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TE 855
Gurganus Final

<u>Research Question:</u>

How can students use fact families to help them understand the concepts of addition and subtraction?

Introduction:

As a teacher that has taught both at the Elementary and Middle School level I have

witnessed first hand how students are lacking a strong foundation in their Math skills.

Many students just do not understand the basic mathematics concepts. The void is either

in not knowing the facts in the area of multiplication and division or it goes even deeper

to addition and subtraction. Since Multiplication and Division are just repeated Addition

and Subtraction I feel that students need to really have the skills of adding and

subtraction in their arsenal. I have just recently switched from a seventh grade classroom

to a first grade class and I have witnessed first hand how students in these young grades

are not being taught how to memorize their facts and are allowed to rely on their fingers

as the only tool to understand their facts and to solve problems. By doing this, these

young students are being set up for failure as they move forward in their career as

students. If these young students do not get the understanding of addition and subtraction

and memorize their facts then they will struggle with multiplication and division. One

area that I have seen as a great tool for students to do Math quicker and also to help them

memorize their facts is Fact Families. Fact Families are three digits that can be ordered in

different ways to create addition and subtraction problems.

Example: 2, 3, and 5

$$2+3=5$$

$$3+2=5$$

$$5-3=2$$

$$5-2=3$$

You can see by the problems created how a student can get an advantage in learning their facts if they can see that 2,3, and 5 are a family and instead of learning 4 facts to solve they can just memorize one family.

My observation will be to see just how much easier students can do their Math problems if they are taught facts families. I will measure their success by using two areas of measurement. The first area will be in the area of correctness, and will be measured by taking the total number of problems given and divide it by the total number of problems that they answer correctly. The other area that I will measure is in the area of time it takes to complete work. In my first round of observations I will be giving students 2 minutes to finish as many problems that they can finish. The second round of observation I will be timing individual students and seeing how long it will take them to answer all problems correctly. During this observation I will be working one on one with different students and they will have their work checked at the end and will be given back their papers if there was incorrect problems and they will continue working until all problems are done correctly.

By doing my observations I will see first hand how important the area of Fact Families truly is in the life of a student so they can be successful. After my observations and looking over of the data that is found I will have that reassurance that I am doing the right thing in my classroom and working towards the success of my students.

Review of Literature:

I read an article about inverse relationships written by Camilla K. Gilmore and Elizabeth S. Spelke entitled: *Children's understanding of the relationship between addition and subtraction.* In this article the authors wrote about how students who are learning concepts in Mathematics such as inverse relationships or Fact Families. The authors wrote about if you can help children understand the concepts of Mathematics then it can make "harder problems easier". (Gilmore 933). That is what I am trying to see first hand with my observations and case studies here.

The article also shows research that shows if a students can get the concept of inverse relationships that it will allow them to me more successful when it comes to the areas of algebra and problems such as X+Y=Z. Like I stated in my introduction I taught at a middle school level and have seen students who are both successful and unsuccessful in Algebra and higher math. It all comes down to their foundation and how their teachers are teaching them about Math.

This article just reaffirms my hypothesis that students who learn Fact Families will benefit in the long run and be more successful in understanding and solving of Addition and Subtraction problems. I hope through my observation that I find similar results as the authors of this article have.

Another article that I read was from the same author as above Camilla K. Gillmore and also written by Peter Bryant and it is entitled: *Can children construct inverse relations in*

Arithmetic? Evidence for individual differences in the development of conceptual understanding and computational skill. In the article the two authors did case studies on students with complex inverse problems in Math. The studies the results of the test and came up with the conclusion that students who have a better understanding of Fact Families or inverse relationships had a better success rates at solving these higher order thinking problems.

An article that I found that connects with my observations and inquiries was: *Approaches to Teaching Mathematics* written by Therese M. Kuhs and Deborah L Ball. In this article the authors write about what makes good Math teachers. One of concepts that they came up with was that teachers who teach their students why Math problems are the way they are and to teach them how to solve Math with reason with concepts of how Math is solved.

This is very pleasing to me because this is what I am looking for with my observations and case studies. When you teach anything Math or even Music, it really makes life easier for a student when they know how to solve and why they solve a problem. When these students get an understanding of why and how these problems or math concepts work such as Fact Families they will have a greater success rate as they move on to higher levels in Math and that is why I feel as a teacher that I need to teach them the concept of Fact Families so they are allowed that success.

Modes of Inquiry:

When coming up with how I am going to complete my observation and study I was coming up with different ways but have chosen the one that I felt will give string data to prove or disprove my theory that Fact Families will be very beneficial to students in the area of memorizing their subtraction and addition facts. How I was going to collect data was the hardest area. I had an idea of using my class and teaching them about fact families and having them take an assessment before I teach and after. I was going to do this with my class and ask another teacher to do the same. I would teach my class the concept of Fact Families and have the other teacher not do so. I would then give the same assessment to my class and the other and compare the numbers. After thinking about it I decided that it would be more beneficial to keep the observation just to my class and break my students into different groups and test that way. I felt that by doing it that way it would be more beneficial.

Results:

Day One of Week One:

I took three groups of students with 4 total students in each group that included 2 boys and 2 girls. I created the groups based upon Math levels. I have 6 Math groups that I use regularly in my class. The 3 groups that I chose were all on the same level so they all start in the same spot. On the first day I gave all three groups a timed addition and subtraction worksheet with 20 single digit problems. I gave each group 2 minutes to do as many questions as possible within the 2 minutes correctly. The 20 questions were composed of 5 different problems based on 4 different Fact Families:

(5,2,7) (6,4,10) (5,4,9) (4,3,7)

Results/Data:

Group A: Average Score of 8/20 correct in 2 minutes

Group B: Average Score of 7/20 correct in 2 minutes

Group C: Average Score of 8/20 correct in 2 minutes

As you can see from the data above that my 1st grade students are no proficient in the area of addition and subtraction. All 3 groups for the most part tested in the same area with either 7 or 8 wrong out of 20. The reason for the incorrect answers was not so much incorrect calculations but the students were doing the problems too slow.

After analyzing the data I was ready to put the plan into action. I decided that Group A and B will be taught the concept of fact families. I decided that group B will continue to use the method of counting on their fingers so they can be the control.

Day 2-5 of Week One

Throughout Week one I work with each group individually teaching Group A and B the concept of Fact Families and continuing to allow the students to use their fingers and not introducing them to the concept of Fact Families

On Day Five I gave the same assessment that I gave the groups on Day One of our Research Project. The results are as follows:

Results/Data:

Group A: Average Score of 10/20 correct in 2 minutes

Group B: Average Score of 13/20 correct in 2 minutes

Group C: Average Score of 7.5/20 correct in 2 minutes

I was shocked by the results because I thought that I would see huge improvements in both Group A and B. Group A and B had an average improvement of 4 more questions answered correctly. Every group was still getting for the most part the questions they

answered correct but were not able to complete the problems in the allotted time. I decided that maybe I was giving the students too many problems in too short of time. I thought that maybe I should change the assessment but after thinking it over I decided that I would continue with what I was doing.

Day 1-4 of Week Two

The week prior I gave each group individual worksheets like those given to them in the assessments. This week I did more practice of the concepts. I really wanted group A and B to really dive into of how the fact families can make up the four different problems for example:

(4,1,5) (4+1=5, 1+4=5, 5-1=4, 5-4=1)

I really stressed to groups A and B this concept and did more practice of just how three numbers can make four problems. I continued to work with Group C on just the concepts of addition and subtraction.

Day Five of Week Two

On day five of week two I gave each of the three groups the same assessment that I gave them on day 1 and 5 of week one. The results are as followed:

Results/Data:

Group A: Average Score of 16/20 correct in 2 minutes

Group B: Average Score of 17.5/20 correct in 2 minutes

Group C: Average Score of 11/20 correct in 2 minutes

Day 1-4 of Week Three

Throughout this week I continued to work with groups re-teaching and working with Group A and B in the area of Fact Families and with Group C just in the area of Addition and Subtraction.

Day 5 Week Three

On this the 15th day of my observation I took individual students from all three groups and sat down with them and had them complete a Math worksheet of 20 problems until the answered all 20 questions correctly. I did this to see just how long it will take the students to do them correct. I wanted to see if this would take some stress off the students so its not considered a race. I did not tell the students I would be timing them and wanted them to feel like they had a normal math sheet to complete. I also did them in random order and not in order of groups. I also made sure that I did them all in the same time frame from 9:30 to 10:30 which was before lunch and recess. I thought it would be unfair to have some students do it in the morning and others in the afternoon.

Results/Data:

Group A:

Student A1 - 2:33

Student A2 - 2:29

Student A3 - 2:04

Student A4 - 2:07

Average Time= 2:18

Group B:

Student B1 – 1:54

Student B2 – 2:13

Student B3 – 2:32

Student B4 – 2:06

Average Time= 2:11

Group C:

Student C1 – 3:23

Student C2 – 2:45

Student C3 – 3:44

Student C4 – 2:57

Average Time=3:24

Group A and B Average Time: 2:14

Group C Time: 3:24

Difference in Time: Group C had a +1:10

As you can see from the data above the students in Groups A and B had a shorter time than those students in Group C. Also from the data you can see that no student from Group C had a better time than the two other groups. From this data I can say that those students who were taught Fact Families had a better success rate than those who were not taught the method.

Conclusions and Next Steps:

From the results above I have come to the conclusion that if students learn the concepts of Fact Families that they will get a better grasp on the concepts of addition and subtraction because they will have the knowledge built into their understanding through the memorization instead of having to rely on their fingers or manipulatives to count on. Even though Group A and B both on the first type of observation improved on an average of 9.25 points compared to Group C 3 points and on the second observation Group A and B finished their problems in an average time of 2:14 compared to Group C who finished in an average of 3:24 I can also say that a child will get a better understanding of math concepts through hard work and determination such as group C had. It just takes extra practice and with concepts such as fact families that a child will get a better head start and have a better understanding of the concepts of addition and subtraction.

If I could do this observation again I will change a couple of things. The first thing that I would change is the groups. I would have made another group of students that I did not teach the concept of fact families too. I would also use every student in my class in the observation. I would change this because what if I would have picked different students for the groups, would the results have been different or the same? This is the question that makes me doubt my results because I do not have those answers. I would like to do this observation over next year in my class with all of my students. I feel if I do this then I can answer those questions that make me doubt my findings.

A new question that I have as well is does doing your problems quicker really mean that you know them better. I have students that work slower than other students but I know that they know their facts. There are many reasons for students to work slower that has nothing to do with their academic levels. For example I have a student that works very slow but he does this because he wants to make sure that his handwriting is perfect and also double checks all of his problems. If I used his time then it would show that it took him a long time to do his work but in reality he could do his problems very fast orally but the writing takes him longer so maybe next time I can test both in a written assessment and oral assessment.

References:

Gilmore, Camilla K., and Peter Bryant. "Can Children Construct Inverse Relations in Arithmetic?" _British Journal of Developmental Psychology_ 26 (2008): 301-16. Web. 24 Oct. 2010.

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