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Cooperative Groups and Student Engagement: Exploring Cooperative Learning Groups in Mathematics

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Abstract

This action research project explores using cooperative learning strategies, specifically five of the structures designed by Dr. Spencer Kagan within a third grade mathematics classroom for six weeks. There were twenty-three participants in the third grade classroom, ages 8 to 9 years old. Students were given a survey of their opinion of math before the unit started, as well as after for comparison. During the unit, students participated in five different structures (or strategies based on KAGAN's research) multiple times within each mathematics lesson. To determine if the action research was successful or not, unit scores from the current unit of instruction (implementation unit), as well as the previous unit were compared. Both units taught multiplication and division, so comparable in nature. The increase in scores, as well as the improved opinions and confidence in math showed that the use of these cooperative learning structures were successful for the students.

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Exploring Cooperative Learning Groups in Mathematics

by

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Abstract

This action research project explores using cooperative learning strategies, specifically five of the structures designed by Dr. Spencer Kagan within a third grade mathematics classroom for six weeks. There were twenty-three participants in the third grade classroom, ages 8 to 9 years old. Students were given a survey of their opinion of math before the unit started, as well as after for comparison. During the unit, students participated in five different structures (or strategies based on KAGAN's research) multiple times within each mathematics lesson. To determine if the action research was successful or not, unit scores from the current unit of instruction (implementation unit), as well as the previous unit were compared. Both units taught multiplication and division, so comparable in nature. The increase in scores, as well as the improved opinions and confidence in math showed that the use of these cooperative learning structures were successful for the students.

Keyword: Cooperative Learning

Cooperative learning groups have been around for decades, dating back to the 1960s. Cooperative learning is defined as "…. a teaching arrangement that refers to small, heterogeneous groups of students working together to achieve a common goal" (Kagan, 1999). While many teachers use different variations of cooperative learning groups within their classroom, how many do it consistently enough to show gains in achievement in a particular subject?

The Teaching Effectiveness Program, operated out of the Teaching and Learning Center at the University of Oregon states that some of the reservations teachers have regarding the use of cooperative learning groups is that they have never had proper training on how to implement and properly run them, uncertainty of how to assess students when work is shared (the lack of individual accountability), and overall classroom management structures. (Teaching Resources, n.d.)

Marzano has published research outlined in Classroom Instruction that Works that states when cooperative learning groups are used correctly, with fidelity, achievement gains can be in the 28th percentile or more (Marzano, Pickering, and Pollock, 2001). Not only are there achievement gains, but students also have the opportunity to develop interpersonal intelligence, higher level thinking (logical and mathematical intelligence), developing roles in peer responses (verbal/linguistic intelligence), as well as the result of functioning in a team player role. (Kagan, 1998)

Statement of the Problem

Through the studies of Kagan, it is has been found that the use of cooperative groups allows students to feel more confident in their learning, not as anxious, and develop social relations, an important life skill. Kagan lists many more benefits such as academic achievement, positive class climate, increased participation, and diversity skills. (Kagan, 1999)

In a study published by Turkish researcher Kamuran Tarim and Fikri Akdeniz in 2007 states that many students have anxiety during math due to the how mathematics is taught in today's schools. This research also suggested the use of cooperative groups ease anxiety because it creates an environment that decreases fear of failure by taking risks when applying mathematical concepts. (Tarim & Akdeniz, 2007)

Even teachers have been known to describe themselves as being "math anxious," largely due to how math was taught when they were in school, and what is expected in schools today. Math is much different than decades ago from the rote practice that was known by many. Mathematics curriculum now has gone through a huge reform. It focuses on problem solving and reasoning, discussion around mathematical topics, and use of technology. (Senger, 1999)

With these changes in curriculum, it only makes sense to start to look at the delivery of instruction and see what changes can be made to help students apply higher levels of thinking, get discussions going, and applying them to problem solving and reasoning.

Research Questions/Hypothesis

With the adoption of the Common Core and seeing first-hand how concepts that were once taught in fourth grade, are now to be mastered in third grade, teachers are being pushed to see themselves as guides, rather than the answer givers. (Senger, 1999) With this push, how will students receive instruction?

For this study, the correlation to incorporating cooperative learning group exercises daily into mathematics instruction will show an increase in achievement. The questions to be investigated are as follows:

- Will using cooperative groups multiple times daily in mathematics over a six week period, show an increase in achievement on the end of unit exam among third graders in Ankeny, Iowa?
- Does participating in cooperative learning groups help students feel more confident in their mathematics abilities?

Definitions

Cooperative learning is a teaching arrangement that refers to small, heterogeneous groups of students working together to achieve a common goal (Kagan, 1998). A variety of cooperative learning activities will be utilized to promote problem solving, reasoning, collaboration amongst students, as well as encouraging higher order thinking skills. Kagan's essential 5 structures will be the staples of cooperative learning activities implemented into the third grade classroom. The structures are: Rally Robin, Timed Pair Share, Round Robin, Rally Coach, and Stand Up, Hand Up Pair Up (Cowles, 2011).

Summary

As these specific cooperative learning structures are implemented into the classroom, the hope is that there is a gain in achievement on the next unit test. Student surveys will be utilized to judge opinions of cooperative learning groups, anxiety in math, as well as confidence in mathematical concepts. At least two of these structures will be utilized during math instruction daily, more if possible. Students will be instructed how to use these structures prior to

implementation, so that time management is not lost. By allowing students the opportunity to discuss their thinking with peers, apply mathematical concepts within their conversation and work with students outside of their personal peer group, students will hopefully see an improvement in their unit scores.

Literature Review

Interest in this topic for an action research project, came from working with both the curriculum design as well as providing instruction within two districts. As I helped teachers implement the new Common Core standards within the last three years, it was apparent that the content was more difficult than previous curriculum mapping and students were struggling with successful and strong teachers. The approach for research for this project was to start broad such as worldviews on mathematics and focus in on teaching and how the Core and cooperative learning groups might impact growth in students.

The lack of success in mathematics in the United States is known throughout the country, as well as the world. The United States has been behind other countries such as Singapore and China in mathematics and science for years. In assessments taken by fourth and eighth graders worldwide (not the same assessment, but similar content is assessed), only 7 percent of US students received an advanced level score in eighth grade, while Singapore scored almost 7x that with 48 percent of their students scored in as advanced level (Rich, 2012). Also, based on a report from the PISA (Program for International Student Assessment) our students tested 25th out of 34 countries sampled. (Cash, 2013).

While Iowans may think this doesn't apply to their children, there may be a need for concern at the global level. In an article published by CNN in 2009, Secretary of Education Arne

Duncan stated that constantly trailing behind these other countries could prove to be an economic concern, meaning that jobs could go to citizens from those countries, versus our own citizens (Holland, 2009).

The National Assessment of Educational Progress (NAEP) is an assessment given to fourth, eighth and 12th grade students. Their website states that one of the main objectives of administrating the NAEP is to track trends over time. With this assessment, achievement can be tracked as far back as 1971. In the 2015 assessment for mathematics, 40% of the US's fourth graders scored proficient or higher, and 33% of our 8th graders scored proficient or higher (NAEP, 2015).

Once this information was accessed, the next step was to look at my district's yearly assessment for mathematics. In Ankeny, which is the eight largest district in Iowa, our fourth graders have been holding steady right 80% scoring proficient or higher (Ankeny, 2015, pg. 10) on the Iowa Assessment. Finding these scores satisfactory, these scores were then compared to the largest district in Iowa, Des Moines Public Schools, which had about 63% of their third graders score proficient and above in the 2013-2014 school year (Des Moines Public Schools, 2015). While the demographics of these two districts are very different, the data is important to understand. These scores provide insight in the good instruction that must be happening. However, when compared these scores to the NAEP, which is used to discuss our students as a nation, there are some gaps.

Knowing this data is important, but going forward it almost is obsolete with data that will be collected in the future. This is due to the recent adoption of the Common Core standards. These are standards that are implemented in 45 states across the country (Cash, 2013). The standards for mathematics are two-part. The Mathematical Practices are overarching standards

that will develop how students engage with mathematical concepts and they are the same for every grade. The Standards for Mathematical Content are different for each grade level, building upon the previous grade. These standards define what students should be able to demonstrate by the end of the academic year. Integrating both the Practice standards and Content standards into daily instruction is needed, although not *all* Practice standards will be present within every lesson (Burns, 2012).

The Common Core Mathematical Practices and Standards for Mathematical Content focus on rigor (Cash, 2013) and are meant to challenge students to develop and articulate their thinking. In regards to the Mathematical Practices, students are required to make sense of math concepts, unpack problems, reason their answer and thinking, construct arguments to support their thinking (explain why), and be precise.

This way of thinking in mathematics instruction is different from what some teachers are used to. Students in the past have been able to add, subtract, borrow and carry ones but they didn't know why they were doing this. (Burns, 2012) The Common Core will eliminate this inability to explain their thinking and develop their number sense.

While the Common Core depends the students' understanding of how math works, they will require teachers to look at their instruction differently. Ken Kay, founder of EdLeader21 states that leaders should start implementation of the Common Core with the 4 C's. The four Cs are: critical thinking, creativity, communication, and collaboration. By implementing these concepts within math instruction, it will provide students with the opportunity to strengthen these ideas that are necessary in the employment world, providing students with college and career readiness (Cash, 2013).

So how should educators tackle this task of teaching the rigorous Core to today's students? There has been a proven correlation between student engagement and assessment scores. The more engaged students are, their achievement increases (Marzano, Pickering, and Pollock, 2001). As students are having to grapple with more difficult content in mathematics, perhaps a more engaging method is needed to use for instruction. Through this research, the idea of cooperative learning groups was discovered.

As mentioned, cooperative learning is defined as "a teaching arrangement that refers to small, heterogeneous groups of students working together to achieve a common goal" (Kagan 1999, pg. 244-245). Groups should have anywhere from two to six members in each group. The goal of each group session requires students to depend on each other to complete the work together. In a cooperative learning group, all students in the group equally contribute because each member has a role in the group; each student is accountable. To complete the learning objective, they must communicate their ideas with one another in order to get the task completed. In order to be considered a true cooperative learning group, all components described should be present. (Leikin and Zaslavsky, 1999, pg. 240-243)

There are many different types of cooperative learning groups. One researcher who continues to publish resources, methods, and data on the idea of cooperative learning is Dr. Spencer Kagan. Kagan began studying the effects on student engagement and cooperative learning and how those two areas correlate to success, within the content. His first study dates back 23 years and he has been researching new ideas ever since (Kagan, 2003).

Kagan developed his cooperative groups into something called structures. These structures found their name by changing the word *strategy*, which is what Kagan called these ideas at first. But while *strategies* in reading often reminded teachers and students of

connections, visualizing and summarizing, these cooperative learning strategies were different. Instead of helping students understand *specific* content, they were teaching students how to interact with one another about *any* content. (Kagan, 2013).

The Essential 5 are five structures that Kagan developed to incorporative cooperative learning and increase engagement in students. These are suggested as a starting point in Kagan's structures, as they fit into all content areas and help develop cooperation and communication skills. The five structures in the Essential 5 are RallyRobin, Timed Pair Share, RoundRobin, Rally Coach, Stand Up/Hand Up/Pair Up (Cowles, 2011). These structures require students to practice their communication skills, develop social skills, as well as build their knowledge and procedure learning. The chart below shows the correlation to each Structure with the different areas of cooperative learning, interpersonal (blue) and academic (black).

Figure 1
Functions of Structures (Cowles, 2011)

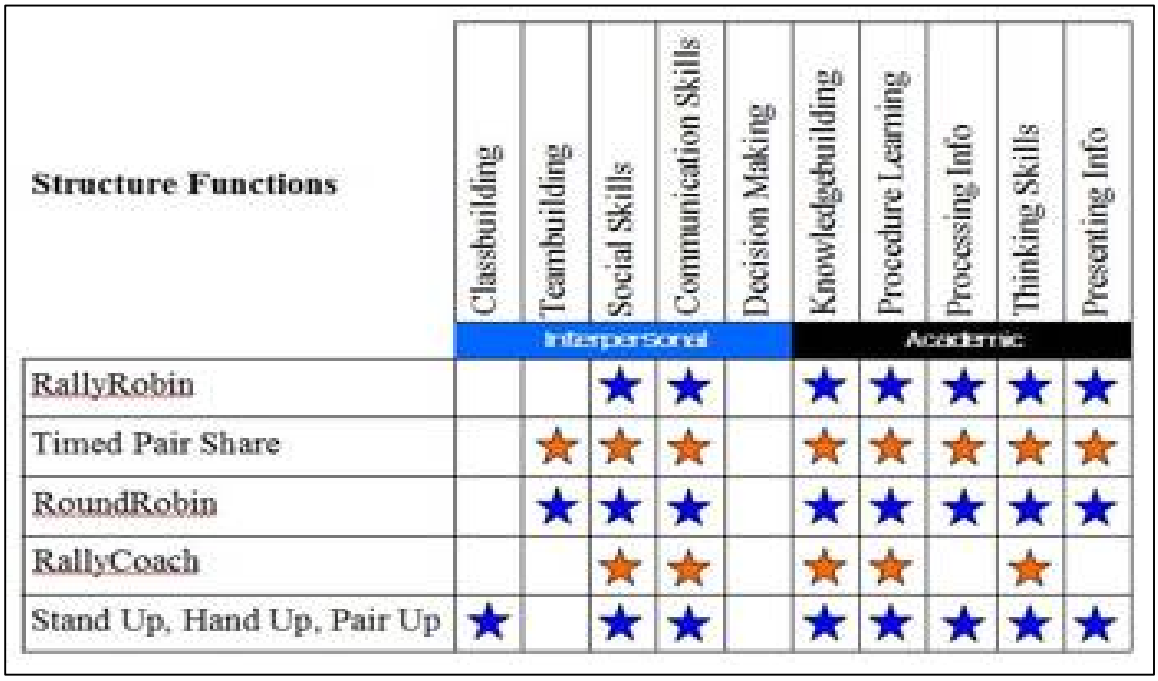

Table 1
Structure Definitions (Kagan 2009)

RallyRobin – students take turns responding
Timed Pair Share – Partners take turns responding within a time limit, they then respond to each other by giving feedback
RoundRobin – Groups go around the table to share within a set time limit (usually 30 sec)
Rally Coach – One student solves a problem while the other coaches, then switch
Stand Up, Hand Up, Pair Up – Students find partners quickly by putting their hand up and walking towards a hand

So why cooperative learning? Cooperative learning groups have been a proven way to increase student engagement. Districts often have to seek answers to why are there so many behaviors, large achievement gaps, and dropout rates. Kagan suggests rather than focusing on how to change the student, perhaps a change in focus, in this case instruction. (Kagan, 2010). It was proposed that a change in instructional strategies that engage all students was the key to success.

Evidence of closing the achievement gap by utilizing cooperative groups has been documented in many different studies. One study being at Foster Road Elementary just outside of Los Angeles, CA. This school is about 80% Hispanic and almost 70% free and reduced meals. In 1999 Foster Road scored 446 on their Academic Performance Index (API), which resulted in being tied for the lowest elementary school in the district. The principal knew things had to change so they implemented with fidelity the Kagan structures in their building. In 2006 Foster Road was a completely different school. Their API was 745, which is just 78 points away from

being tied for the highest performing school in eh district. Principal Jean Maddox contributes the school's success to implementation of the Kagan structures in all classrooms (Maddox, 2007).

In a study done in the UK, designed to improve the number of behavior instances over a period of time by implementing cooperative learning groups, the results were favorable for the effect of cooperative learning in the classroom. Over a four year period of implementation of these cooperative learning structures, the average number of behavior instances reduced from almost 30 to 5 per session! In this study, the idea of incorporating cooperative learning groups into daily instruction helps engage all students, providing very little time for behavior issues to surface. (Kagan, 2010).

Other positive outcomes for incorporating cooperative learning groups within the classroom are: learned responsibility, reducing achievement gaps, increased participation, accountability, social relations, self-esteem, and empathy. (Kagan, 2010). These benefits support the idea of the Common Core through the use of speaking and listening standards, as well as providing students with the practice of collaboration and communication.

While Kagan's structures sound very engaging for students to participate in, the question proposed was if these cooperative learning groups would prove useful in mathematics instruction, specifically when using our new Common Core standards, where students have to explain their thinking and reasoning.

In a cooperative learning group environment, students would be required to vocalize their thoughts and ideas, putting their processes into words. By talking or writing through their process, content is processed better and remembered more. Also, if students have to explain their solutions to their peers, they will elaborate, and be prepared in order to do so. This kind of

inquiry leads to a higher level of thinking and also provides them practice in arguing their opinion with others (Elbers, 2003, pg.80).

During these cooperative groups, teachers are often circulating, listening to students thinking and also finding students to share their thinking with the class. So now, the students had to reason their thinking, work it out together, and now are having to explain it to the class. This second opportunity of explanation helps with understanding and retaining information. (Elbers, 2003, pg. 93).

With the Common Core implementation across the state moving forward, teachers will need to find alternative strategies to use for mathematics instruction. As part of the Practice Standards, students will need to reason and explain thinking, use precision, and make sense of the problem (Burns 2012). An important component of the Common Core is to be able to explain their thinking and in order to do this, critical thinking, creativity, communication and collaboration should be practiced and taught to make this transition to new “curriculum” successful. These components would be fully supported in cooperative learning groups.

Methodology

In previous research, it has been proven that incorporating cooperative learning groups in the classroom will show an increase in achievement in the content area. As the Common Core is implemented in my district for mathematics, achievement has dipped across our building in preliminary assessments. This research project will determine if using cooperative learning groups in mathematics instruction daily, will show an increase in achievement in the upcoming unit. In addition, student opinion will be surveyed as well to determine if they feel more, less or no change in their confidence in mathematics.

Participants

My class of 23 third graders, aged 8-9 years old will be participating in this research study. They are students at a school in Ankeny, IA. Ankeny is a suburb north of Des Moines with a population of about 54,000 people (US Census, 2015). The community is mostly Caucasian and are middle to middle-upper class in economic status.

Materials

The students will participate in a survey at the beginning and end of the project. The survey will consist of 10 questions regarding their feelings on mathematics, the importance of mathematics and reflection pieces on the confidence that have (or don't have) in their mathematics ability.

The independent variable in the project is the learning environment during mathematics instruction. The Essential 5 structures will be incorporated into daily instruction. Students will have at least two to three opportunities to participate in these structures within one mathematics lesson.

The dependent variable will be the unit pre-test and post-test, along with the previous unit's posttest as a base comparison. The survey completed by students will also be utilized to determine if confidence and outlook on mathematics increased, decreased, or showed no change within the unit.

Data Analysis

Most units in our mathematics curriculum are different and so a comparison would be difficult to do, as it would be different content being assessed. In that case, true comparison is not possible since content would be different. However, Unit 3 and Unit 4 both encompass

learning multiplication and division strategies, in both number models and word problem models It is felt that this would be an adequate comparison Unit 3 will be compared with the next Unit 4 pre/posttest, which would be the unit of implementation.

Results

Data Analysis

Results of student performance on the mentioned units will be organized and ranked from least to most improved. This table will show the end score of Unit 3, the unit just completed. It will show the Unit 4 pretest, which is a score that will reflect basic multiplication and division strategies and will be prior to utilizing cooperative learning groups. Finally, the table will show Unit 4 posttest results, which will be after participating in cooperative learning groups at least two times during each math block for a unit of instruction.

For student opinion, each student take the survey online during math rotations at the beginning and end of the unit. The survey was explained and questions were answered if they arose as they took the survey. The opinion survey results were made into two bar graphs, in order to compare opinions of their math block. The last question, “I feel I am a good math student,” will be the ultimate comparison, as this question shows if students feel confident in their ability.

Findings

Research question one

The first research question developed by the researcher was, “Will using cooperative groups multiple times daily in mathematics over a six week period, show an increase in achievement on the end of unit exam among third graders in Ankeny, Iowa?” In order to answer

this question the previous unit scores were collected, as well as the current unit scores. Gains or losses in scores were analyzed and compared. The results are below:

Table 2

Unit comparisons

Student #	Unit 3 %	Unit 4 Pretest %	Unit 4 Post- test %	Increase from Unit 3 to 4 Post-test %	Increase from Unit 4 Pre and Post %
2	76	66	76	0	10
7	86	46	86	0	40
16	100	90	100	0	10
19	100	80	100	0	20
3	80	70	83	3	13
11	73	70	76	3	6
22	80	73	83	3	10
15	96	83	100	4	17
1	73	63	80	7	17
9	76	53	83	7	30
10	73	66	80	7	14
13	63	56	70	7	14
20	93	80	100	7	20
21	83	70	90	7	20
4	83	50	93	10	43
8	90	76	100	10	24
12	66	60	76	10	16
18	86	73	96	10	23
23	66	53	76	10	23
14	50	40	63	13	23
6	66	46	80	14	34
5	70	60	86	16	26
17	83	73	100	17	27
Mean	78.8	65.1	86	7	20.9
Median	80	66	83	7	23

Upon completion, the growth or lack of growth between units was analyzed. When analyzing the data, the average number of percentage points that increased from Unit 3 and Unit

4 assessments was considered. After calculation, the average number of increase between unit tests was 7 percent.

While this number is not overwhelmingly high, it did show that there could be a direct impact of the cooperative learning structures when applied in the mathematics block.

Fifteen out of twenty-three students, or 65% of the class demonstrated the average 7% increase between units. Students 1, 9, 10, 13, 20, and 21 all increased the average percentage points of 7% from Unit 3 to Unit 4. Their beginning scores ranged from close to proficient (65%-79%) to proficient (80% and higher). Students 4, 8, 12, 18, 23, and 1 scored 10% more from Unit 3 to Unit 4. Their beginning scores also ranged from close to proficient (65%-79%) to proficient (80% and higher). And finally, students 14, 6, 5, and 17 showed the most growth between the two units with a range of 13-17% increase. Students 14, 6, and 5 had beginning scores of less than 70% and after participating in the new structures, now are in the proficient range.

To better analyze the data and to determine if the cooperative learning did have an impact, Unit 4 pretest and posttest scores were compared, as this was the unit that the new structures were fully implemented. The average growth between these two assessments was 20.9%, which helps support the answer to Research Question One, that the cooperative learning structures were effective in causing student growth between the unit assessments.

Research question two

Research Question Two stated, “Does participating in cooperative learning groups help students feel more confident in their mathematics abilities?” An opinion survey was given to the students before starting the cooperative groups, as well as at the end of the unit. The results are below:

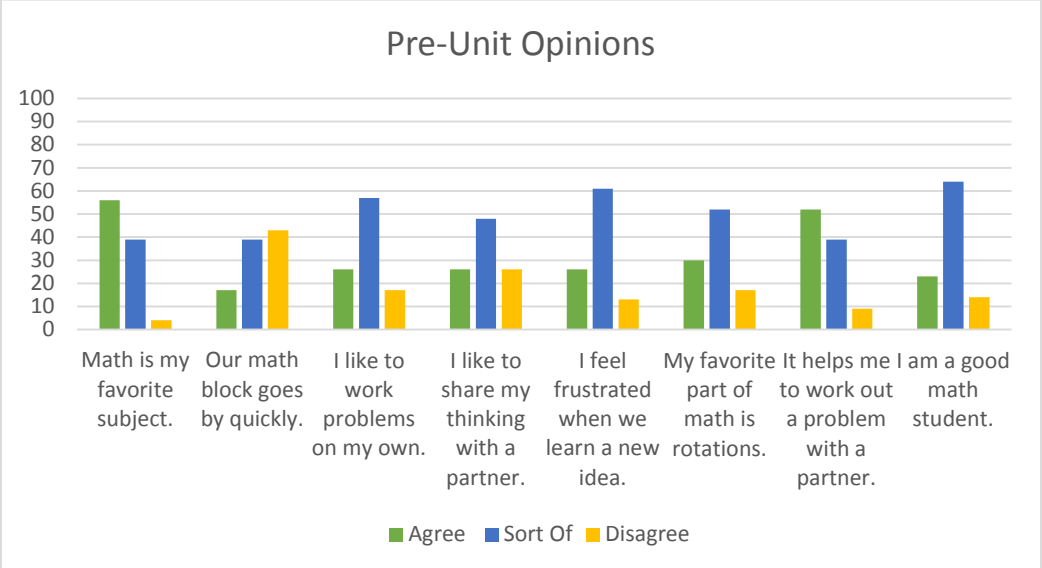

Figure 2

Pre-Unit Survey Results

The Pre-Unit Opinions data shows that about 55% of the students consider math to be their favorite subject, however only 17% of the class thought the math block goes by quickly. Is this because students are not engaged? A little over 50% of the students liked to work problems out with partners, however only 25% liked to share their thinking with a partner. In addition, in regards to working with partners, about 30% enjoyed rotations in math, which rely heavily on students to work together to play games and complete tasks. And finally, while about 55% of the students thought math was their favorite subject, only 22% of the class considered themselves to be a good math student.

After the completion of the unit of implementation, students took the same survey, with the same questions. Below are the results:

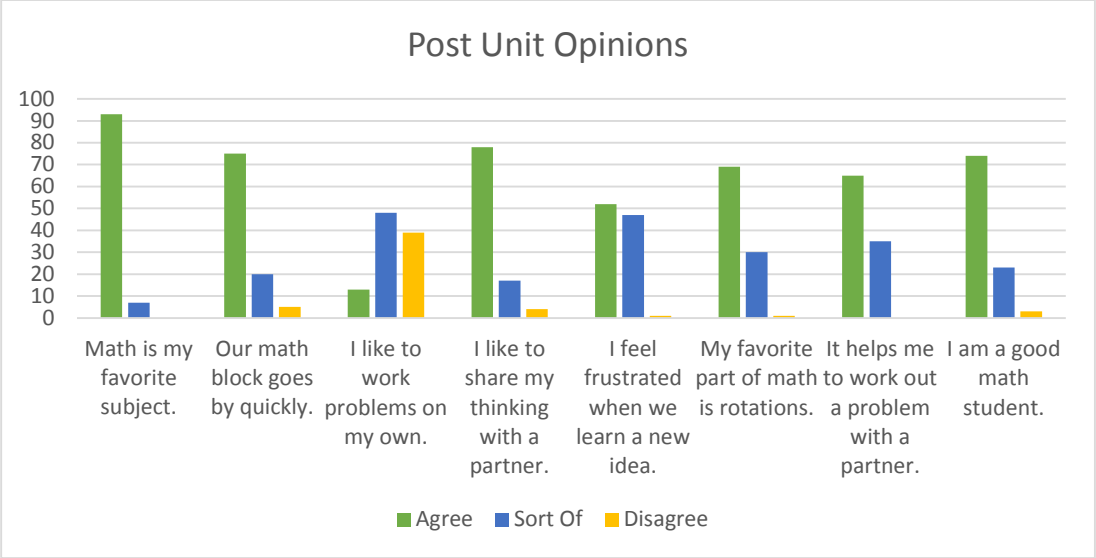

Figure 3

Post Unit Survey Results

The number of students who consider math to be their favorite subject after the unit, increased from about 55% to over 90%. Students who thought our math block goes by quickly went up from about 17% to about 75%. Students who liked to work problems out on their own went down from 25% to about 13%. Finally, students who consider themselves to be a good math student increased from 23% to 75%.

Looking over these results, I believe that Research Question Two can be answered. When only 23% of my class considered themselves to be a good math student before the unit, and now about 75% consider themselves good math students, I believe this has a direct correlation to their confidence as Research Question Two asked.

Discussion

Overview of the Study

The purpose of this project was to investigate if by using the research based cooperative learning structures multiple times would result in higher scores and more confident math

students. The first part of the question, “Will cooperative learning result in higher achievement?” was researched by implementing five different cooperative learning structures and comparing the posttests from our previous unit of study to the unit of implementation. These scores were compared and in doing so, this question can be answered.

In order to answer the second research question, “Will students become more confident in math?” students were given a survey that was taken at the beginning and end of the unit. The statement that was heavily looked at was, “I feel like I am a good math student.” By comparing this question between the two surveys, this second research question could be answered.

Summary of Findings

Regarding Research Question One, I wanted to further investigate why some students made a large growth between units, and others showed little or no growth. Students 2, 16, 19, and 7 all made zero growth from the Unit 3 exam to the Unit 4 posttest exam. When looking into who these students are and considering their individual situations, I developed some theory as to why little growth was made.

Student 2 is staffed for special education and tends to thrive in a small group direct instructional setting. I continued to meet with this student outside of the math block, but during our whole group instruction, where cooperative learning groups were implemented, they participated just the same as the general education students. Student 7 received the same score on both unit tests as well. This student is a general education student and has an average math ability, so quite different than Student 2. Student 7 however, was absent for 10 days of our unit, so it is thought that attendance could be a factor in their overall success during this unit. Student 16 and 19 scored 100% on both unit tests, therefore no increase was possible.

Other students grew more than 10 percentage points between the unit tests. Students 14, 6, 5, and 17 all increased between 13-17 percentage points between the two tests, almost double the average increase among students. Why was this? I believe this is due to the amount of engagement within the math block that these students grew so much. Students 14, 6, and 5 all scored below 70% on the Unit 3 assessment. These students are often ones that just "get by" within our math time and do not often participate in our discussions. During Unit 4, however, they began participating more in both small and whole group discussions.

In regards to Research Question Two, I considered the changes in opinion regarding math and compared the results. When looking at this data before our unit started, about 50% of the responses of students were scored as "Sort Of." When I explained the survey to the students, I discussed with them that "Sort Of" would be similar to not having a preference either way, they could give it or take it either way. I thought it was interesting that about 50% of my class didn't care either way regarding the questions on the entirety of the survey, before the unit began.

Also, before the unit began more students either voted in favor or "sort of" in regards to working a problem out on their own, resulting in about 75% of the class voting this way. When compared to the Post Unit survey, about 60% of the class voted in favor or "sort of." Of this 60%, only 15% of the students voted that they agreed with the statement of "I like working out problems on my own."

Finally, the number of students who voted that their favorite part of math was the rotations we do dramatically increased from 30% to 70%. Could this be due to the practice and application of working within a group? During our rotation time, they are required to work together towards a common goal. Prior to this unit, they sometimes struggled with rotations

because they had not been taught how to explicitly listen and interact with one another. After our cooperative learning experiment, students voted more in favor of rotations.

Conclusion

Recommendations

After completing this research project and seeing the engagement my students had during our math block, I feel the next natural step in my research would be to track and analyze the amount of behaviors in my classroom during this time. My research hinted at the possibility of cooperative learning structures lowering the amount of behaviors in the classroom. I did some further research through the Kagan website and found that a study completed in Wyoming. The Kagan structures have been implemented for three years at the time of publication in 2014. Since implementation, referrals for behavior declined by almost 33%. Teachers at the elementary accredit this to the engagement of the students, who have less opportunity to exhibit off task behaviors (Kramer, 2014).

To further this study, I would suggest gathering some behavior data before implementing cooperative learning structures. Then through the research implementation, behavior data could continue to be documented and observed. After implementation, behavior referrals from my class could be compared to those before implementation. The results may be similar to those seen in my previous research and also this research found on the Kagan website. I feel that my class was completely engaged once the structures were taught and mastered. I don’t feel that they had time to misbehave because these structures kept them going the entire time.

Limitations of Study

While I believe the scores helped show the positive impact of cooperative learning groups in my classroom, I want to recognize one limitation worth mentioning. The data collected was over two different units of study, although connected, they were technically different units. Unit 3 taught the students basic multiplication and division facts and strategies to use, while Unit 4 connected those strategies to unpacking word problems and higher level number models. Since they are not exactly the same unit, there could be discrepancy in actual comparison because they were not the same exact units.

In addition, having been in a different role last year, I do not have comparison data from last year's scores compared to this year's scores. This would have been helpful in that I could have compared Unit 4 from last year without using the cooperative learning structures to Unit 4 this year with the structures. This is not possible though, but could be done in further research.

References

Ankeny School District Annual Progress Report 2014-2015. (2015). pg. 10.

Burns, M., (2012). Go figure: math and the common core. *Educational Leadership*. December 2012/January 2013.

Cash, J., (2013). Transitioning teaching and learning to embrace the common core. *Leadership*. November/December 2013.

Cowles, G. The Essential 5: a starting point for Kagan cooperative learning. *Kagan Online Magazine*. Spring 2011.

Cooperative Learning. (n.d.). Retrieved October 23, 2015, from https://www.teachervision.com/pro-dev/cooperative-learning/48531.html?page=1

Des Moines Public Schools. Retrieved November 24, 2015. www.dmschools.org/about/facts figures.

Elbers, E. (2003). Classroom interaction as reflection: learning and teaching mathematics in a community of inquiry. *Educational Studies in Mathematics, (54)*, 77-99.

Holland, S. (August 2009). US students behind in math, science. Retrieved November 25, 2015 from http://www.cnn.com.

Leikin, R., & Zaslavsky, O. (1999). Cooperative learning in mathematics. *The Mathematics Teacher (92),* 240-246. March 1999.

Kagan, D. (1999). *Kagan Online Magazine*.

Kagan, S. Cooperative learning and multiple intelligences: what are the connections? *Kagan Online Magazine*, Fall 1998.

Kagan, S. Cooperative learning: seventeen pros and seventeen cons plus ten tips for success. *Kagan Online Magazine*, Winter 1999.

Kramer, M. Discipline referrals decrease dramatically at Sage Elementary. *Kagan Online Magazine*, Spring/Summer 2014.

Kagan, S. Disengagement: achievement gaps, discipline, and dropout – treating the disease, not just the symptoms. *Kagan Online Magazine,* Spring/Summer 2010.

Kagan, S. Silly stores and goofy games. (2016): n. pg. Web. 22 Feb. 2016. http://www.melodyshaw.com/files/Cooperative_Learning_Kagan_Quick_Reference_ Guide.pdf

Maddox, J. *Closing the School Achievement Gap.* Kagan Online Magazine, Summer 2007.

Marzano, R. J., Pickering, D., & Pollock, J. E. (2001). *Classroom instruction that works: research-based strategies for increasing student achievement*. Alexandria, Va: Association for Supervision and Curriculum Development.

NAEP Mathematics and Reading. (2015). Retrieved October 24, 2015. http://www.nationsreportcard.gov/reading_math_2013/#/performance-overview

Rich, M. (2012). US still lag globally in math and science. *NY Times, A15.* Retrieved November 25, 2015, from www.nytimes.com

Senger, E. (1999). Reflective reform in mathematics: the recursive nature of teacher change. *Educational Studies in Mathematics, 37*, 199-221.

Teaching Resources - On-Line Postings & Articles. (n.d.). Retrieved October 25, 2015. http://tep.uoregon.edu/resources/librarylinks/onlinearticles/collabcooplearn.html

US Census Bureau. Retrieved November 26, 2015. http://quickfacts.census.gov.

Appendix A

Student Opinion Survey Pre and Post Unit

Math is my favorite subject.	Agree	Sort of	Disagree
Our math block goes by quickly.	Agree	Sort of	Disagree
I like to work problems on my own.	Agree	Sort of	Disagree
I like to share my thinking with a partner.	Agree	Sort of	Disagree
I feel frustrated when we learn a new concept.	Agree	Sort of	Disagree
My favorite part of math is rotations.	Agree	Sort of	Disagree
It helps me to work out a problem with a partner.	Agree	Sort of	Disagree
I am a good math student.	Agree	Sort of	Disagree