Capstone B

Mathematics Manipulatives

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July 27, 2009

Abstract

The purpose of this paper is to share the results of a fourteen-week study that focused on the effects of teaching mathematics instruction with the implementation of manipulatives in an elementary classroom. Students that fill our classrooms deserve the opportunity to use manipulatives to help them grasp all the different concepts that are taught during mathematics instruction. For this project, two fourth grade classrooms will be studied. These two classes are going to be introduced to division concepts. In one classroom, the use of manipulatives will be introduced in context with the division problems. The other classroom will not use manipulatives. Therefore, the variables for this Action Research Project are the use of manipulatives in the classroom and the student's test scores. The interventions for this study are implementing the use of manipulatives into mathematics instruction for students in elementary school. Division can be a very hard concept for children to comprehend, therefore, breaking the process down by using hands-on materials, will allow the students to fully understand the operation and successfully divide numbers.

Introduction

Manipulatives are a great tool to use in the classroom to motivate students and help them to succeed. The purpose of this study is to determine if the use of manipulatives can improve the grades of fourth grade students. This Action Research Project will be conducted during mathematics instruction over a fourteen-week period. This project will take place in two different fourth grade classrooms in Lincroft, New Jersey. One classroom will use manipulatives to help them understand the concepts and one classroom, the control group, will not use any manipulatives. This study is designed to understand if the use of

mathematics manipulatives will or will not improve the success of elementary students. The area of focus for this research project is to determine if the use of manipulatives can increase math grades in an elementary classroom.

Review of Literature

Using a variety of resources for my Action Research Project will make it valid and reliable. It is important to research many different types of literature to fully comprehend the subject matter of my research project. For my Action Research Project, I have comprised a total of ten pieces of literature to include in my study. The first piece of literature that is related to focus is:

Battle, T. (2007). Math manipulatives: The key to an increase in academic achievement in the mathematics classroom: *Increase in academic achievement, 1-29.*

This mathematical analysis explains how the use of manipulatives will improve student learning in an elementary classroom. It demonstrates how important the use of manipulatives are in the classroom and how manipulatives will help children to relate to real life experiences easier. Battle describes this, “No matter where we turn or what we do, we as a society are using some form of manipulative in our lives” (2007, p. 2). There are many unique ideas in this document about how using manipulatives in mathematics can help students that usually struggle in the subject. The use of manipulatives in mathematics takes away the abstract thinking that is usually involved in the concepts. This piece of literature supports the thinking that I initially had about how students will succeed in mathematics when the use of manipulatives are provided. Using this document will allow me to investigate my thinking on a deeper level and reveal important information about the topic.

Another great piece of writing to include for this research project is:

Carpenter, T. (2008). Using knowledge of children's mathematics thinking in classroom teaching: an experimental study. *American Educational Research Association*, 26, *499-531*.

This article challenges me to think about the mathematical issues that I am conducting research on. The goal is to determine if students will become more efficient math students when concepts are broken down for them and manipulatives are implemented into the classroom. This piece of literature shows me that different classrooms use different strategies to teach math. While reading this article, I realized that I can rely on this information. Mills describes what a reliable source consists of, "In a refereed journal, articles are reviewed by a panel of experts in the field and are thus seen as more scholarly and trustworthy than articles from nonrefereed or popular journals" (2007, p. 37). As I research literature for my project, I continuously look to ensure that they are dependable sources.

This next article is something I felt important to include in my research:

Hodge, L. (2008). Student roles and mathematical competence in two contrasting elementary classes. *Mathematics Education Research Journal, 20, 32-51*.

This analysis describes two different math classes. It shows that using different teaching strategies in the classroom will improve student learning. This type of literature allows me to see two different teaching approaches to mathematics. The advantages and disadvantages are revealed about how different teaching strategies will affect the learning of students. This literature does present some promising practices that will help me to solve my problem about breaking down mathematical concepts for students to understand more thoroughly. Hodge explains an important teaching practice, "The analysis reported in this article emphasizes the importance of listening to students – not just their mathematical think and reasoning – but what they are thinking as they engage in certain activities, as they do

certain mathematics as it is constituted in specific classrooms" (2008, p. 33). This article is a great way to see my Action Research Project through someone else lens and help me to solve my problem. It will be an insightful article to use throughout this research project.

The next important piece of literature focuses on how to have fun while learning and teaching mathematics. This article is the following:

Lee, L. (2007). Learning math and loving it with manipulatives and games. *Christian, Education, Family & Parenting, 1-7.*

This is a great article that has a variety of suggestions about using manipulatives in the classroom as a fun learning tool. I do agree with this article because children are allowed to have fun and learn at the same time. It is a wonderful way for students to have a positive learning experience in school.

Another article that I found while researching my topic is one that challenges my viewpoints about using manipulatives to improve student learning. This piece of literature is cited as the following:

McNeil, N. (2007). When theories don't add up: disentangling the manipulatives debate. *Theory into Practice, v 46, 309-316.*

McNeil explains how many educators do believe that manipulatives will improve student learning, but she does not completely agree with this notion. She explains her thoughts as this, "First, manipulatives might lead students to focus on having fun at the expense of deep learning" (2007, p. 306). This is an issue that I have thought about and have taken the time to observe in my classroom. I believe that manipulatives are fun to use for students, therefore, when students are first introduced to new manipulatives; teachers should allow ten minutes for the students to just relax and explore the manipulatives for fun. After that initial free time, the students get the fun part out of their systems and then will be ready

to use the manipulatives as a learning tool Also, the teacher should explicitly explain how manipulatives can be fun but their number one job in the classroom is to help learning. Therefore, I understand what McNeil is saying about manipulatives but I do not completely agree. I believe that manipulatives are a wonderful part of the learning experience and will allow students to have a deeper understanding of the concepts.

The next piece of literature that will be included in this project is:

Reimer, K. (2005). Third-graders learn about fractions using virtual manipulatives. *Journal of Computers in Mathematics and Science Teaching, 1-9*.

This article allows for the reader to see the issue "through someone else's lens" by introducing great ways to put manipulatives into action in the classroom. The author provides many excellent ways to use manipulatives as a great learning experience for the children. This article relates to something that Mills explains, "It also assumes that teacher researchers are committed to continued professional development and school improvement and that teacher researchers want to systematically reflect on their practices" (2008, p. 7). This article has provided me with a wealth of information that I will use in the future.

The next piece of literature that will be included in my Review of Literature portion of my research project touches upon another important topic to educators of mathematics. This article is referenced as the following:

Scott, E. (2008). Math manipulatives for special education students. *Make Math Concepts Easier to Understand, 1-8.*

The author of this article focuses on special education students that struggle in mathematics. Scott expresses the best ways in which to help struggling learners, "When students work with manipulatives, they are using their visual and tactile skills to enhance their learning experience" (2008, p. 2). Scott demonstrates many of the same beliefs I have

about using manipulatives in the classroom. Manipulatives work to help students become more efficient and active learners.

The next piece of literature that will be included in my Action Research Project is the following:

Smith, L. (2008). The effects of instructional consistency: Using manipulatives and teaching strategies to support resource room mathematics instruction. *Learning Disabilities: A Multidisciplinary Journal, v15,* 71-76.

This journal article includes results from a study about implementing math manipulatives in the Resource Room. For this case study, children who struggle with mathematics were placed in the Resource Room and received instruction using manipulatives to help with problem solving skills. This piece of literature supports my initial thoughts about this research project. It is meant to investigate if using math manipulatives in the classroom will improve student learning. Smith reveals the results of this study, "Pre-post results indicated support for the hypothesis that performance increases through the use of multisensory materials and strategies" (2008, p. 71). The key idea of this article expresses that students will become higher achievers in mathematics when manipulatives are included in instruction. These results correlate with the way I feel about my research project. As I continue to investigate my research I will see if I obtain the same type of results.

The next piece of literature for my research project is the following:

Steedly, K. (2008). Effective mathematics instruction. *National Dissemination Center for Children with Disabilities, 3, 1-11.*

After reading this article, I learned more information about the Action Research Project I am doing. One important feature of this article is the teaching method, Concrete-Representational Abstract (CRA). Steedly describes this teaching technique, "CRA is a three part instructional strategy in which the teacher first uses *concrete* materials to model the

mathematical concept to be learned, then demonstrates the concept in *representational* terms, and finally in *abstract* or symbolic terms" (2008, p. 8). This is a great process to break down the difficult math concepts into stages and ease children into the mathematical world. This article will help me with my project because it focuses on the same issues. Dorothy Korzym describes the significance of this, "Area of focus is a clear concise direction that you as the classroom teacher would like to go into to improve an area that there is a gap, to improve something your students are missing, or in my case it was just something I wanted to be better at" (*Video: Expert Commentary*, How can I identify an area of focus for my research?). As I continue my research about mathematical instruction, I want to ensure that I have a clear focus of study to reach my conclusions.

The last article is related to my focus statement and helps me to investigate my research further:

Waycik, P. (2006). Learning math with manipulatives. *Education Articles, 1-3.*

This piece of literature leads me to think about my initial thoughts and feelings about my Action Research Project because it focuses on the importance of manipulatives. When teachers introduce new mathematical concepts to students, it can be too abstract for them to comprehend. Therefore, the use of manipulatives into the equation can help to clarify the problem. Wakcik explains this idea, "Base ten blocks are just one of many excellent manipulatives available to teachers and parents that give students a strong conceptual background in math" (2006, p.2). Being able to successfully implement manipulatives into the classroom would help many students in learning math concepts.

Overall, these ten pieces of literature are all unique and will help me complete my Action Research Project successfully. They all have critical information included in them and will be used to help my focus of study.

Research Process

Research Questions	Data Source		
	1	2	3
1. Is there a correlation between using manipulatives and an improvement in math achievement in an elementary classroom?	Teacher Observation (Active Participant Observer)	Parent Surveys	Literature Review
2. Will students understand the transfer from the concrete use of manipulatives to the abstract form of numbers?	Teacher Observation (Passive Observer)	Likert Scale	Standardized Test (given without manipulatives)
3. Is there a difference on student scores on lessons with math manipulatives, compared to lessons taught without math manipulatives?	Teacher made Pre-test (given without manipulatives)	Teacher made Post-test (given with manipulatives)	Student Surveys

There are many different types of data collection techniques one could use to gather information for an Action Research Project. The first question I will be researching says, “Is there a correlation between using manipulatives and an improvement in math achievement in an elementary classroom?” This question will help me to come to a conclusion about if manipulatives will improve student learning. The first type of data collection I will use for this question are observations, which is a qualitative method. This technique can be very

helpful in the classroom. Mills describes this practice, "As teachers we are constantly observing our environment and adjusting our teaching based on what we see. Action research gives us a systematic and rigorous way to view this process of observation as a qualitative data collection technique" (2008, p. 57). By observing my students multiple times I will be able to determine if manipulatives in the classroom are improving student learning. Another data collection technique I will use is parent surveys. Parents are an essential part of my students learning and I would like to know their input about this subject matter. Having a parent fill out a survey about the use of mathematics manipulatives will provide me with descriptive information about my study. Another way to analyze my research question about student's scores and using manipulatives is by interpreting all of the literature research I completed. By reading different articles about manipulatives will help me share my research results.

The second question for my study is "Will students understand the transfer from the concrete use of manipulatives to the abstract form of numbers?" Being able to transfer knowledge from the concrete form to the abstract is an important feature of successful learning. By providing different sources I will be able to study the results of this question. Taking part is more observations will help me to study this research question. During this observation, I will be more of a passive observer. I will not include myself in the lesson, but simply just observe what the children are doing and saying about the manipulatives. The Likert scale is another data source that I will be using for my Action Research Project to determine if students are transferring their knowledge to think concretely then abstractly. Mills describes a Likert scale as this, "A Likert scale asks students to respond to a series of statements indicating whether they strongly agree (SA), agree (A), are undecided (U),

disagree (D), or strongly disagree (SD) with each statement" (2008, p. 75). The results to this instrument will help me to understand how students transfer their knowledge when manipulatives are involved. The thing I like most about the Likert scale is that it is numbers-based, but it also can reveal some descriptive information about manipulatives as well. Another way to assess if students have taken what they learned about the concrete use of manipulatives and transferred it to the abstract form of numbers is by administering a standardized test. The standardized test will be given at the end of the study without manipulatives. It will be a good evaluation to see if students now understand the concept strongly enough to apply it without the use of manipulatives.

Using teacher made pre-tests and post-tests will help me to target the research questions about determining if the use of manipulaitives will in fact improve student's grades. I will be able to see student scores before and after the implementation of manipulatives. These tests will give me numbers-based data, which will help me to share my results of this Action Research Project.

Time line

Dates	Type of Research
February 23, 2009- April 5, 2009	Collecting Data
April 6, 2009 – May 11, 2009	Analyze and Interpret Data
May 12, 2009 – May 29, 2009	Write-up research results

The amount of time it will take for this Action Research Project to be implemented, analyzed, and written up will be about a total of fourteen weeks, from February 23, 2009 to May 29, 2009. The first six weeks, February 23, 2009 to April 5, 2009 will be dedicated to

collecting data for my research project. The next five weeks, April 6, 2009 to May 11, 2009 will give me time to analyze and interpret my data. The last three weeks, May 12, 2009 – May 29, 2009 will be for writing up a unique presentation to share my results. In these fourteen weeks, I plan to work hard to find results that will improve student learning.

This Action Research Project will provide me with important information about the best way to teach a division lesson in an elementary classroom. When I am finished with this project, I will be able to share my results with members of this class, colleagues at school, and administrators. I truly believe this is an important research topic to investigate further. As a teacher, I want to instruct my students in the most effective way to improve student learning.

Data Analysis

As the research is analyzed and interpreted here, keep in mind that the classrooms that were studied for this project consist of twenty students each. Therefore, every survey, test, or observation is based on twenty students.

Research question one of my study asks if there is a correlation between using manipulatives and an improvement in math achievement in an elementary classroom.

The first data source that I used to analyze this question is teacher observations, where the teacher acted as an active participant observer. As the teacher, I observed the classroom ten times over the course of the study. 100 percent of those ten times I wrote down positive feedback remarks about using the manipulatives. I commented how the students all worked well with the manipulatives and were doing well on the class work assignments.

The second source used for the first research question was parent surveys. Parents are a huge component of a successful education for students and I felt that having them fill

about a survey about their child's mathematical education was really important. After reviewing the completed parent surveys, I found that sixteen out of the twenty parents felt that using manipulatives in the classroom really helps their child have a deeper understanding of the math concepts. The same sixteen parents also reported that they use manipulatives at home with their child because their child likes it and they understand it better that way. The other four parents reported that they think it is a waste of time and just want their students to do the computation accurately. The parents that stated this have children that are advanced learners and understand the concepts right away with or without the manipulatives. Although four of the parents disagree with using math manipulatives, the other sixteen are huge advocates of it. Therefore, this demonstrates to me that I have a majority of parent support when I use math manipulatives in the classroom.

The third data source used for this research question one is the research work of different pieces of literature. In order to fully investigate my study, I researched various articles about the use of math manipulatives in the classroom. Nine out of the ten articles support the idea that using manipulatives in the classroom is extremely important and significant to a successful education. One article in the literature review does not support the use of manipulatives in the classroom. The author of this article believes that students tend to use the manipulatives as toys in the classroom. As the teacher of the classroom, I make sure that my students are using the models as learning tools. Using this literature review as a data source that helped me to learn that manipulatives are a very important tool to use in the classroom.

The second research question in my study was if the students will be able to understand the transfer of knowledge from the concrete use of manipulatives to the abstract form of numbers

The first data source used for research question two is teacher observations as a passive observer. For these observations, the teacher's role will be to just simply observe a class that is working with manipulatives without interacting with the students. As the teacher for this research study, I was able to observe the classroom six different times. During these visits, the class would start the lesson using the manipulatives and then end the lesson doing practice problems without the manipulatives. The teacher was trying to guide the children to transfer the knowledge they learned and be able to apply it. As the passive observer, I saw that all students were able to successfully solve the problems with the manipulatives. When the manipulatives were taken away was when some students would have a little trouble. The problem was that the students relied too much on the manipulatives and did not understand what to do on paper and pencil. In these instances, the teacher was able to intervene with these students and use both the manipulatives and the paper and pencil to show the students exactly what to do for each step. After this intervention, every student in the class was on the right track and was able to successfully divide many different numbers.

The second data source for research question two is a Likert scale style questionnaire as a data source (Appendix A). Likert scales are very beneficial for this project because they will be able to reveal the advantages and disadvantages about using manipulatives in the classroom. After the twenty students in the class completed the survey, the results revealed that fifteen out of the twenty students really enjoy working with the manipulatives and feel

that they have learned so much by using them. This supports the researcher's idea that I should continue using manipulatives because a majority of my class learns from them.

The third data source for this research question is a standardized test (Appendix A) that will be given to both classrooms without the use of manipulatives. The results of the test will show how the students in the experiment group are able to transfer what they learned from the manipulatives and then apply it to a standard test. The control group will be used to complete assessments like this, so we will also see how they score on the test. The experimental classrooms scores show that 85% of the class were successful on the test and received an 80 or higher. The other 15% of the class received lower than that and obviously had trouble transferring their knowledge learned about manipulatives to the standard test. For the control group, 75% of the students scored an 80 or higher and then other 25% scored lower. Therefore, as a whole, the experimental classroom scored higher achieving marks on their tests than the control group. This proves that the use of manipulatives in the classroom will help elementary students to understand the concepts on a deeper level and be more successful in mathematics.

The third research question of this Action Research Project asks if there is a difference on student scores on lesson with math manipulatives, compared to lessons taught without math manipulatives. This is where comparing the two classrooms will really be studied to determine if the use of manipulatives does improve scores on math tests.

The first data source for research question three is the teacher-made pre test. This test is designed to see how well the students are able to do with solving division problems without using any manipulatives. It is a good starting point for the teacher to understand where each student is at with his or her division knowledge. After analyzing the scores from

the pre-test, the students in the experimental class had three students score in the 60's, three students score in the 70's, seven students score in the 80's, six students score in the 90's, and 1 student score a 100. Therefore, I have 35% of my class scoring a 90 or higher. This is definitely a good number, but for a basic division test, I would like to see this number higher. In the control group, there are two students that score in the 60's, three students score in the 70's, seven students score in the 80's, six students score in the 90's, and two students score a 100. The control group has 40% of their class scoring a 90 or higher on the pre-test. Both of these scores on the pre-test are very close. Both classes seem to have about the same knowledge of division problems.

The second source of data to determine if the use of manipulatives will improve student scores on mathematics tests is to analyze scores of a post-test (Appendix A). This post-test is given to two different classrooms that have both had practice with division. One of the classrooms, the experimental group, worked with manipulatives during this time while they solved division problems. They seem to have a good understanding of the concepts. The post-test will show how their scores compare to the pre-test. The experimental group will be allowed access to the manipulatives during the test. The other class, the control group, did not have access to manipulatives while learning about division problems. They just learned division by the standard paper and pencil method. For the experimental group, fifteen of the students improved on their test score from the pre-test. For the control group class, only nine students improved their scores. This proves that the use of manipulatives in an elementary classroom will improve the learning of students. This is number based data that is very useful for teachers to see and understand that using manipulatives in the classroom is very beneficial to students.

The final data source collected for this research question is the student surveys (Appendix A). Each student filled out a survey about his or her feelings on mathematical manipulatives. Seventeen out of the twenty students commented on their surveys that they understand division better when they use the manipulatives. They also think it is a fun way to learn about division in the classroom. Reading these types of comments from the students made me so happy because my students truly are learning and having fun at the same time.

The data analysis performed for this Action Research Project has provided me with so much information about my study of using mathematical manipulatives in the classroom. In every data collection that I used for this project, the results have proven that using math manipulatives in the classroom will benefit the learning of the students. Students learn better when they are able to do it in a fun and interactive way. Math manipulatives provide students will this type of learning. Teachers need to be aware of this data and then implement this into the teaching of their classrooms. This Action Research Project was a great learning experience and I believe that it will improve the learning of students in many classrooms after teachers review the research done here.

Action Plan

This Action Research Project has taught me a lot about my plan for the future as an educator. After performing and analyzing this study, there are things that I would like to change, keep the same, and improve upon. Something that I would like to change is to always use manipulatives when introducing basic division to the students. Using the manipulatives helps students have a deeper understanding about what it truly means to divide. Instead of introducing how to use the manipulatives after a two week period of division concepts, I will introduce them right away. This will allow the students to make a

connection right from the start of doing division concepts. The thing that I would like to keep the same is the actual process of using manipulatives. This research project has proven to me that mathematical manipulatives will improve students' understanding of division concepts. I have qualitative and quantitative data to demonstrate to others that manipulatives do truly help students learn. As a teacher and researcher, there is something that I would like to improve upon. I would like to improve some of the activities that I do with using manipulatives in the classroom. Sometimes I tend to just use the same couple of games, but there are so many others that can be included when using manipulatives in the classroom. As an educator, I need to remember that the best teachers are those that are constant learners. Therefore, I will keep researching other topics and other activities in order to provide my students will the best education possible. My plan of action for the future is to keep working hard and finding ways to teach in the most effective way. This Action Research Project has been a complete success because it has proven that students learn division concepts better when they are using mathematical manipulatives. As an effective researcher, I also plan to share this Action Research Plan with others to communicate my findings. My Action Research Project will be shared to others by sending it to an educational journal. Other educators, parents, or even students will be able to read about my study and understand that manipulatives do truly help children to learn better.

References

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Smith, L. (2008). The effects of instructional consistency: Using manipulatives and teaching strategies to support resource room mathematics instruction. *Learning Disabilities: A Multidisciplinary Journal, v15,* 71-76*.*

Steedly, K. (2008). Effective mathematics instruction. *National Dissemination Center for Children with Disabilities, 3, 1-11.*

Waycik, P. (2006). Learning math with manipulatives. *Education Articles, 1-3.*

Appendix A

Teacher Observation

Student Anecdotal Record Form as Active Participant Observer

Student Name: _____

Date: _____

Grade: _____

Area of Focus:

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Teacher Comments:

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Parent Survey

Please fill out this survey to the best of your knowledge about your child's education. This survey is meant to improve the instruction used for the students. We are all here with the children's best interest in mind. Thank you for your continued support.

1.) How do you feel your child is doing with the mathematics concepts covered this year?

_____
_____
_____
_____

2.) What are your child's strengths in mathematics? Where do you think improvement is needed?

_____
_____
_____
_____

3.) Do you think your child had a better understanding of division concepts after manipulatives were introduced in the classroom?

_____
_____
_____
_____

4.) How often did your child use the manipulatives that were sent out to complete homework and/or other work?

_____
_____
_____
_____

5.) Overall, do you think manipulatives will help your child's understanding of math concepts for the future?

_____
_____
_____
_____

Literature Review

1.) Article by Battle – agrees that manipulatives will improve learning of children

2.) Article by Carpenter – thinks manipulatives will help students learn math better

3.) Article by Hodge – shows how math manipulative affect two different classrooms and that manipulatives will improve student learning

4.) Article by Lee – believes manipulatives are a fun learning tool for children

5.) Article by McNeil – disagrees with manipulatives because thinks children think of manipulatives as toys in the classroom

6) Article by Reimer – believes manipulatives are a great learning experience for students

7.) Article by Scott – thinks that manipulatives can really help special education students in the classroom

8.) Article by Smith – proves that students become higher achieving learners when manipulatives are involved

9.) Article by Steedly – believes manipulatives help students make the concrete to abstract connection in mathematics

10.) Article by Waycik – believes manipulatives help clarify misunderstandings for students.

This literature review demonstrates that nine out of the ten articles that I reviewed believe in using manipulatives in the classroom. It is so informative to learn about what other professionals believe to be the most effective strategies to use in the classroom. This literature review has made me believe that using manipulatives in the classroom will improve the learning of my students.

Teacher Observation

Student Anecdotal Record Form as Passive Observer

Student Name: _____

Date: _____

Grade: _____

Area of Focus:

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Teacher Comments:

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Likert Scale

Please circle the answer choice that best completes the sentence. The choices are strongly agree (SA), agree (A), undecided (U), disagree (D), or strongly disagree (SD).

1.) Working with manipulatives helps me to understand division better.	SA	A	U	D	SD
2.) I like to work with manipulatives when doing division problems.	SA	A	U	D	SD
3.) I would rather just work with numbers instead of the manipulatives.	SA	A	U	D	SD
4.) When I was doing my homework I would use manipulatives to help me.	SA	A	U	D	SD
5.) After using the manipulatives for awhile, I started to understand exactly what it meant to divide.	SA	A	U	D	SD
6.) I could help a younger student understand division by explaining it with manipulatives.	SA	A	U	D	SD
7.) After using the manipulatives for awhile, I could understand the concept without using them and solve the equation on my own.	SA	A	U	D	SD

Name _____

Standardized Test

1.) 54 / 7 =	2.) 45 / 5 =	3.) 44 / 2 =	4.) 67 / 7 =
5.) There are 28 pieces of cake and 5 children. How many pieces of cake will each child get it they all get an equal amount?	6.) There are 87 bananas and eight monkeys that needed to eat. How many bananas will each monkey get if they are distributed equally?	7.) Will there be a remainder if 65 is divided by 5? How do you know this?	8.) 34 / 6 =
9.)Draw an illustration of how you can divide 59 / 3 =	10.)Draw an illustration of how you can divide 19 / 4 =	11.) 72 / 3 =	12.) 39 / 4=
13.) 92 / 6 =	14.) 84 / 8 =	15.) 28 / 6 =	16.) 73 / 9 =
17.) There are 24 brownies that need to be shared among 6 children. How many brownies will each child get?	18.) 47 / 8 =	19.) 52 / 6 =	20.) 65 / 2 =

Name _____ Date _____

Teacher Pre-test

1.) 35 / 7 =	2.) 43 / 2 =	3.) 15 / 6 =	4.) 46 / 9 =
5.) 32 / 3 =	6.) 67 / 7 =	7.) 41 / 9 =	8.) 28 / 6 =
9.) 58 / 2 =	10.) 49 / 9 =	11.) 72 / 5 =	12.) 38 / 9 =
13.) 42 / 7 =	14.) 32 / 7 =	15.) 64 / 6 =	16.) 19 / 4 =
17.) 45 / 8 =	18.) 65 / 8 =	19.) 23 / 4 =	20.) 43 / 4 =

Name _____ Date _____

Teacher Post-test

1.) 43 / 7 =	2.) 89 / 6 =	3.) 17 / 5 =	4.) 76 / 3 =
5.) 47 / 4 =	6.) 95 / 7 =	7.) 30 / 10 =	8.) 54 / 3 =
9.) 69 / 7 =	10.) 39 / 9 =	11.) 18 / 5 =	12.) 52 / 5 =
13.) 75 / 8 =	14.) 28 / 7 =	15.) 49 / 6 =	16.) 32 / 4 =
17.) 53 / 9 =	18.) 38 / 7 =	19.) 56 / 2 =	20.) 52 / 8 =

Results of Pre-test and Post-test

Experimental Class			
Student Number	Pre-test Score	Post-test Score	Change
1	80	90	+10
2	60	75	+15
3	90	100	+10
4	75	90	+15
5	85	95	+10
6	95	90	-5
7	80	90	+10
8	65	70	+5
9	100	100	--
10	90	95	+5
11	70	80	+10
12	80	75	-5
13	80	85	+5
14	75	85	+10
15	60	70	+10
16	85	80	-5
17	90	95	+5
18	90	90	--
19	90	95	+5
20	80	90	+10

Control Group Class			
Student Number	Pre-test Score	Post-test Score	Change
1	80	75	-5
2	95	100	+5
3	85	95	+10
4	80	85	+5
5	90	80	-10
6	90	95	+5
7	85	90	+5
8	80	90	+10
9	100	90	-10
10	90	95	+5
11	75	75	--

12	70	70	--
13	85	80	-5
14	90	100	+10
15	75	70	-5
16	65	75	+10
17	65	65	--
18	90	80	-10
19	100	95	-5
20	80	80	--

Student Survey

Please answer these questions to the best of your ability. The questions are meant to help me become a better teacher and for all of you to learn better.

1.) Do you understand the concept of division better when you use or do not use manipulatives?

_____

_____

_____

_____

2.)If you had a choice to use the manipulatives for a test, would you use them or not use them? Why?

_____

_____

_____

_____

3.) Did you get a better score on the Pre-test without manipulatives or the Post-test with manipulatives?

_____

_____

_____

_____

4.) With your answer from Number 3, why do you think you got a better score on this test?

_____

_____

_____

_____