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# **Differentiated Math Interventions for Third Grade Students Using Push-In and Pull-Out Models**

**An Action Research Report  
By Anne Jarzyna-Ingles, Tara Schletz and Melissa Young**

**Differentiated Math Interventions for Third Grade Students Using  
Push-In and Pull-Out Models**

Submitted on May 21, 2014  
In fulfillment of final requirements for the MAED degree  
St. Catherine University  
St. Paul, Minnesota

Advisor \_\_\_\_\_ Date \_\_\_\_\_

## Abstract

This research examines two models of third grade math intervention at two different elementary schools. Intervention teachers at School A, a diverse, suburban school, take underachieving students out of the classroom for math support while at School B, a private, urban school, intervention teachers came into the classroom to instruct on grade-level students. A pretest was administered to determine participation in the intervention group. Formative assessments were used to determine student learning throughout the unit, as well as a post-test. Students were surveyed about math attitudes once at the beginning of the unit and again at the end of the unit. The results of this research show benefits of both intervention models as most student test scores in multiplication and division increased by the end of the unit. The research also demonstrated that there may be a greater need for students to improve basic facts in order to further master more complex math concepts.



In classrooms across the country, students are lacking an understanding of basic skills and concepts necessary for the advancement of their academic success. The 2005 National Assessment of Educational Progress (NAEP) data shows that 64% of 4th graders and 70% of 8th graders have below grade level math skills (Poncy, B. C., Skinner, C. H., & Jaspers, K. E., 2007). This data suggests that interventions are needed in the math classroom.

Throughout the past few years, our schools have noticed a need for more individualized math instruction. Our school administrators, teachers and parents have been concerned with student achievement in the math classroom, as well as standardized test scores on the Measure of Academic Process (MAP), Minnesota Comprehensive Assessments (MCA) and Educational Records Bureau (ERB) tests. We decided to pose the question: which is more effective in improving the math outcomes for struggling students: having a math interventionist push-into the classroom, working with them in a small group setting, or pulling those students out and working with them individually? When determining the difference between using a pullout model or a push-in model, we needed to determine which method increased students understanding, engagement and mathematical thinking of multiplication and division concepts as demonstrated by a post test in a 3rd grade classroom.

According to Lawrence-Brown (2004), differentiated math interventions help to create a classroom community in which all learners can be successful. Teachers can help to maximize achievement of curriculum standards and accommodate a wide range of abilities and interests by establishing interventions for students. These students will benefit from different expectations and tasks that are created specifically for them. “Differentiated instruction is as important for students who find school easy as it is for those who find it difficult. All students benefit from the availability of a variety of methods and supports, and an appropriate balance of challenge and success” (Lawrence-Brown, 2004, pp. 36-37).

As math interventionists we have the advantage of observing and collecting data from two different schools using two different instruction methods. For the past few years at these two urban schools, students have been identified as needing intervention. Students are now benefitting from a math interventionist or resource teacher in both schools.

There have been numerous studies on how differentiation in a math classroom has had positive results. One study that was done in a Dallas, Texas school with 476 fourth and fifth grade students showed how teachers differentiate in their classrooms by using technology, according to Rosen and Beck-Hill (2012). For instance, differentiation in one classroom can be facilitated with computer-based programs, like the Take the Time To Know program. Rosen et al. (2012) states that the program is designed to be implemented in a blended, teacher-driven, student-centered, computing learning environment. This program may not be suited for all school districts, as it requires one-to-one laptops, although it could also be used as an alternate station when differentiating instruction. The results of Rosen and Beck-Hill's study showed that one-to-one teacher/student interaction increased drastically when using the computer-based program in their classrooms. Implementing this technological program also increased student attendance and reduced discipline issues in the classroom by 62% according to Rosen et al. (2012). Another study done by Jackson (2008) states that teachers who use technology as a catalyst could advance educational reform related to student learning by increasing access to expand content, providing practice with life-long learning skills and encouraging positive disposition to learning.

Research shows the effectiveness of intervention strategies in terms of student academic growth. Through intervention students are able to focus intensely on concepts and skills that are integral to classroom achievement. By adapting these strategies in classrooms, teachers can witness student growth during various time periods including chapters, units, and the year as a whole. While differentiation and

critical thinking skills used as interventions within the Response to Intervention (RtI) model are just a few of the strategies used in intervention, they are an important piece to this ever growing educational movement.

At each school, the focus on math instruction is not based on whole group instruction, but individualizing math instruction and accommodating each student. At School A it is the third year that they have had a math interventionist, but this is the first year they have had two interventionists and flexible groups. In the past, the lowest non-special education students were placed in intervention and math instruction was very much limited to the individual classrooms. After a decline in test scores and teacher input about struggling math students, interventionists were added in math. This year there is a greater focus on consistency across grade levels, differentiation, and an intervention time that allows for flexible grouping.

Schools around the United States have done research on differentiation in their math classrooms and have found that the results have been positive. One study completed by Ensign in 2008 examined outcomes from differentiation in a large school district in Seattle, which serves over 47,000 students that speak over a hundred languages implemented math coaches throughout their district. These coaches were set in place to help teachers use differentiation in their classrooms. In 2008 a teacher of a combined fourth and fifth grade class developed a math workshop format for the class that consistently used differentiation strategies including: flexible grouping, ongoing assessment, and a variety of daily math tasks (Ensign, 2008). Students were learning so well in this classroom that the coach had other teachers observe the class.

Murray and Jorgenson (2007) stated when students are engaged in the exploration and solution of a problem that “grabs them,” they will go as far as they can, or as far as their readiness takes



them. According to research it seems that differentiation in different schools with different demographics pose positive results in learning and behavior.

This is the second year that math resource teachers are pushing into the third and fourth grade classrooms at School B. Just as at School A, math instruction was also limited to individual classrooms. It was decided that there was a need to increase student achievement individual standardized test scores and student grouping. The math resource teacher pushing in the classroom allows for smaller groups and more individualized lessons. The goal is to make sure all students are working at their personal level. Therefore, students are grouped based on their pre test scores within the classroom, and a math resource teacher pushes in and is the third teacher in the math classroom.

The goal at both schools is to be more focused on essential learning outcomes and looking more at student achievement in individual skills. Our schools hope to have flexible groups based on what they see on pretests and formative assessments. We want to see student growth in all topics of math individually instead of math as a whole. We would also like to see a rise in MCA, MAP and ERB scores.

The research for this study took place in third grade at two different schools; we will call the two schools School A and School B.

School A is a suburban, public elementary school. The student enrollment is 503 students in grades kindergarten to sixth grade. School A has a diverse population with 47 percent of students identified as an ethnicity other than white and 49 percent of students receiving free or reduced lunch. In addition to ethnic diversity, School A also has a diverse learning population with 17 percent of students receiving special education services, 16 percent identified as limited English proficient, and 6 percent of students in grades three through six identified as gifted and talented.

The students in this study were six students from two separate third grade classes at School A. The students were pretested at the beginning of their unit on multiplication and division number stories. Based on their pretest scores and teacher input, students were placed in the intervention group outside of the classroom with a math interventionist. In general, these students are behind their peers in math. They struggle with basic number sense including multiplication and division facts. Out of the six students, two are identified as English Language Learners (ELLs). The group is diverse with three out of the six identified as white, two identified as Asian, and one identified as Hispanic. This group met for a half hour each day for two weeks.

School B is an urban, private school. The total student enrollment in kindergarten through Grade 12 is 901 students, with 279 of those students enrolled in the lower school, grades kindergarten through fifth. School B identifies 29 percent of students as “students of color,” and 23 percent of students receive financial aid to cover enrollment costs.

The students in this study come from two different third grade classrooms at School B. Students were given a pretest on multiplication and division and placed into two groups based on the pretest score. The two groups consisted of students who were at grade level and students who were above grade level. The math interventionist came into the classroom to work with students at grade level in the two different classrooms while third grade classroom teachers worked with students who were above grade level. The intervention teacher came into the classrooms daily to work on multiplication and division with students.

While School A and School B have many differences, including how they do third grade math intervention, the goal was the same at both schools; to improve student understanding of multiplication and division.

Research shows the effectiveness of intervention strategies in terms of student academic growth. Through intervention students are able to focus intensely on concepts and skills that are integral to classroom achievement. By adapting these strategies in classrooms, teachers can witness student growth during various time periods including chapters, units, and the year as a whole. While differentiation and critical thinking skills used as interventions within the RtI model are just a few of the strategies used in intervention, they are an important piece to this ever growing educational movement.

#### Description of Research Process

Data was collected at both schools in the study beginning mid-January and was finished at the end of February 2014. Data collection was conducted on different days with third grade students focusing on the concepts of multiplication and division.

In order to determine which model was more effective in improving math outcomes, we used the same sources of data collection at both schools. Our data collection sources included: Pre and post intervention student interest questionnaire, teacher observations of student engagement and questioning during the intervention period, formative assessment scores, pre and post assessments, and exit slips.

At each school, the unit began with a student questionnaire regarding their feelings about math (See Appendix A). The survey asked the students ten questions about how students feel about math, how they see themselves as a math learner, and their outlook for their future in math.

Teacher A works as a math interventionist, pulling students out of the classroom for intervention at School A. Students in third grade at School A were given a pretest on multiplication and division stories (See Appendix B). School A uses Math in Focus: Singapore Math (2013). The problem solving skill of bar modeling was also addressed in this pretest. As a result of this pretest; six students from two different homerooms were selected for math intervention help outside of the classroom. This intervention time did not take the place of the in-class instruction, but instead was used to supplement

the teaching by the classroom teachers. All of the six students had received intervention help during previous math units.

At School A, students attended intervention for 30 minutes over the course of two weeks. The format of the lessons included a review of previous learning, whole group practice of multiplication and division stories, and individual practice. After individual practice, the practice problems were corrected and discussed. Most days ended with an exit slip to determine student learning. The review and practice materials came from the “Math in Focus” re-teaching curriculum and various online resources including Super Teacher Worksheets (2013) and Worksheet Works (2013). The exit slips were created by the Teacher A and shared a similar format to the problems worked on in class.

The review section of the lesson touched on the concepts being learned in the classroom as well as the previous day’s learning during intervention time. This review time was extremely important for this group of students. It allowed for students to become re-engaged and ready for learning.

The unit began with a study of multiplication and division problem including one-digit by one-digit, two-digit by one-digit, and two-digit by two-digit multiplication problems. Students had prior knowledge in all of these types of problems, but continued to struggle with some of the basic facts that were necessary for new learning. As a result, there was quite a bit of practice with multiplication and division during the first three days of intervention classes. Along with the multiplication practice, the bar modeling strategy was taught and practiced both whole group and independently. Student understanding was observed by the intervention teacher and based on student work.

After the initial lessons with multiplication and division number stories and bar modeling, the lessons and practice moved into multi-step problems. These problems involved addition or subtraction alongside a multiplication or division problem. Students practiced using the bar model strategy with these problems. The first three days focused on multi-step problems with multiplication and the last

three days focused on multi-step problems with division. There were four formative assessments consisting of one multi-step problem given at the end of lessons (See Appendix C). The formative assessments, along with observation of students and their work, helped to determine student understanding and what concepts still needed more practice.

The six students were given a posttest of the unit in their homeroom class. The posttest was exactly the same as the pretest. Each of the third grade teachers corrected their tests in the same manner in order to preserve test fidelity. These test scores were shared with Teacher A.

Upon the completion of the unit, students were given the student math survey to see if attitudes about math changed over the course of the unit (Appendix A).

Teacher B works as a math resource teacher within two different classrooms at School B. Data was collected in Classroom One for seven consecutive days. The group consisted of nine third graders that are considered at grade level. The remaining three third graders work at a fourth grade level. This group of nine third graders was given a pretest on division, which consisted of mental division, quotient and remainder, odd and even numbers, and division without remainders and regrouping (Appendix D). The pretest was derived from the Math in Focus (2013) grade three curriculum. As a result of the pretest, Teacher B was an additional teacher in the classroom, working alongside the homeroom teacher with the nine third grade students. Instruction took place during a 60-minute math period each day. The lesson format included a warm up which reviewed previous learning, whole group instruction and practice of division concepts, and individual practice in the student workbook. During direct instruction, one teacher was teaching while the other was circulating the room answering questions and supporting students. An exit slip was administered on day four of instruction to assess student understanding of division concepts in a format that students had learned (See Appendix E). At the end of the chapter, all nine students were given a posttest identical to the pre test, which was corrected by

Teacher B. The scores were shared with homeroom teachers. The formative assessments, along with observation of students and their work, helped to determine student understanding and what concepts still needed more practice. Formative assessments were corrected by the teacher and scores were shared with Teacher B.

Data was also collected in Classroom Two for seven consecutive days. The group consisted of eight third graders that are considered at grade level. The remaining four third graders work at a fourth grade level. This group of eight third graders was given a pretest on Common Core standard 3.OA.3, which consisted of solving multiplication and division story problems by using equations and model drawings (See Appendix F). As a result of this pretest, Teacher B instructed these eight students within the classroom. The other two teachers were instructing students at the fourth grade level and above, within the classroom. Instruction took place during a 60-minute math period each day. The lesson format included a warm up which reviewed previous learning, whole group instruction and practice of multiplication and division stories, and individual practice. The unit began by asking students to solve story problems in two ways using strategies of their choice. Students shared their strategies, which included repeated addition and subtraction, drawing pictures to solve, and mental math. During each class period, Teacher B instructed students on solving multiplication and division story problems using different strategies. The strategies included equal groups, equal shares, writing equations using variables, and bar models.

The review and practice materials (see Appendix G) came from a few sources, which included Math in Focus (2013), Math Expressions (2013), and online resources such as Illustrative Mathematics (2013). The formative assessments, along with observation of students and their work, helped to determine student understanding and what concepts still needed more practice.

An exit slip created by Teacher B was administered on day four of instruction to assess student understanding of the process of creating a bar model to solve a story problem (see Appendix G). At the end of the chapter, all eight students were given a posttest identical to the pre test, which were corrected by Teacher B. The scores were shared with homeroom teachers. In class work was corrected by Teacher B and scores were shared with homeroom teachers.

Upon the completion of the unit, students were given the student math survey to see if attitudes about math changed over the course of the unit.

### Data Analysis

The data that was collected from School A included a pretest, exit slips, teacher observation of student work, and a post-test. The pre and posttests were given in the students' homerooms, while the exit slips, surveys, and observations took place in the intervention classroom. The data that was collected at School B from two classrooms included a pretest, an exit slip, teacher observation of student work, and a post-test. All School B assessments were given by the math teacher.

Both schools gave a math survey prior to and after the unit regarding student feelings and belief about math. The survey items were the same at both schools.

To protect the identities of the third grade students participating in this study, each student was given a letter and a number as an identifier. The "A" in the student identification refers to School A. The "B" in the student identification refers to School B. The classrooms are labeled Classroom "One" and Classroom "Two."

### **Math attitudes survey- School A and School B**

At the beginning and end of the unit, students from both School A and School B took a math survey about their feelings about math, how they learn best, the support they receive at home, and how they see math related to their future.

In terms of attitudes related to math, the survey results overall were positive. When students were asked if they enjoyed math (Figure 1), the majority of students said they sometimes enjoy math. This was reported on both the pre-unit and post-unit surveys. The majority of students also believed that sometimes they were good at math (Figure 2) on both the pre-unit and post-unit survey.

On the pre-unit survey and the post-unit survey, students expressed an interest in working with others both when learning a new concept and when solving problems. All students said in both the pre-unit and post-unit survey that when it comes to trying their best before they ask for help they do so sometimes or always. Additionally, only two students believe that homework never helps them understand a concept. While some students believe homework always helps them, the majority of students think that homework only helps them sometimes.

All students receive parental help on their homework sometimes or always. This was a positive statistic as it shows that students have some support at home, even if it is not all of the time. Student attitudes about their future in math were also positive. All of the students believe that if they try hard they will improve in math. Only one student believes that math is not important for the future. All of the other students see math as an important skill for any career path they choose. This shows that students see the value in math and understand math skills important are in order to be successful.

The positive attitudes and beliefs regarding math is important for these struggling learners, and the data seems to indicate that students see the importance of learning and understanding math skills.



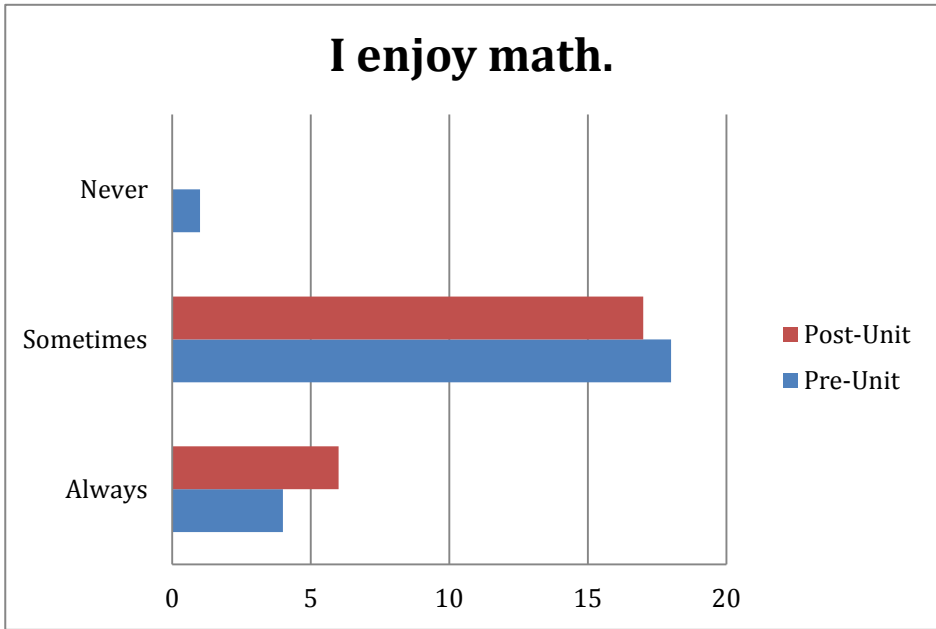


Figure 1

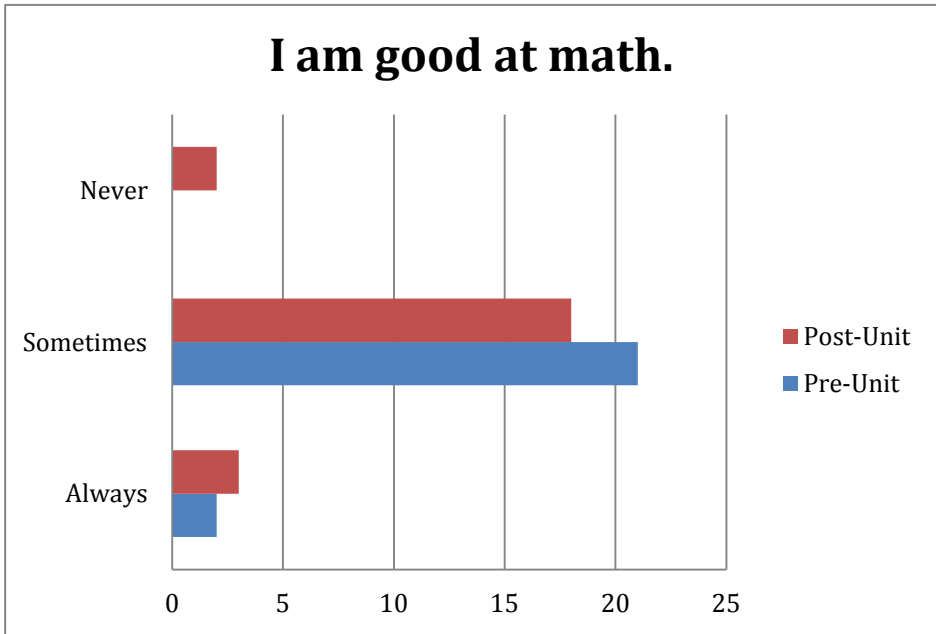


Figure 2

### *School A Data Analysis (Figure 3)*

**Student A1:** Student A1 received 29 percent on the classroom pre-test for the unit. The pre-test demonstrated the student's difficulty in understanding multiplication and division, as well as a lack of knowledge in the bar modeling strategy.

During intervention time, Student A1 was an active participant who, after classroom instruction, appeared to understand the concepts of multiplication and division, as well as bar modeling. Student A1 was able to demonstrate the thought process, as well as answer questions directed to the group. While this student could understand the process, it appears that it did not always transfer when formative assessment occurred. On Exit Slip Number One, Student A1 only attempted one step of the multi-step problem and that attempt was incorrect earning Student A1 a zero out of three points. There were similar results on Exit Slip Number 2 along with incorrect computation. There was improvement on Exit Slip Number Three when Student A1 earned two out of three points. On this exit slip, the student set up the problem correctly but incorrectly divided to get the final answer. On the final exit slip, Student A1 completed all parts of the problem correctly and earned three out of three points. Student A1's difficulty recalling basic multiplication and division facts was the main factor in Student A1's struggles with this unit. Despite the performance inconsistency, Student A1 received a 91 percent on their post-test in the classroom.

**Student A2:** Student A2 also scored a 29 percent on the classroom pre-test for the unit, demonstrating a lack of multiplication and division skills. This student was an active participant during intervention time. However, Student A2's performance was inconsistent. Student A2's first exit slip was perfect and met all the requirements earning the student three points out of three. However, the other exit slips earned lower scores. On the second exit slip, Student 2A received a zero out of three, as the

student completely missed all of the requirements of the exit slip. On both of the final two exit slips, Student 2A earned two points out of three by only partially meeting the requirements.

Student A2's willingness to participate in classroom activities may have helped to strengthen the student's skills in this unit. However, it appears Student A2's poor computation skills interfered with complete mastery of this topic and the student earned a 65 percent on the posttest in the classroom.

**Student A3:** Student A3 scored zero percent on the pre-test in the classroom. This student's attendance is very poor. As a possible result of this poor attendance, Student A3's academic performance is well below that of their peers. Basic number sense skills such as basic addition, subtraction, multiplication, and division may be missing which appears to make learning new mathematical concepts extremely difficult.

Student A3 only was present for three of the four exit slips. This student had continuous problems demonstrating understanding of the concepts. On the Exit Slip #1, Student A3 received one point out of three, as they were able to complete the initial addition needed to solve the problem. There was an attempt made at drawing a bar model of the problem, even though it was incorrect. Student A3 received a zero out of three on Exit Slip #3. This student had incorrect computation and also added instead of dividing. On the final exit slip, Student A3 earned one point out of three, as the initial set-up of the problem was correct. However, Student A3 continued to struggle with computation, which made it difficult to solve the problem.

Student A3's poor attendance record and an apparent lack of understanding of basic skills hinders academic performance. In addition, Student A3 lacks focus, which was evident in observable student behaviors including looking around the room, playing with materials, talking to other students, and having difficulty sitting properly in a chair. As a result, Student A3 often needs redirection to focus attention back to the learning task. On the classroom post-test, this student received an 18 percent.

**Student A4:** Student A4 received a 19 percent on the pre-test, which showed an inability to understand multiplication and division stories with bar modeling.

This student shows inconsistency in their math performance. One day the student will be actively participating and giving correct answers and the next day participation is less. The student seems to view the same material as new as demonstrated by limited recall. The classroom teacher also sees this type of inconsistency in all academic areas.

Student A4 was present for only three of the four exit slips. In all three of the exit slips that were completed, the first step involving adding was done correctly. The follow up steps of multiplication or division were incorrectly done in all three completed exit slips. However, improvement was shown on Exit Slip #4 where Student A4 earned two points out of three instead of one. On the final exit slip the student set up the problem correctly, but divided incorrectly resulting in an incorrect answer. Despite demonstrating a greater understanding of the process for these types of problems, the lack of computation skills resulted in a 65 percent on the classroom post-test.

**Student A5:** Student A5 received zero percent on the pre-test. This student also appears to struggle due to lack of number sense as they demonstrated difficulty in recalling basic multiplication and division facts that were related to the problems that were being worked on in class. Student A5 is also very inconsistent in demonstrating mastery of a skill. The student also tries to work ahead of the group, in turn missing a key instructional element, which puts the student further behind.

Student A5's exit slips show how the lack of focus and lack of number sense contributes to this student's math struggles. On Exit Slip #1, Student A5 received one point out of three. The student was able to complete the addition step of the problem, but was unable to use that information to multiply to find the final answer. The second exit slip was much improved with the student completing the problem accurately and thoroughly and earning three points out of three. This was despite the fact the student

claimed, “I don’t know how to do two-step problems.” Student A5 earned two out of three points on the third exit slip. The problem was set up correctly and the addition was done right. However, the division part of the problem was incorrect. On the final exit slip, Student A5 earned one point out of three. The problem was set up correctly but the computation was incorrect. Despite a wide range of scores on the exit slip, Student A5 was able to earn a 73 percent on the post-test.

**Student A6:** Student A6 earned 14 percent on the pre-test. This student demonstrated a greater mastery of basic facts than the other students, but had difficulty staying focused and on task. When asked a series of basic multiplication facts in the game “Around the World,” the student was able to give the correct answer. When working in a large group, the student was able to answer questions related to specific math facts. However, Student A6 often looked around the room and talked to others, which required the student to be redirected to the learning task. The classroom teacher reports this student has difficulty completing classroom assignments. Student A6 does better in a smaller group as demonstrated by the student’s ability to participate and complete work, but still has focus issues. Because of attention issues, this student’s ability to retain information may be greatly affected.

Student A6 did poorly on the first two exit slips, receiving zero out of three points on both assessments. On both exit slips, Student A6 was unable to set up the problem in the correct manner. The computation was correct but it was not the right operation. However, on the last two exit slips, Student A6 completed the problems correctly, earning three out of three points on each. The overall lack of focus may cause Student A6 to miss out on instruction in both intervention and the classroom. Despite knowing more basic facts than the other students in the intervention group, Student A6 had difficulty demonstrating mastery of the concept and earned a 65 percent on the post-test.

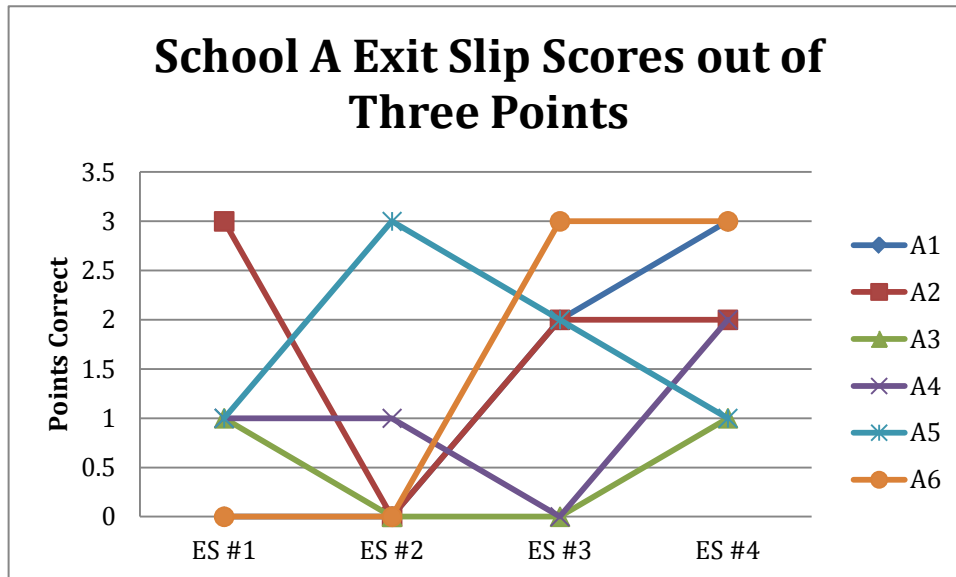


Figure 3

### Overall Conclusions from School A

In general, the six students from School A demonstrated growth in their knowledge of multiplication and division number stories from the pre-test to the post-test (Figure 4). Each of the six students raised their percentage significantly from their starting score. Clearly the instruction the students received helped increase their knowledge of the skill. However, only two of the six received a grade of C or higher, raising questions about the unit instruction and the needs of the students. Part of the problem for this unit may be the lack of number sense demonstrated by the six students. The students were able to explain, with help, how to do the problems, and could even set many of the problems up on their own. The real problem came when students were determining what operation to use and then completing the operation. Many times students were unable to identify which operation was supposed to be used.

When they were able to identify the operation correctly, they often did the wrong computation.

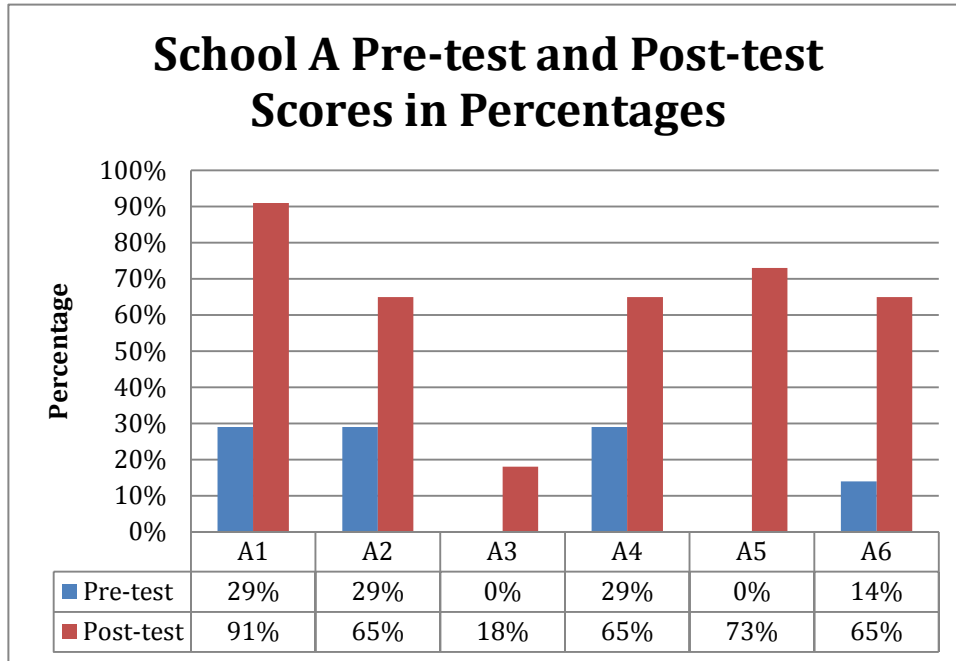


Figure 4

**School B Data Analysis**

**School B, Classroom One (Figure 5)**

**Student B1:1** Student B1:1 scored 62 percent on the pretest. This student showed mastery of basic multiplication and division facts, but showed difficulty with place value, and long division. He was an active participant in class, and was able to answer questions related to multiplication and division in the large group setting. This student completed all problems correctly on the exit slip. Despite his focus and participation in class, he only earned one more point on his posttest increasing his percentage to 69 percent.

**Student B1:2** This student shows mastery of basic multiplication and division facts and concepts, and scored 85 percent on the pretest. The student tended to rush through her work and seemed

less focused as other students. This often resulted in error in classwork. This student earned full points on the exit slip, but her post-test score of 77 percent was lower than the pre test score. This student is the only student that did not increase their score from her pretest to posttest. This may have been due to the fact the student often does not take time during their work.

**Student B1:3** This student earned 62 percent on her pretest. The student was very focused during instruction time and asked questions when not understanding. They worked well with their partner during student work time as well. Student B1:3 earned 6 out of 6 points on her exit slip. The posttest score increased to 77 percent.

**Student B1:4** The pretest score for this student was 38 percent. Student B1:4 works very quickly on classwork and asks many questions. This student was often the first student finished. They showed knowledge of basic skills on the pretest, but struggled with division with remainder concepts. The student's score of six out of six points on the division exit slip showed student learning since the pre test. This student was one of the students that checked "never" to the statement, "I am good at math." Student B1:4 increased her score on her pretest significantly, earning a 62 percent on the posttest.

**Student B1:5** Student B1:5 struggled with focus and attention at times during the math instruction period. The student often was looking around the room or distracted by an object or another classmate and needed to be redirected. Student B1:5 had a pretest score of 23 percent and demonstrated a lack of understanding of basic multiplication and division skills. The second teacher in the classroom was often working with this student during the instruction time and student work time. The student scored 31 percent on the posttest, which may be because they did not read the questions carefully or due to a lack of knowledge of basic multiplication and division number sense. The answers Student B1:5 provided were not consistent with what the questions were asking.



**Student B1:6** This student scored 23 percent on the pretest. During math instruction the student was not confident in their ability as demonstrated by the continued questions asked with the majority of the work. Student B1:6 often asked questions such as, “Did I do this right?” or “Can you help me with this? I can’t remember what to do next.” This student does show basic multiplication and division fact knowledge, but did make minor errors in their work. The student scored 5 out of 6 points on the exit slip. Student B1:6 made one error on the exit slip when dividing mentally showing that they may need more practice with number sense, specifically multiplication and division facts. The student scored 62 percent on the post-test.

**Student B1:7** Student B1:7 scored 46 percent on the pretest. During class time the student needed to be redirected by one of the teachers often because of off task behaviors such as talking with a friend. This student demonstrated basic knowledge in multiplication and division number sense, but showed a lack of understanding with division with remainder concepts on the pre test. The posttest score increased to 69 percent and showed student learning with the concept of remainders.

**Student B1:8** Student B1:8 worked very slowly on the pretest and did not finish. The resulting score was 28%. During this math class the student was very articulate and took their time. Student B1:8 often raised their hand and asked questions to make sure the work was being done correctly. The student was on task and focused and worked well with peers. The exit slip score was 3 out of 6 points. When working individually with students B1:8, was showing understanding on the division with remainders concept. However, it appears that Student B1:8 may have been confused about the question on the exit slip, as they did not draw the correct number of equal groups. This appears to have been a point of confusion when looking for the remainder. This student significantly increased the percentage on the posttest and earned 88%. This may be due to attention to detail in the student’s work.

**Student B1:9** This student scored 38 percent on his pretest, and showed a basic understanding with multiplication and division facts. However, this student had a lack of understanding of division vocabulary and remainders. During instruction time, teachers rotated through the classroom and often stopped to work with this student individually. Student B1:9 made one error on the exit slip showing that they may need more practice with number sense, specifically multiplication and division facts. The posttest score increased to 62 percent.

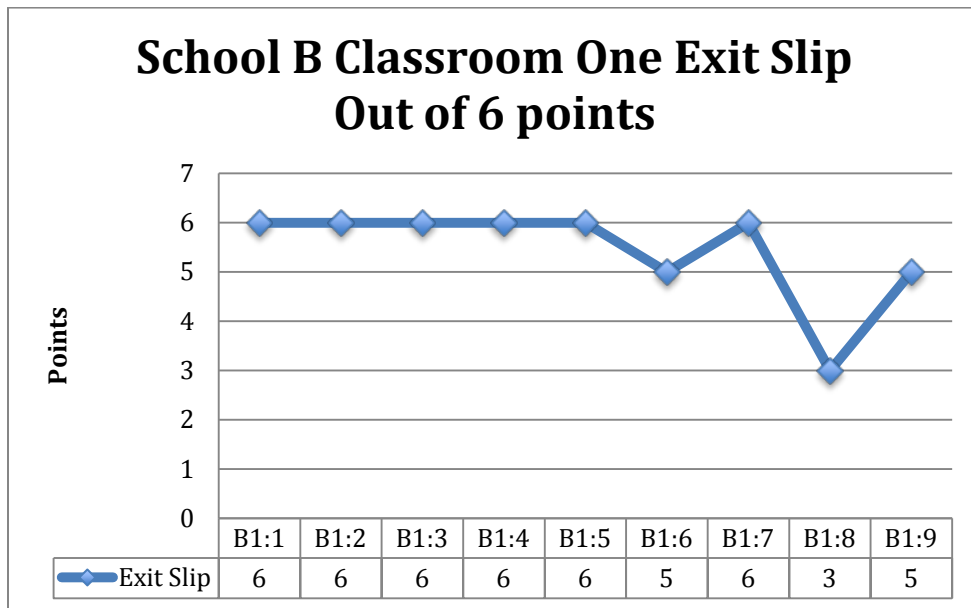


Figure 5

**Overall Conclusions from School B, Classroom One (Figure 6)**

Students from School B, Classroom One demonstrated growth in their knowledge of mental division, quotient and remainder, odd and even numbers, and division without remainders and regrouping. Eight out of nine students increased their score from pretest to posttest. (Figure 5) The instruction of two teachers in the math classroom may have helped to increase their knowledge of these skills. A few students in this classroom showed a lack of number sense skills with basic multiplication and division facts. Without this basic number sense, concepts in this unit seemed more difficult for

these students. With a small teacher to student ratio, student attentiveness, on task behavior, questioning and teacher proximity helped students to stay on task and work through each problem carefully and accurately.

Exit slips were administered on day four of this unit. Student B1:6, B1:3, B1:9 are the only three students who did not receive a perfect score on the exit slip. In general, students showed growth from pretest to posttest. Not only was there a score difference, but it was observed that students drew pictures using equal groups to solve problems on pre tests. This happened much less on the posttest. This is evidence that during the unit, students had learned strategies to solving division problems, especially with basic place value and vocabulary concepts such as “remainder”, and “quotient.”

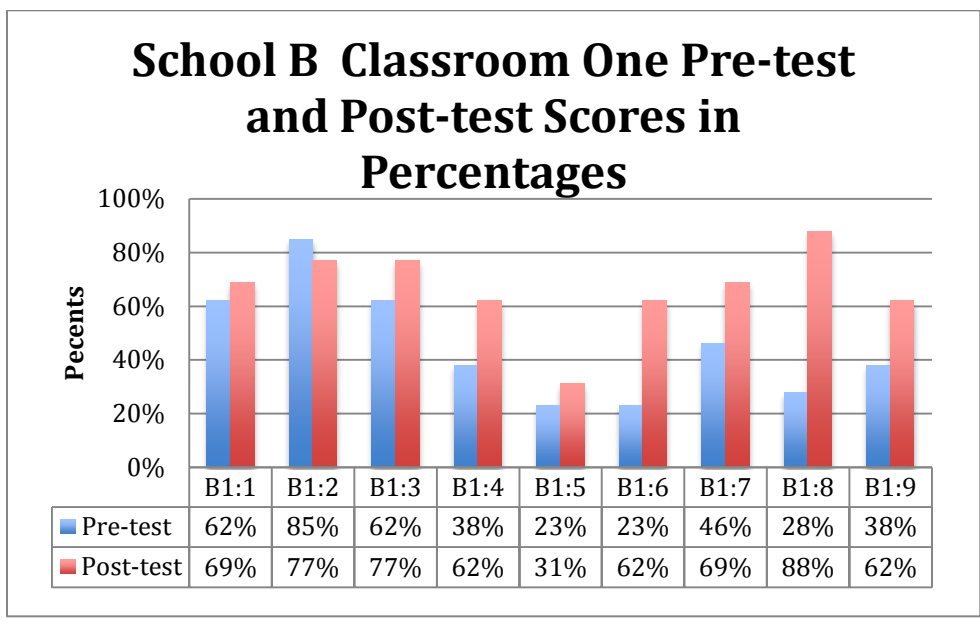


Figure 6

**School B, Classroom Two (Figure 7)**

**Student B2:1:** Student B2:1 did not finish the pretest after two class periods and earned a score of 30 percent. This student lacks understanding in basic multiplication and division facts, which was by the student wanting to be able to use a multiplication chart during work time to solve basic

multiplication and division problems. During the post test, the student may have benefitted from questions being read aloud. The student was able to catch mistakes and fix them on their own. On the post test the student scored 70 percent.

**Student B2:2** Student B2:2 scored 40 percent on the pre test. This student tended to rush through work and may not be confident in some multiplication and division facts, specifically multiplying by six, seven and eight. This was demonstrated by wanting to use a multiplication chart to help solve problems. Student B2:2 was often was distracted by other objects or peers during class and needed redirection. During the post-test the student needed extra help and further explanation with the concepts. The student scored 80 percent on the posttest.

**Student B2:3** This student demonstrated excellent thinking skills by using many strategies for solving problems. Student B2:3 scored 60 percent on the pre test. During the posttest the student needed to be reminded to read carefully. After rereading, Student B2:3 realized mistakes and fixed them. As a result, this student scored 100 percent on the posttest.

**Student B2:4** Student B2:4 demonstrated in the pretest that practice with basic number sense of multiplication and division facts was needed as the student scored 50 percent on his pre test. The student often wanted to use a multiplication chart to help solve problems during class time. Student B2:4 participated often during class time by asking questions and explaining strategies for solving problems. This student benefitted from teacher proximity and extra help, which showed in the posttest score of 75 percent.

**Student B2:5** This student's pretest score was 50 percent. The student demonstrated good thinking skills and the ability to produce great work when participating in class discussions. Often times, the student tended to rush through work forgetting important steps in the process or leaving out required items in order to get full points. The student's score on the exit slip was four out of six

points. This may have been improved if the student followed directions, as work showed understanding of the concept but did not include all required parts. This also showed on the posttest. Student B2:5 earned a score of 65 percent.

**Student B2:6** Student B2:6 scored 55 percent on the pre test. This is another student that lacks basic understanding of number sense with multiplication and division facts. Student B2:6 consistently needed extra help with basic facts during class time. The student also needed to be prompted by the teacher to participate during class. The exit slip score was five out of six points. Extra practice with multiplication and division facts may benefit this student based on the posttest score of 50 percent. Student B2:6 was one of the two students who did not show growth from pretest to posttest.

**Student B2:7** This student's score on the pre test was 80 percent. Student B2:7 was a very quiet student during instruction time and did not participate in class very often. Based on the exit slip score of six out of six points, and the in class work, this student demonstrated different strategies and takes time with work. The posttest score was 70 percent.

**Student B2:8** Student B2:8 score on the pretest was 90 percent. The student's knowledge of basic multiplication and division facts seem to help develop strategies for solving problems and producing excellent work. This student does sometimes need clarification when reading story problems. During the post-test the student needed extra help getting started and asking questions. Student B2:8 was able to organize their thinking and solved the problems on their own. This student's score on the posttest was 100 percent.

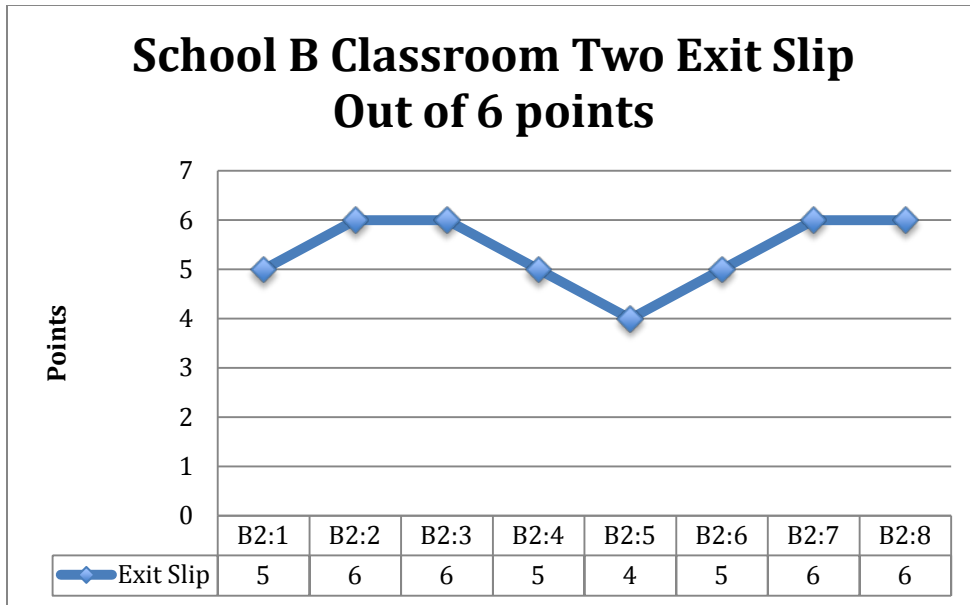


Figure 7

**Overall Conclusions from School B, Classroom Two (Figure 8)**

Students from School B, Classroom Two demonstrated growth in their knowledge of solving multiplication and division story problems by using equations and model drawings. Six out of eight students increased their score from pretest to posttest. (Figure 8) Students were grouped based on their level. All eight students in this class were instructed by the math intervention teacher and were placed in this group because of their pre test scores. A few students in this classroom showed a lack of number sense skills with basic multiplication and division facts. Without this basic number sense, concepts in this unit seemed more difficult for these students. Exit slips were administered on day four of this unit. Four out of eight students did not receive a perfect score on the exit slip. However, students showed growth from pretest to posttest. Students also showed growth on their student work and participation in class, which is evidenced by the strategies that were observed by the teacher and discussed in class.

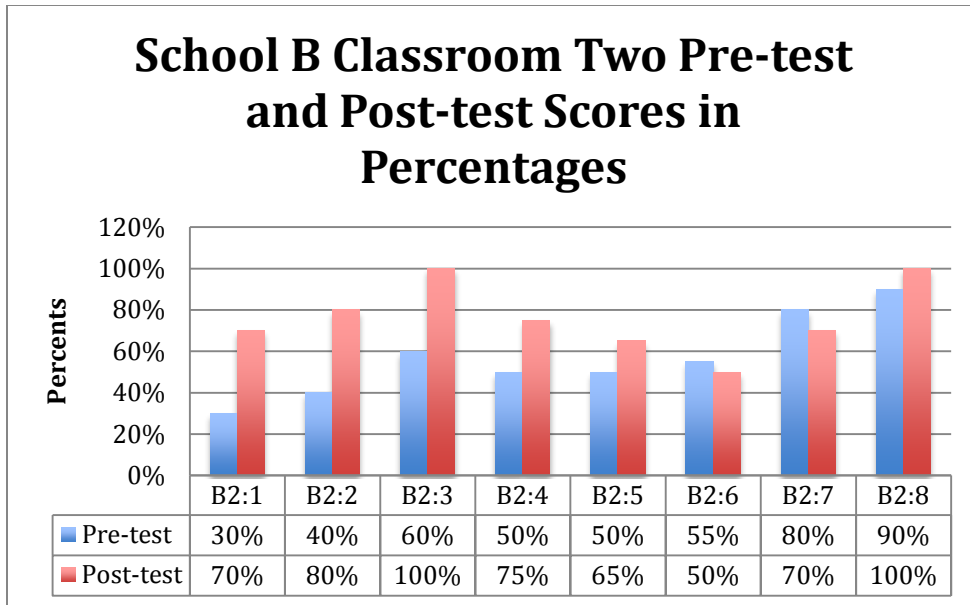


Figure 8

#### Action Plan

Students from School A all increased their scores on the unit post-test. While it appears that the students benefited from small group intensive instruction, it is hard to know for sure how much of the improvement was a result of small group instruction and whole group, classroom instruction. An assumption perhaps can be made that if students are receiving individualized attention and specialized guidance there is a greater likelihood of effort by students. Perhaps this additional effort can result in student improvement.

All students from School B, Classroom One increased their scores on the unit post-test, with the exception of one student. By having two teachers in the classroom, students benefitted by having the opportunity to ask questions and work individually with teachers. Students also performed well on their exit slips, which also may have been a result of a smaller teacher to student ratio.

In School B, Classroom Two, all students increased their scores on the unit post-test with the exception of one student. These students may have benefitted by being placed with at grade level peers in a group setting.

Aside from group size and teacher to teacher ratio, another factor in performance may be attributed to the mathematical ability and skills of the students in the study. At both schools, the computation errors of the students may have impacted their ability to fully demonstrate understanding of the concept that was taught. Basic operations of addition, subtraction, multiplication and division are integral pieces of prior knowledge for the unit. Unfortunately, many of the students at School A demonstrated an inability to either identify the operation that was being used or difficulty in solving a basic operation. Some students from School B demonstrated difficulty with basic number sense such as multiplication and division facts. This may have impacted their ability to solve more complex multiplication and division concepts. Mathematical understanding involves both conceptual knowledge of numbers and an ability to use that conceptual knowledge to carry out procedures.

School A's intervention plan involves students being pulled out of the classroom for small group instruction, while School B's model involves an intervention teacher coming into the classroom and teaching alongside the homeroom teacher or with a small group. Both of these intervention models involve identifying students who need extra support, but the support is given in a different way. One aspect that we were curious about going into this project was if both models were effective. We wondered if one method could be shown to be more effective than the other. Despite the different settings and model of interventions, we attempted to measure effectiveness of both so what we are able to use the method that seems most beneficial for students.

The research shows that students benefited from both intervention models. The pullout model included students who were below grade level and needed more individualized attention. The pullout model appears to work well for these students because of the small size of the group and the opportunity for the reteaching of important skills. The students were surrounded by students at the same ability level, which allowed for the intervention teacher to teach lessons targeting the skills necessary for success in



the unit. This targeted, small group instructional model is effective in reaching lower achieving students and will be continued to be used in future practice.

The push-in model included students who were at grade level. The group size was larger than the pullout group but smaller than the regular classroom. This allowed for a group of students at the same ability level to work together on the target skill. It appears that this model worked well for students who pre-tested with grade level knowledge as it allowed them to the opportunity to continue to study and practice of the unit skills with others at their same ability level. This model demonstrated a positive outcome for on-grade level students and will be considered by us as a future instructional practice.

The results of this research demonstrate a greater need to focus on the basic building blocks of mathematics including instruction and practice on basic addition, subtraction, multiplication, and division facts. Without knowledge of these core skills, it appears to be difficult to learn higher-level skills, which may inhibit student learning of a concept. This demonstrates a need for interventions that help students to develop fact fluency. The small intervention group would be an ideal place for students to practice their facts in conjunction with working on the skills that are being addressed in the math unit in their classroom. Allowing for a few minutes each day to practice skills would require some adjustments to the intervention classroom, but the outcome may be worth the time commitment. It would be beneficial for each of these schools to continue to use a math interventionist to help focus on teaching those students with the greatest need whether it be pushing into the math classroom or pulling students out of the classroom.

The results from School A within this research shows that pulling students out of the classroom into an intervention classroom with one teacher may improve student performance. This method allows for grouping students based on pretest scores of each unit. The groups are smaller, which allows for more one-on-one time between student and teacher. It, also, allows for more collaboration among

students and, possibly, for students to feel more comfortable in their setting. This model showed positive results based on the findings of the research.

The results from School B within this research shows that flexible grouping can be done within the classroom based on pre test scores of each unit. An additional teacher pushing into the regular math classroom benefits students and gives them more opportunities to ask questions and work more individually with teachers and with peers at their own level. This model may be beneficial for other schools to adopt to improve student performance.

In order to measure the long term effectiveness of the methods described in this study, students who took part in this research could be followed-up with after a set amount of time to see if they continue to demonstrate growth and understanding of the concept of multiplication and division. Further research could also examine the effectiveness of placing on grade level students in small, pullout intervention groups. The research could focus on targeting students who have the grade level skills to see if small group individualized instruction could impact their learning, perhaps taking the students' skills to a higher level. Finally, using these two methods with students who do have the basic skills and knowledge base necessary to complete work may help "tease out" the effectiveness of pull-out and push-in models. As stated previously, it is difficult to teach higher level skills when the foundational skills are lacking. Bringing together groups that do have the basics mastered and then teaching new skills in a pull-out or push-in program may help researchers determine which model produces the best results.

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## Student Math Survey

I enjoy math.

- All the time
- Sometimes
- Never

I am good at math.

- Always
- Sometimes
- Never

When I am learning a new concept in math, I like to work...

- By myself
- With a partner
- In a small group
- With the whole class

When I am learning a new concept in math, I like to...

- Talk about it
- Write about it
- Think about it

I like to solve problems...

- On my own
- With a partner or group

I try my best before I ask for help.

- Always
- Sometimes
- Never

Homework helps me to better understand what I am learning in math.

- Always
- Sometimes
- Never

My parents help me with my homework.

- Always
- Sometimes
- Never

I believe if I try hard I will get better at math.

- Yes
- No

I think math is important for my overall success in life, regardless of what career path I choose.

- True
- False

Name \_\_\_\_\_

Date 1/17/14

### Chapter 9 Pre-Test

+ 2  
7pts.

Solve. Use the bar model to help you.

1.  $\begin{array}{c} 12 \\ \underbrace{\hspace{2cm}} \\ \hline \square \quad \square \quad \square \quad \square \end{array}$

1pt.  $\begin{array}{r} 12 \\ \times 3 \\ \hline 36 \end{array}$

2.  $\begin{array}{c} 15 \\ \underbrace{\hspace{1cm}} \\ \hline \square \\ \hline \square \quad \square \quad \square \quad \square \quad \square \quad \square \end{array}$

1pt. 1 Unit  $\Rightarrow$  \_\_\_\_\_

1pt. 6 Units  $\Rightarrow$  \_\_\_\_\_

3. Mrs. Preston spends \$24.

Mrs. Stoltz spends five times as much as Mrs. Preston.

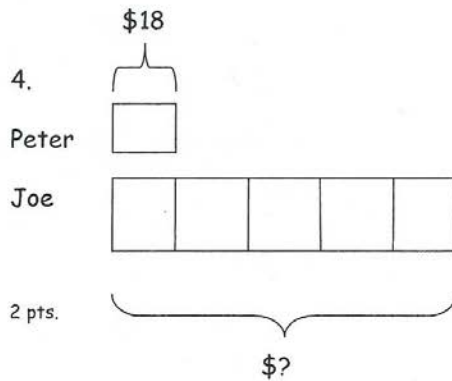
1 pt. How much money does Mrs. Stoltz spend?

$$\begin{array}{r} 24 \\ \times 5 \\ \hline 120 \end{array}$$



1 pt. Mrs. Stoltz spends \$ 120.

Write a word problem using the bar model given. Then solve the problem.





Appendix C

Name: \_\_\_\_\_

**Solve the problem. Show your work. Write your answer in a complete sentence.**

Annie has 12 chocolate chip cookies and 10 sugar cookies in one bag. She has 5 bags. How many cookies does she have in all?

Appendix C

Name: \_\_\_\_\_

**Solve the problem. Show your work. Write your answer in a complete sentence.**

Ali has 34 "Captain America" comic books and 26 "Thor" comic books. She puts the comic books into 5 boxes. How many comic books are in each box?

Appendix C

Name: \_\_\_\_\_

**Solve the problem. Show your work. Write your answer in a complete sentence.**

Oliver is making party favors. He puts 8 Starbursts and 14 Hershey Kisses in each bag. There are 7 bags. How many pieces of candy does Oliver have?

Name: \_\_\_\_\_

**Solve the problem. Show your work. Write your answer in a complete sentence.**

Nick bought 35 red balloons and 45 blue balloons. He wants to make bunches of balloons. How many balloons are in each bunch?

Name \_\_\_\_\_ Date \_\_\_\_\_

### Division Post-Assessment

1. Divide 25 tens by 5. What is the answer?
  - a. 5 ones
  - b. 50 ones
  - c. 15 tens
  - d. 50 tens
  
2. What do you get when you divide 23 by 3?
  - a. 2 remainder 7
  - b. 7 remainder 2
  - c. 7 remainder 3
  - d. 2 remainder 3
  
3. Divide 48 by 4. What is the quotient?
  - a. 12
  - b. 14
  - c. 15
  - d. 17
  
4. Which number when divided by 2 will leave a remainder of 1?
  - a. 12
  - b. 15
  - c. 16
  - d. 21
  
5. Mary has 84 oranges. She puts an equal number of oranges into 2 baskets. She puts the remaining oranges in the refrigerator. How many oranges does Mary put into each basket?
  - a. 39
  - b. 40
  - c. 42
  - d. 47
  
6. Divide 75 by 4. What is the remainder? \_\_\_\_\_

Appendix D

7. When 18 is divided by 5, both the quotient and the remainder are the same number. What is the number?

\_\_\_\_\_

8. What number belongs in the box?

$$\begin{array}{r} \phantom{4} \phantom{9} \text{R}3 \\ 4 \overline{) 99} \end{array}$$

9. 700 7 has the same value as \_\_\_\_\_ x 10.

10.  $A \times A = 81$

63  $A = B$

Appendix D

What does B stand for? \_\_\_\_\_

11. A baker buys 98 eggs to bake cakes. He uses 3 eggs for each cake. He bakes as many cakes as possible. How many eggs does the baker have left?

\_\_\_\_\_ eggs are left.

12. 3 friends share 19 pencils equally. How many pencils does each friend have?

Each friend has \_\_\_\_\_ pencils.

How many pencils are left over?

\_\_\_\_\_ pencils are left over.

Appendix E

Name \_\_\_\_\_ Date \_\_\_\_\_

Divide Mentally.

1.  $40 \div 8 =$

2.  $320 \div 8 =$

3.  $2500 \div 5 =$

Solve.

Four dogs share 19 dog treats equally. How many dog treats does each dog have?

$19 \div 4 =$

How many dog treats are left over? \_\_\_\_\_

What is the quotient? \_\_\_\_\_

What is the remainder? \_\_\_\_\_



Name: _____	Date: _____	
<b>3.OA.3</b>	<b>Standards Based Assessment</b>	Score
<p>1.) Mr. Smith pays \$9 each day to take the subway to work. What is the total Mr. Smith paid after 5 days of work?</p> <div style="border: 1px solid black; height: 150px; margin-top: 5px;"></div>	<p>2.) Thomas had 20 cherries to divide into 5 bowls. How many cherries will be in each bowl? Draw a picture to help solve for the quotient.</p> <div style="border: 1px solid black; height: 150px; margin-top: 5px;"></div>	
<p>3.) Harry had enough pancake mix to make 64 pancakes. He will make 8 pancakes at a time. How many times can Harry make 8 pancakes?</p> <div style="border: 1px solid black; height: 150px; margin-top: 5px;"></div>	<p>4.) Colton buys seven 9-packs of pencils on sale. How many pencils does he get? Draw a picture below to show your understanding.</p> <div style="border: 1px solid black; height: 150px; margin-top: 5px;"></div>	
		# Incorrect

## Appendix G

Draw a unit bar to solve this problem.

A garden has 40 flowers. Each row has 8 flowers. How many rows of flowers are in the garden?