kits. From this study they were able to see what type of impact the intervention made on their students. The data points that

were compared were the Measurement of Academic Progress (MAP) data for the control and treatment groups.

The author reviewed a lot of scholarly literature on best teaching practices in mathematics, developmental theory of pre-adolescent students and teaching students of poverty. Meaningful practice, student/teacher interactions, and problem-solving strategies were reviewed as being best teaching practices to improve mathematics achievement. Teaching using multiple strategies and modalities even when they were uncomfortable for the teacher was also found to be very important because it zoned in on individual students learning needs. Developmental stages were also discussed and the importance in making sure that the activities students were asked to do were not too difficult based on their ability level. The author also found information regarding how difficult it was to teach students of poverty because they were found to have their minds pre-occupied on other topics besides school like when their next meal would be coming, a medical problem they were having, or a disruptive home situation.

The participants were chosen from 53 fifth grade students at Hazel Valley Elementary School in Burien, Washington.

Hazel Valley had a free and reduced lunch percentage of 59.2%. There were 13 students chosen from the 53 to receive the intervention

based on an assessment. Six of the students in the treatment group were English Language Learners (ELL). Two students in the treatment group had an Individual Education Program (IEP). Ten of the students in the control group were ELL. Six students in the control group had an IEP.

The *Do the Math* intervention kit was part of a Response to Intervention (RTI) model. The module that was piloted was a Tier 2 intervention: targeted group intervention for students who were a year behind and struggling to move forward and for students who needed help being more efficient with multiplication.

It was determined that there was no support for the hypothesis and therefore the null hypothesis was accepted. There was not a higher increase in MAP scores between the treatment group who received the intervention and the control group who did not. There was no significant difference in MAP scores between the two groups of students.

Conclusions

The author found no significant difference in MAP scores between the students who received the *Do the Math* intervention and the students who did not therefore the author accepted the null hypothesis.

The author also found there to be no support for the hypothesis which meant that there was not a higher increase in MAP scores for the

students who received the *Do the Math* intervention as compared to the students who did not receive the intervention.

The results were a mix of positive and negative because the two groups of students grew significantly closer to each other over the course of the intervention, but the achievement gap between them was not completely closed by the end of the intervention. It was concluded that the students, schools and districts time and money were not completely wasted and this intervention could be run again at Hazel Valley. However, the intervention needed to be looked at and possibly changed to help close the achievement gap completely.

The fact that the intervention was implemented by support staff played a part in why the intervention was not as effective as Hazel Valley Elementary School would have liked. Support staff were not certificated and did not have the range of tools that teachers have in terms of what students needs and teaching strategies to help students understand concepts. They were not trained to differentiate instruction and make adjustments to lessons.

Even though the materials that were selected as curriculum for the intervention were fifth grade appropriate according to state math standards; Bobby Ojose wrote in his work about Jean Piaget's developmental stages that students have been found to not be ready to do

such complex mathematical thinking because they cannot make the connection between concepts.

Recommendations

The author recommends not using the *Do the Math* modules as kits for running interventions. They should be used as classroom supplements to help teachers differentiate instruction and also provide in-class support for their own struggling students. Each classroom teacher knows their students strengths and weaknesses better than anyone else and should be able to use these materials in a way that will have a direct, positive impact in student achievement.

It is the recommendation of the author that the *Do the Math* modules be used for their concepts where applicable. The grade level on a kit shouldn't hold someone back from using it. Each student is capable of different things compared to other students and the modules should be used accordingly.

REFERENCES

Aagaard, L., & Boram, R. (2003). Cognitive development of fourth graders in a high-stakes state. 1-16.

Arispe, I., Banfield, M., Benbow, C., Clements, D.H., Ferrini-Mundy, J., Gersten, R., Loveless, T., Williams, V. (2007). Chapter 6: report of the task group on instructional practices. *Foundations for success: report of the national mathematics advisory panel* (248). Washington, DC. U.S. Department of Education.

Bafumo, M. E. (2006). Making math relevant. *Teaching K-8*, 10-12.

Beilke, J.R., & Burney, V.H. (2008). The constraints of poverty on high achievement. *Journal for the Education of the Gifted*, 31(3), 171–197.

Berliner, D. (2009). Poverty and Potential: Out-of-School Factors and School Success. Boulder and Tempe: Education and the Public Interest Center & Education Policy Research Unit. Retrieved May, 18, 2010 from http://epicpolicy.org/publication/poverty-and-potential

Berliner, D. (2009). Are teachers responsible for low achievement by poor students. Kappa Delta Pi, 46, 18-21.

Campbell, L. (1997.) How teachers interpret MI theory. *Educational Leadership*, 55(1), 14.

Douglas O., Reese-Durham N., & Smith Burton K. (2008). The effects of the multiple intelligence teaching strategy on the academic achievement of eighth grade math students. *Journal of Instructional Psychology*, 35(2), 182-187.

Duffy M. L., Furner, J. M., & Yahya, N. (2005). Teach mathematics: strategies to reach all students. *Intervention in School and Clinic*, 41(1), 16–23.

Gardner, H. (1997). Multiple intelligences as a partner in school improvement. *Educational Leadership,* 55(1), 20-21.

Gay, L. R., Mills, G. & Airasian, P. (2009). *Educational research competencies for analysis and applications*. Upper Saddle River, NJ: Pearson.

Imamoglu, Y., & Kahveci, M. (2007) Interactive learning in mathematics education: review of recent literature. *The Journal of Computers in Mathematics and Science Teaching,* 26(2), 137-153.

Northwest Evaluation Association. (2009). *Measures of academic progress (MAP) basics overview*. Retrieved December 5, 2009 from http://www.nwea.org/support/article/1172

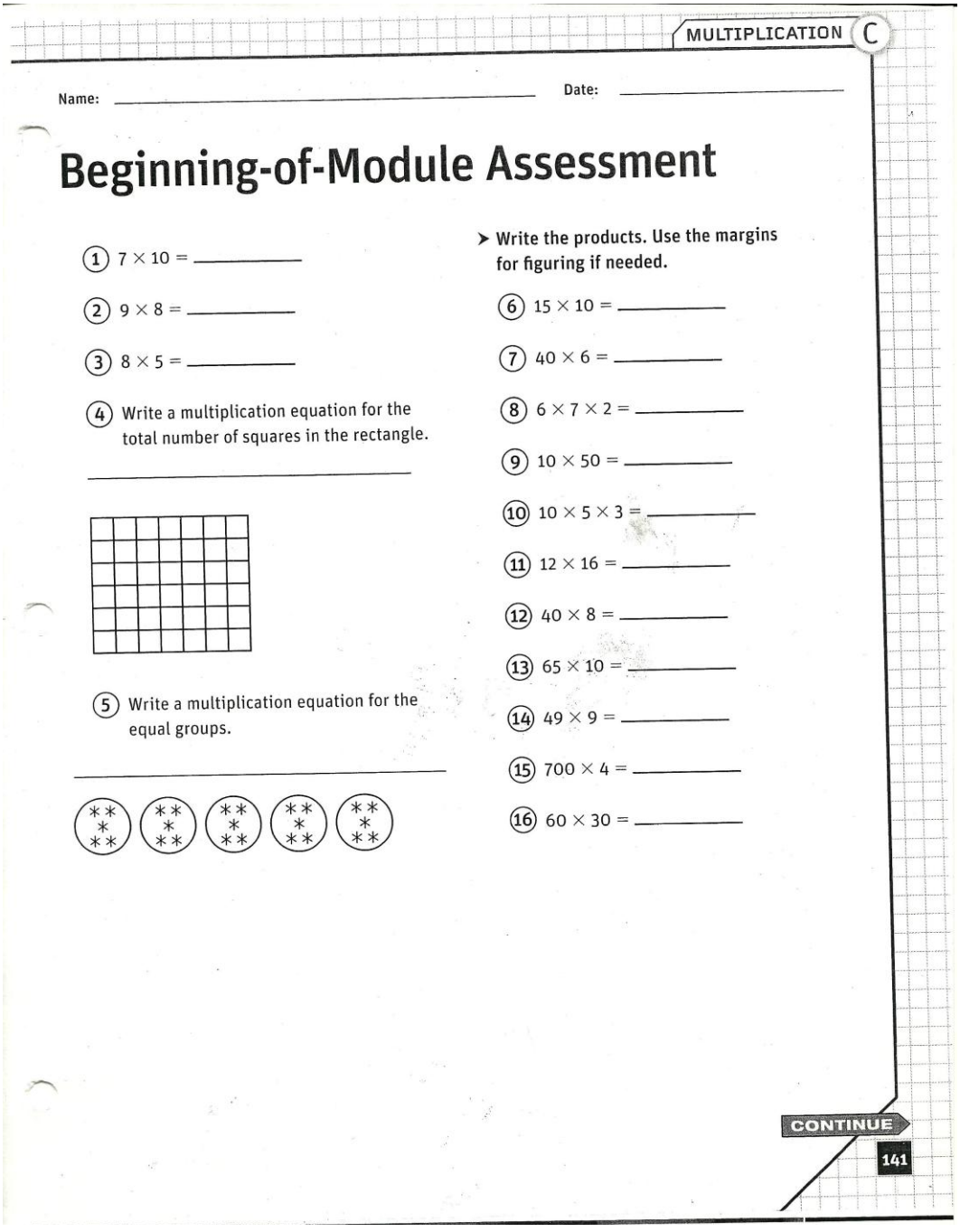
Northwest Evaluation Association. (2010). *Teacher handbook measures of academic progress (MAP)*. Retrieved May 27, 2010 from http://www.nwea.org/support/article/1151

Ojose, B. (2008). Applying piaget's theory of cognitive development to mathematics instruction. *The Mathematics Educator*, 18(1), 26-30.

Payne, R.. (2009). Poverty does not restrict a student's ability to learn. Phi Delta Kappan, 90(5), 371-372.

Weil, A. (2007). A health plan to reduce poverty. *A Future for Children*, 17, (2), 97-116.

APPENDIX A



MULTIPLICATION C

Name: _____ Date: _____

Beginning-of-Module Assessment

(1) $7 \times 10 =$ _____

(2) $9 \times 8 =$ _____

(3) $8 \times 5 =$ _____

(4) Write a multiplication equation for the total number of squares in the rectangle.

_____

(5) Write a multiplication equation for the equal groups.

_____

➤ Write the products. Use the margins for figuring if needed.

(6) $15 \times 10 =$ _____

(7) $40 \times 6 =$ _____

(8) $6 \times 7 \times 2 =$ _____

(9) $10 \times 50 =$ _____

(10) $10 \times 5 \times 3 =$ _____

(11) $12 \times 16 =$ _____

(12) $40 \times 8 =$ _____

(13) $65 \times 10 =$ _____

(14) $49 \times 9 =$ _____

(15) $700 \times 4 =$ _____

(16) $60 \times 30 =$ _____

CONTINUE

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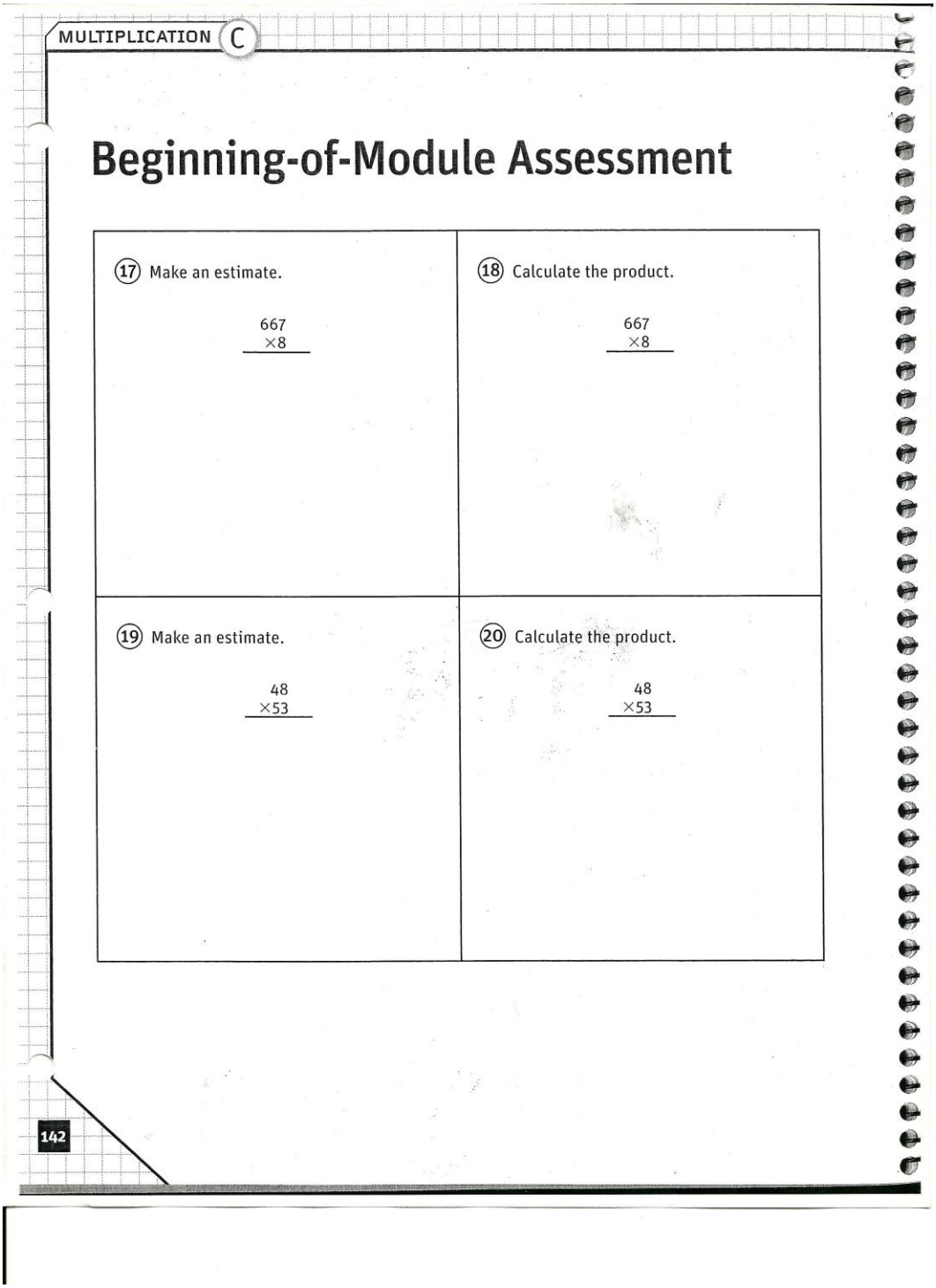
APPENDIX B



MULTIPLICATION C

Beginning-of-Module Assessment

(17) Make an estimate.

$$\begin{array}{r} 667 \\ \times 8 \\ \hline \end{array}$$

(18) Calculate the product.

$$\begin{array}{r} 667 \\ \times 8 \\ \hline \end{array}$$

(19) Make an estimate.

$$\begin{array}{r} 48 \\ \times 53 \\ \hline \end{array}$$

(20) Calculate the product.

$$\begin{array}{r} 48 \\ \times 53 \\ \hline \end{array}$$

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