Impacts of Cooperative Learning Groups Experiences and Journaling on Conceptual Understanding in an Eighth Grade Pre-Algebra Class

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Abstract

In this action research study of my eighth grade Pre-Algebra classroom, I investigated whether cooperative learning groups or journal writing would have any impact on students' conceptual understanding. I discovered that I need to incorporate the strategies for a longer period of time to accurately determine what kind of impact these strategies would have on students' conceptual understanding. As a result of this research I plan to utilize journaling regularly in the classroom and continue with cooperative learning groups to see if extended time using these strategies will have an impact on conceptual understanding.

Introduction

My topic of research was the use of cooperative learning groups and journaling in the mathematics classroom to determine if there was any significant change in conceptual understanding of the content. My students have always scored well on tests and seem to have the computational process of the mathematics proficiently but when I ask them questions that require conceptual understanding they hit road blocks. I wanted to see if making some changes in my instructional strategies would have an impact on that aspect of their experience in my classroom.

I have always refrained from using cooperative learning groups for several reasons. I wanted to guide student learning and feared that if students worked in groups that they would not gain the information that I wanted them to gain and that their interactions would be more social and less educational. I have not utilized writing as a tool for students to express themselves and their thinking because I have used the excuse that I do not have time for it.

I know that research and other colleagues have argued that cooperative learning can lead to a richer classroom experience and understanding of the content. I was curious to see if what a cooperative learning experience can provide for a student would be more beneficial to their experience in my classroom compared to the whole class, question-based activities that I have been using.

Problem Statement

Conceptual understanding can help lead to retention of mathematical topics. In mathematics teachers are constantly re-teaching what their students already should know because they have not retained the information for some reason or another. If cooperative learning groups and having students write about the mathematics they are thinking is going to improve that then I think educators should all be interested enough to see if they are really effective. Teachers' main

complaints about cooperative learning group activities and journaling is that they do not have the time. What if teachers utilize the strategies well and in return spend less time re-teaching because conceptual understanding has taken place and teachers have finally produced students who have retained the information? I would much rather spend my time creating lesson plans that will lead to better understanding than spending my time re-teaching the information.

The National Council for Teachers of Mathematics process standards require that students make connections among mathematical ideas and find ways to organize their thinking through communication. For problem solving, students are expected to monitor and reflect on the process that they have used to solve problems and to communicate their thinking to their peers clearly. Written work of student thinking is an excellent way to reflect on their thinking and working in cooperative learning groups allows them the opportunity to share and solve problems with their peers and interact with one another to find different strategies to solve problems.

Literature Review

I read several research articles related to cooperative learning groups and writing in the mathematics classroom. I identified two main themes: Conceptual understanding is improved by student's explaining their thought processes in written words. Conceptual understanding is improved when students participate with their peers in cooperative learning groups.

Writing in the Mathematics Classroom

Pugalee's (2004) study involved analyzing ninth grade algebra students' written and oral descriptions of their mathematical problem solving processes. This study involved 20 ninth grade students who were involved in a two-week enrichment period in which they were given problem sets to solve and were asked to write every thought that they had while solving the problems. The students then had to go back and expand and elaborate on their thinking. Students then presented

their presentations of problem solving to the others in the class. The students who were more successful at writing their thought processes improved on their problem-solving tasks throughout the study. Pugalee's study found that successful problem solvers are able to use writing as a tool to support their meta-cognitive framework.

Draper and Siebert (2004) co-authored a study in which they took their different perspectives and adopted models that highlighted important aspects of learning in mathematics as related to writing in the classroom. The participants were 25 Brigham Young University students who were in their first of three mathematics methods classes with Siebert. Twenty-three of the participants were female. This group met twice a week for a semester. Draper and Siebert's study showed that although the intent of writing in the mathematics classroom was different for each of the researchers, the benefits of the students writing about their mathematics was evident. The participants kept journals and read their journals in smaller groups. Draper and Siebert found that writing about the mathematics promoted better understanding.

Ntenza (2006) did a study in which he investigated forms of writing specifically in seventh grade math classrooms. The participants in his study were South African students from three urban schools, one township school and two rural schools. His study took place over two terms. Students and teachers were encouraged to use more writing when discussing and exploring new math concepts. The amount of written work was much less than suggested and, upon analyzing the lesson plans of the six mathematics teachers, Ntenza found that tests and exams were still regarded as only "the means of determining successful learning and teaching in the mathematics classroom" (p. 340). Ntenza also found that very few students would write about their mathematics in their own words. They simply copied what they thought was explaining their math from the textbooks.

Ntenza (2006) suggested that there be some professional development for teachers to gain some understanding of how to successfully interpret student writing in the mathematics classroom. “Even experienced mathematics teachers can come up with conflicting interpretations of the mathematics from the same learners’ written work.” (p. 341) His findings indicate that although writing can be effective, teachers need to know what kind of writing to look for and may need training on the difference between writing about mathematics and writing about thinking of mathematics.

Baxter, Woodward and Olson (2005) studied how one teacher in a low-track, seventh grade mathematics classroom used writing to support communication in her classroom. Baxter, Woodward and Olson developed profiles of four students and how they were able to put in writing what they were unable to say orally. Baxter, Woodward and Olson were in direct support of writing for conceptual understanding. These students were able to express mathematical ideas, explain the strategies they used to solve the problems and discuss and share with one another their findings. Baxter, Woodward and Olson (2005) found that students who did not participate in class discussions were quite expressive in their journal writings. The teacher was able to have a much better understanding from reading the students’ journals what they did and did not understand and those insights were used to better her instruction. The students engaged in active construction of their knowledge and were able to write about it. Baxter, Woodward and Olson go on to say that “researchers have found that students’ conceptual understanding and problem-solving stills improve when they are encouraged to make sense of mathematics by writing about and discussing their mathematical thinking” (p. 14).

Ntenza (2006) found that the students were not able to successfully write about their mathematics and even when they were able to write about it, they were not able to explain their

written presentation to show conceptual understanding. Baxter, Woodward and Olson (2005) and Pugalee (2004) had a different outcome. Students were able to show an increase in their conceptual understanding and it was determined that writing in the mathematics classroom did have a positive impact on their students. Ntenza pointed out that professional development would be highly recommended so that the teachers would know what to look for and model this writing in a more meaningful way. Pugalee (2004), Draper and Siebert (2004) and Baxter, Woodward and Olson (2005) did not indicate what kind of professional development took place to prepare their teachers but did indicate that writing improved students' understanding.

My study used similar methods to all of the studies mentioned. I had students writing in journals regularly and attempted to have them explain their mathematics in their own words and to also write about what they were thinking as they were solving the problems. The biggest difference in the method that I used was that I gave the students journal prompts and the other studies did not. If I were to do this again I would not give prompts and see if that would make any difference in student success with writing in the mathematics classroom.

Cooperative Learning Groups

Cooperative learning groups are created so that students can have learning experiences in smaller, independent groups. The purpose of the learning groups is to allow for students to have active roles and interactions with other students to enhance their learning experience.

Gabriele and Montecinos (2001) studied 70 fourth and fifth graders and paired the participants with same gender, one being a low achiever and one being a high achiever to see if collaboration would increase achievement on a learning or performance goal. Fourth- and fifth-grade students from three participating urban public schools in the Midwest were the focus of this study. Each school served a diverse ethnic and socioeconomic community. Each pair of

students was given a task/problem and then asked to write their solutions both computationally and structurally accurate. The students then took surveys and responded to questions based on their experience with the other student. The surveys included questions about their own knowledge versus the knowledge of the other student and how that affected their participation. Gabriele and Montecinos found that teachers who are successful in creating norms in the classroom that emphasize learning goals may not need to be concerned about creating cooperative learning groups for low achievers. They suggest that teachers "focus on providing ways of supporting the thinking of all members of the group so that the most sophisticated thinking get externalized regardless of which group member contributes the idea" (p. 175).

Gillies (2003) studied 220 eighth graders as they worked in cooperative learning groups to solve problems in mathematics, science and English across three school terms. The students worked in four-person, gender-balanced, heterogeneous achievement groups. Some of the groups were structured and some were not. Gillies showed that structured group work gave the participants support for one another and provided them with an opportunity to do quality work together in comparison to the unstructured groups. "Understanding what happens as students work in small groups and how they perceive their small-group learning experiences is critical to understanding the processes involved in cooperative learning" (p.137). Gillies recognized what many educators neglect to recognize: it was not about the teachers – it was about the students. Gillies reported that student achievement overall in mathematics scores increased but there was still a huge gap that continued to grow among racial groups.

Leonard (2001) studied the achievement of 177 sixth grade mathematics students who were studied for two consecutive years. The purpose of the study was to compare the benefits of homogeneous groups with heterogeneous groups. The results showed more achievement in the

heterogeneous groups but that the "quality of student interactions may be influenced more by group cohesiveness than group composition" (p.175). Leonard (2001) researched what we can do to narrow the gap between low and high achievers and stated, "The use of small groups can help teachers to facilitate learning when students are diverse in terms of race, gender, ethnicity, linguistics, and abilities" (p.176).

Paradis and Peverly (2003) explored the effects of students' general mathematics knowledge and the type of mathematics task on peer-directed questions in fifth grade cooperative work groups. Paradis and Peverly grouped the students in sets of three. One student was high achieving, the second was average and the third was low achieving. Paradis and Peverly (2003) stated, "Cooperative learning and help-seeking researchers view peer-directed questioning as a social problem solving strategy that enables students to perform tasks that they may be unable to complete alone" (p.117). The students were monitored based on interactions with their peers, the number of times that they participated in the conversations, whether they asked or answered questions and whether their communication was based on the task at hand. Paradis and Peverly speculated that the average students in this study "resorted to asking for answers from the teachers or stopped asking questions altogether if their initial peer directed requests were ignored" (p.135).

My study had cooperative groups in which the students completed an activity with one another that reviewed what they had learned in their groups the previous day, took that information and built on it to come to a conjecture or a conclusion. Roles were established clearly and although it was not a whole class experience, the discussion was very much determined by the "agenda" set for them following the activity. My cooperative groups were more structured with a very specific goal at the end of the experience. Unlike Paradis and

Peverly (2003), my study did not just focus on the kinds of interactions and the frequency of student interactions. My study was focused more on the quality of the interactions and whether conceptual understanding was taking place.

Purpose Statement

The purpose of this study is to determine what impact cooperative learning groups and writing about mathematics has on conceptual understanding in the mathematics classroom. I want to answer the following questions: What happens to the level of student conceptual understanding of mathematics when I incorporate student journal writing and discussions in math class? What happens to the level of student conceptual understanding of mathematics when students participate in consistent cooperative groups experiences in math class? How does my teaching look when I allow students to explore concepts in cooperative learning groups?

As a teacher there are many new strategies and programs presented every year that are claimed to improve conceptual understanding of mathematics. I wanted to see if there was something that I could change in my classroom that would not require purchasing a curriculum, software or needing supplemental material that could improve conceptual understanding for my students. Cooperative learning groups and journaling can be incorporated into almost any teacher's plans. Would these strategies make a difference?

Method

I chose an eighth grade Pre-Algebra class that has a wide range of 17 learners. There are seven males and 10 females. Two of the students are English Language Learners (ELL) and two of the students receive special education services for learning disabilities. Ten of the students are of Hispanic origin, one is Native American and the other six are white. The study took place over the duration of about eight weeks (February 15th to April 24th) and focused on conversions

between decimals, fractions and percents and the introduction to solving word problems. The students were given pre-post surveys, journal prompts, interviews and a test that would measure conceptual understanding of conversions and gauge their attitudes and opinions about working with others. A pre-survey was given to determine students' attitudes about working with others in groups the very first day, before any changes to my instruction had taken place (See Appendix A).

Journal prompts were given every two weeks and the students were given 15-20 minutes each time to write in their journals. The prompts were proposed to encourage students to think about their experiences in class and to give insight into their conceptual understanding of the material. I also kept a journal in which I wrote every Friday afternoon for the duration of the study. I reflected on what I was observing, challenges that I was finding and instances that stood out to me. There were three journal entries total. The students wrote their entries on March 5th, March 19th and April 9th.

Interviews were given every two weeks opposite of the weeks in which the journal writing took place. These interviews were used to determine to what extent conceptual understanding had taken place as well as to receive input about their learning experiences while they were working in the groups. The teacher who had collected the permission slips for the study gave me a list of eight students to interview. The interviews took place on March 12th, April 2nd and April 16th.

A two-part test was given March 22nd that required the students show computational and conceptual knowledge of the conversions (See Appendix B). The first part was computational only, worth 10 points, and the second part was short answer questions that required the student to

demonstrate conceptual understanding, worth 40 points. This same test was given again on April 12th just to determine retention of the information (See Appendix B).

Findings

Each day of the study was challenging in different ways. The first couple days of each week the students would participate in their assigned cooperative learning groups to review what the class had learned from the previous week. The students would have approximately 10-15 minutes of an activity which required them to complete a form of review by either discussion as a group or completion of a worksheet in the form of fill-in-the-blank. During this time I would walk from group to group and listen for key vocabulary and proper use of that vocabulary. If a group started to get off task I would redirect them as a whole group with a question and ask them to discuss it. This time was particularly hard for me because I had to allow the students to make mistakes in their discussions and allow the students to correct one another. It would have been easier to just correct them and move on to save some time but it was important to me to listen to their interactions and observe their participation in the groups.

Some of the weeks this review process took one day and a couple of the weeks the students took three days to complete the activity. There was always one group that finished before the others. I would give the students in that group other questions to challenge what they had already discovered and forced the students in that group to think about why their findings were true and whether the students in that group could elaborate and share their thinking. That group picked up on my plan quickly. After the first few weeks they magically began taking just as long as the other groups to finish.

After each group had completed the review portion of the activity they were then lead through a series of guided questions which would then lead the groups to a conjecture. The

conjecture was given to them partially and each group was expected to complete the conjecture in their own words based on the discussions that each group had. This part of the study was very enjoyable for me. I was able to observe a lot of reasoning, arguing and frustration which to me meant that learning was taking place. At the end of the class period I would ask a representative from each group to share their group's conjecture. As a whole class, the students took all of the conjectures and narrowed them down to one that the whole class could agree on.

Each week then ended with an opportunity for the students to put the conjecture into practice. The students continued to work in their cooperative groups but were each expected to have proof of their practice to hand in as individuals. There were normally 15-20 problems that each student had to complete to get their participation points for the week. These practice problems, if time permitted, were presented to the whole class by individual students that either volunteered or chosen by me. The presentations gave me a better understanding of what learning had taken place and whether each student was just going through the motions or had a clear conceptual understanding of the material.

What happens to the level of student conceptual understanding of mathematics when I incorporate student journal writing and discussions in math class? I found that the responses to the journal prompts that I gave did not indicate whether conceptual learning had taken place and that the students did not effectively communicate their thinking or learning when given the time to write in their journals. One piece of evidence to support this assertion is the fact that students would only write two to three sentences when given at least 20 minutes to journal. Here is a journal entry from a student and in this writing Maritza was to reflect on her learning experience in her cooperative group and to explain the relationship between 0.8 and 4/5.

Here is Maritza's complete journal entry:

> *They are related to one another because they have the same numbers and you can solve them and you will get the same answer. I can confirm it because if 0.8 is 8 tenths and then you move the decimal twice to the right you will get 80% and 4/5 is half of 80% if you reduce.*

Maritza had 20 minutes to write in her journal and she showed no reflection of that experience and her writing did not indicate a clear understanding of the concepts that were involved in showing that 4/5 and 0/8 are equivalent values. More than half of the students were not able to articulate that these are equivalent values and none of them were able to explain in words with great detail and proper vocabulary to explain how to convert from 0.8 to 4/5.

The test also gave evidence that the students' journal writings and discussions made no real significant change in their conceptual understanding. Question number eight on the test read: "Describe a real-life situation where decimals are used instead of fractions." Here is Maritza's response:

> *Money, because the numbers behind the decimal show it is in the hundredths place and you couldn't read it in fractions.*

She was able to identify that decimals were commonly used for money but her written explanation does not make sense. It is clear that she is unable to describe why the decimals are used because she does not have a clear conceptual understanding of the relationship between fractions and decimals. Fifteen of the 17 students were unable to write a response that indicated that they knew the relationship of the two and why that relationship exists. There were two students that indicated that they understood why decimals would work better for money than fractions.

The students wrote in their journals about everyday life experiences that they encountered and I asked them to recall some of those events when I interviewed them. Students were able to review their journals prior to the interview so that what they wrote would be fresh in their minds.

Here are some of the responses to this interview question: “Think of examples from your life in the last few months in which fractions, decimals or percents were used outside of the classroom and describe one or two of these examples.” Here are some responses:

> Adrian: “*Percent of a car when you are going to buy one. My brain is empty*.”
> Maritza: “*Can’t think of any”*
> Alaska: “*Dogs, share treats between them, I separate them into equal parts.”*
> Maria: “*There wasn’t any.”*

Not a single one of these students were able to relate the concept of converting between fractions, decimals and percents to any part of their lives. Their social studies teacher gives them their points out of points possible on quizzes weekly and wants them to calculate their grade. Not one student mentioned that experience. I asked the students to look at their journals and look at some of their entries to see if they wanted to change their responses and none of them had additions to make.

> On February 26th, I wrote the following in my teacher journal:
>
> *I realized that they have not had to do too much writing and the fact that their journal entries were VERY SHORT and vague might be because they have not practiced enough to have their journaling be effective.*

The entry indicated to me that my expectations might have been too high because I had not had the students write about their thinking before in class. Looking back, I wish that I would have modeled some sample writing or prepared the students better for their writing experience.

Overall, the evidence showed that there was little to no conceptual understanding developed through writing. I would actually say that there were two or three of the students who completely shut down and were very frustrated with having to write about the math and that frustrations alone may have had a negative impact on their conceptual understanding. Students were able to give correct computations but they were not able to use mathematics vocabulary and concepts to explain their thinking and support their solutions.

What happens to the level of student conceptual understanding of mathematics when students participate in consistent cooperative groups experiences in math class? My findings indicated that cooperative learning groups did not increase students' conceptual understanding in my classroom. My observations of the groups indicated that only a very small number of the students were making connections and when it appeared that some connections were being made then somehow those connections became blurred as they discussed with their peers. Here is one interaction that I documented in my teacher journal on February 26th:

> *One student asked another student, 'Why don't we just change 3/5 to 6/10 and then make it 60/100 by adding a zero to the top and bottom to get 60% instead of multiplying top and bottom by 20 to get 60%?' The other student responded, 'You have to get 100 right away to get a percent.' I was glad that the first student was making connections but the second student's response simply stopped the first student from continuing with their thought. It was as though they knew it would work but did not have the tools or knowledge to be able to defend their belief.*

This entry indicates good discussions but is poor support for conceptual understanding.

The two-component test was given in late-March. All conversions had been taught and the test was a pre-assessment to determine whether the students were ready for the district test over this material. Here is the information for each of the students:

Computation Only	%	Conceptual Understanding	%	Total Average on Test
8/10	80	16/40	40	24/50 = 48%
9/10	90	13/40	32.5	22/50 = 44%
9/10	90	17/40	42.5	26/50 = 52%
10/10	100	19/40	47.5	29/50 = 58%
10/10	100	14/40	35	24/50 = 48%
10/10	100	19/40	47.5	29/50 = 58%
9/10	90	13/40	32.5	22/50 = 44%

8/10	80	10/40	25	18/50 = 36%
9/10	90	19/40	47.5	28/50 = 56%
9/10	90	7/40	17.5	16/50 = 32%
10/10	100	11/40	27.5	21/50 = 42%
9/10	90	11/40	27.5	20/50 = 40%
10/10	100	22/40	55	32/50 = 64%
10/10	100	12/40	30	22/50 = 44%
10/10	100	24/40	60	34/50 = 68%
8/10	80	18/40	45	26/50 = 52%
9/10	90	12/40	30	21/50 = 42%

This information indicates that all of the students are proficient in converting between decimals, fractions and percents. However, none of them were proficient at explaining the math and making conceptual connections between the values. This indicates that the cooperative groups were successful in determining the computations used to convert between decimals, fractions and percents. This data also indicates that very little conceptual understanding took place in the cooperative groups overall. I gave this same test again three weeks later just to see what kind of retention took place, and here are the results from that test:

Computation Only	%	Conceptual Understanding	%	Total Average
6/10	30	6/40	15	18/50 = 36%
10/10	100	10/40	25	20/50 = 40%
1/10	10	11/40	27.5	12/50 = 24%
1/10	10	5/40	12.5	6/50 = 12%
7/10	70	14/40	35	21/50 = 42%
4/10	40	11/40	27.5	15/50 = 30%
4/10	40	8/40	20	12/50 = 24%
3/10	30	10/40	25	13/50 = 26%
2/10	20	12/40	30	14/15 = 28%
7/10	70	5/40	12.5	12/50 = 24%
5/10	50	6/40	15	11/50 = 22%
4/10	40	10/40	25	14/50 = 28%
7/10	70	14/40	35	21/50 = 42%
6/10	60	7/40	17.5	13/50 = 26%
7/10	70	20/40	50	27/50 = 54%
6/10	60	10/40	25	16/50 = 32%
8/10	80	10/40	25	18/50 = 36%

These tables represent the students respectively. The tables support that students in a very short period of time did not retain what was taught and that shows that conceptual understanding did not take place.

Student responses during the interviews were also great support for my assertion. One of my questions was, “What does 50% mean to you, please elaborate.” Here are some of the student responses:

Adrian: “half of something, that’s all”
Maritza: “out of 100”
Alaska: “half of something”
Maria: “half of a whole percent”

These responses indicate no conceptual understanding. Alaska and Adrian understood that 50% is half of something but given time they did not elaborate or make any other connections. If conceptual understanding had taken place they would have indicated that it is equivalent to 1/2 or maybe 0.5 or discuss how 6/12 is the same as 50% for example. These students had participated in cooperative learning groups and were expected to discuss and make connections based on the learning activities but there is no evidence that those connections were made.

Here are some journal entries from three students that indicate the lack of conceptual understanding. The students were asked to describe how four-fifths and 0.8 are related. Here is Maritza’s journal entry:

> *They are related to one another because they have the same numbers and you can solve them and you will get the same answer. I can confirm it because if 0.8 is 8 tenths and then you move the decimal twice to the right you will get 80% and 4/5 is half of 80% if you reduce.*

There are a lot of problems with her conceptual understanding. I know that she wants to explain that they are equal values and then tried to explain how she can prove it but her response clearly indicates that the evidence of conceptual understanding is not there.

Here is Adrian's journal entry:

> *They are both a percent of one another. Like 8 is out of 10 and 80% is out of 100%. They are both like a fraction of something. They are all equal.*

Adrian's entry is a great indicator that Adrian is not used to writing about math nor did he understand the vocabulary that is needed to show the conceptual understanding related to this problem.

Here is Maria's journal entry:

> *They are related because they are like the same # and then when you solve them they come out as the other same #s. Yup that is how they are related. Also like if you reduce 4/5 you can make 80% idk? They equal to all of those #s there are a lot of ways to make them equal.*

Again, Maria understands that the values are equal but has no way of writing how she knows that they are equal. She is trying to use mathematics vocabulary that we use in class but really is making no connections conceptually. All of this evidence indicates that conceptual understanding was not improved by working in cooperative learning groups.

How does my teaching look when I allow students to explore concepts in cooperative learning groups? My teaching changed significantly during this study. I allowed the students to discuss more and allowed them to experience more frustration than they would have if I was doing my regular whole class instruction. I did not correct and lead their discussion with formative questions like I had before I began the study. I answered fewer questions and asked more questions. My teaching was more supportive of self-exploring and student participation. On February 26th I wrote this in my teacher journal:

> *It was very difficult for me not to step in today. I really wanted to bring them back as a whole class and start from scratch. They were not off task but their thinking was not making sense and it was very obvious to me that they were not getting conceptual understanding. It took all that was in me to let them muddle through it.*

This entry could have been duplicated over and over throughout my journal. I really struggled with students getting lost, hearing interactions that were inaccurate and had to refrain on many occasions from just getting them back on track. Instead, I listened to what they were saying to one another, tried to give them leading questions that would get them back on track and tried to stay out of the discussion as much as possible.

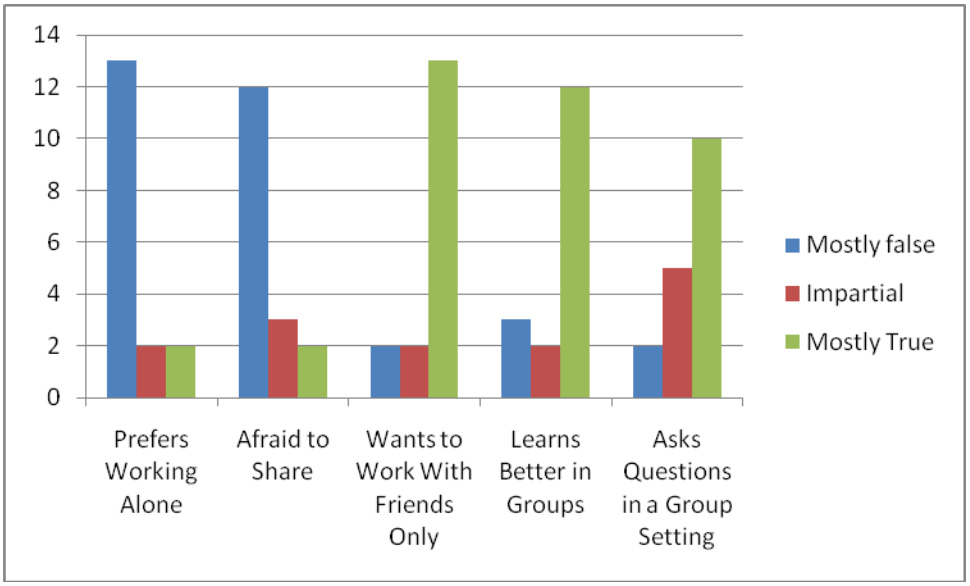
One of my interview questions was "In what ways have your interactions with Mrs. Archie changed over the past month or so?" Here is Maritza's response:

> *Mrs. Archie answered less questions and in our groups we tried to figure the problem out.*

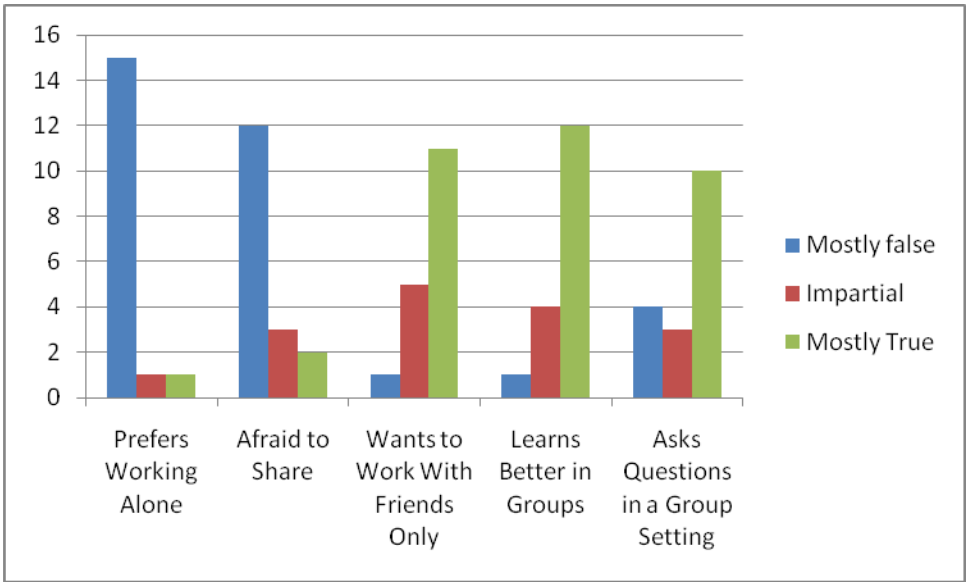
Maritza indicates that I answered fewer questions and forced them to work in groups. I know that the students were required to do more thinking but the responses to questions and results on the test indicate that although they were in a position to think more momentarily, they were still not making the connections that I would want them to in order to show a deeper conceptual understanding.

I also gave the students a survey that would reflect how they felt about group experiences before working in cooperative learning groups and again after working in groups for several weeks. The responses were very interesting:

Pre-Survey: February 4th



Post-Survey: April 1st



These survey results indicated that students determined their experience to be positive overall in the cooperative learning groups and that they enjoyed discussing with one another. The graphs indicate that the students became more comfortable sharing with one another in general and that they felt better asking questions and sharing after being in the groups for a period of time.

In summary, the students prefered cooperative learning groups as an instruction method over whole class activities that the students were previously participating in. The surveys supported the fact that the students felt more involved and that their roles as students changed when they were in cooperative learning groups. I did not spend as much time answering questions as I did asking them. I will use cooperative learning groups in the future because the students' responses indicated a positive change in their learning experience.

Conclusions

As a teacher I believe that I need to work on developing math students who are able to write about their experiences and challenge them to think more about their thinking. Although my students test well I need to develop strategies and activities that are going to allow them to retain the information that is essential for their success in the future. I do not think that my study challenges any of the literature that is out there because I do not think that enough time was spent on working in cooperative learning groups, journaling and sharing with one another to defend that my findings contest the research articles that I read. I know that my students gain confidence in my classroom. I also know they enjoy working in cooperative learning groups, and I would like to do more of that in the future.

One of the main concerns that I have as a teacher is how blind I can be to the fact that there is very little conceptual understanding going on, and I have not developed a system of identifying or recognizing those gaps in their learning. Paradis and Peverly (2003) stated, "Cooperative learning and help-seeking researchers view peer-directed questioning as a social problem solving strategy that enables students to perform tasks that they may be unable to complete alone" (p.117). The results of my study supported that the students like to problem

solve in cooperative learning groups with someone on their own level and they feel more comfortable than they do in the whole class setting.

Gabriele and Montecinos (2001) suggest that setting a norm for clear learning goals may not need to be concerned about creating cooperative learning groups for their low achievers. I feel like the lessons and reflections of students who are in my whole class experience reflect better conceptual understanding because I have well-developed norms of participation and my low achievers are not afraid to be wrong. They have never felt that way in my classroom. It is common for mistakes to be made and no one is allowed to belittle or comment and I praise mistakes because it is an opportunity to learn something that they might not have known before class started.

Implications

As a result of this study I am convinced that I need to allow for more writing opportunities in the classroom, which force the students to write about their thinking. I think responses to journals and interview questions were hindered because my students were not used to those forums in discussing their learning. I need to develop better lesson plans and activities that will foster more thinking and less guiding in the cooperative learning group activities. I am convinced that new strategies and activities need to be implemented in order to support student retention. I will continue to make it a classroom expectation that proper vocabulary is used at all times. As was evident in journal entries and interview responses, my students do not use mathematics vocabulary proficiently. I would like to use cooperative groups in the future, and I think that setting is ideal for certain outcomes and goals in certain situations, but I do not plan on using them regularly. In addition, I have to check for conceptual understanding on a more regular basis and in different ways. My students are not making the connections that I want them to

make so I would like to utilize these strategies more extensively and see what kind of difference they can make.

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Appendix A

Student Survey: Name: _____

The following statements are to help you describe yourself as you see yourself in this class. Please respond to them as if you were describing yourself to yourself. Read each statement carefully, then select one of the three responses that best fits you.

I prefer working alone in math class.

Mostly false Partly false/partly true Mostly true

I would rather work alone and be confused than work in a group that might help me.

Mostly false Partly false/partly true Mostly true

I think we should do group work more often because I learn better with my peers.

Mostly false Partly false/partly true Mostly true

I like to work in groups but ONLY if I am with my friends.

Mostly false Partly false/partly true Mostly true

I don't feel that I have anything to say when I am working in a small group.

Mostly false Partly false/partly true Mostly true

I am afraid to share what I know in a small group because I think I might be wrong.

Mostly false Partly false/partly true Mostly true

I ask a question whenever I am confused.

Mostly false Partly false/partly true Mostly true

One of the reasons I don't ask questions is because everyone else seems to know what they are doing.

Mostly false Partly false/partly true Mostly true

Appendix B

Converting between Fractions, Decimals and Percents Test

Name: _____ Date:_____

1. Complete the table with the correct decimal, percent or fraction. (10 pts)

Decimal	Percent	Fraction
0.45		
	14%	
		2/5
	36%	
0.08		
		1/4
0.20		
	102%	
		1/2
1.2		

2. Describe the relationship between 4/5 and 80% (5pts)

3. If I wanted to convert ¾ to a percent, what would I do and why? (4 pts)

4. What fraction do you think of when you see 50%? Why? (3 pts)

5. Why are “fourths” sometimes referred to as “quarters”? (3 pts)

6. What percentage is equivalent to the fraction value of ¼? Explain what this fraction means. (4 pts)

7. Why is 60% equivalent to 3/5 and 12/20? (4 pts)

8. Describe a real-life situation where decimals are used instead of fractions? Why? (5pts)

9. If you are shopping and see a 3 for $1 sign on your favorite candy. What would you spend for one piece of that candy? Explain how you came to that answer. (5pts)

10. What do fractions, decimals and percents have in common? (7 pts)

Appendix C

Converting Fractions to Decimals
A Cooperative Group Activity

Select a member of your group to be the **reader**. This person will read through the activity as you go. Now choose someone to be the **group leader.** This person will make sure that everyone agrees and make sure that everyone is recording information as the group works through the activity.

The first task is to make sure that everyone in the group understands how to SAY a decimal mathematically. 0.9 is sometimes read as “0 point 9”. That is not mathematically correct. It should be read as “nine tenths”.

Q1. What is the mathematically correct way to read 0.4?

_____

Q2. What is the mathematically correct way to read 0.23?

_____

Q3. What is the mathematically correct way to read 0.367?

_____

It is very important that we know how to say decimals correctly.

If the denominator of a fraction is a 10,100 or 1000 then we can easily write it as a decimal. 8/10 is read as “eight tenths” which is 0.8. 23/100 is read as “twenty-three hundredths” which is 0.23.

7/10 is read as _____which is _____.

44/100 is read as _____which is_____.

So, converting fractions with denominators of 10, 100 or 1000 is pretty easy. What if the denominator is not one of those numbers but we can multiply to make them that easy?

Take 3/5 for example, I can multiply the denominator by 2 to get a 10 and then I would multiply the numerator by 2 as well and get 6/10 which is read as “_____” which we know is 0.6.

Now look at 11/25. I can multiply the denominator by 4 to get a 100 and then I would multiply the numerator by 4 as well and get 44/100 which is read as “forty-four hundredths” which we know is _____.

We know that we can convert a fraction with a denominator of 5 to a 10 and we can also convert a fraction with a denominator of 25 to a 100. Are there any other denominators that this would work for?