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Cooperative Learning as an Effective Way to Interact

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Math in the Middle Institute Partnership
Action Research Project Report

in partial fulfillment of the MAT Degree
Department of Mathematics
University of Nebraska-Lincoln
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Cooperative Learning as an Effective Way to Interact

Abstract

In this action research study of my classroom of 8th grade mathematics, I investigated the effects of students' interactions while cooperatively learning in groups. I discovered that in order to be cooperative, a lesson must be well-defined, open for discussion, and have positive face-to-face interaction. The cooperative learning groups should be teacher generated rather than student-selected. When done correctly, cooperative learning tends to promote student relationships, more positive attitudes toward mathematics and the teacher, and greater self-confidence in a student's mathematics abilities. As a result of this research, I plan to better incorporate cooperative learning into the classroom. Students will be instructed on how to effectively work in cooperative learning groups.

Children are not born instinctively knowing how to interact effectively with others. This is a skill that education reinforces, as students should be actively involved within the classroom. There is no way to overemphasize the importance of the skills required to work effectively with others. Cooperative skills are necessary to maintaining a trustworthy family, a successful career, and a secure group of friends. One of the great advantages of cooperative learning is that important life skills are required, used, reinforced, and mastered within a task situation. Participating in cooperative learning situations requires students to develop and use the social skills necessary for living productive and fulfilling lives as adults.

Throughout my years of teaching, I have encountered a couple of recurrent classroom problems. First, students do not use their free time to work on homework. The second problem deals with students helping other students. It seems that when they do work on their homework, I have a line of students asking questions to see if their answers are correct. I would like for the students to be able to discuss their findings or lack of findings with the students around them. Not until then do I want to field their questions. I want the students to explore and take risks.

I feel my problems may stem from conflicting teaching styles. The familiar classrooms of passive students who are expected to absorb rules that appear as random instruction are gradually giving way to learning environments that encourage students to explore, help students to verbalize their mathematical ideas, and show students that many mathematical questions have more than one right answer. Students in the past were not allowed to talk or discuss their problems. If they had a question, the teacher would be the one to answer it. Through time and different strategies, I would like the students to look to each other for guidance and see the importance of building confidence in themselves and those around them.

Problem Statement

Many teachers teach mathematics the way they were taught. Mathematics is doing arithmetic. Algorithms are taught symbolically with students working by themselves and focusing on getting the right answers by themselves. The teaching of mathematics today involves helping students to think mathematically, to understand the connections among various math facts and procedures, and to be able to apply formal mathematical knowledge flexibly and meaningfully. Cooperative learning must be employed in math classes because mathematical concepts and skills are best learned as part of a dynamic process with active engagement on the part of the students, and this helps students gain confidence in their individual mathematical abilities (Davidson, 1990, p. 107).

Within cooperative groups, students receive considerable encouragement and support in their efforts to learn mathematical processes, strategies, and concepts. The interaction and experience of actively working through math problems with others helps students gain confidence in their mathematical abilities. When students work together in cooperative groups, they tend to like each other, support and encourage each other's efforts to solve math problems successfully, provide help and assistance in doing so, value each other, and see each other as able in solving mathematical problems (Davidson, 1990, p. 109).

Literature Review

Working together to get the job done can have profound effects on students and teachers. A great deal of research has been conducted on the relationship among cooperative learning or collaboration. Korinek, McLaughlin, and Walther-Thomas are faculty members at the College of William and Mary. They have published numerous articles and book chapters on the topic of collaboration while studying various types of classrooms. Korinek, McLaughlin, and Walther-

Thomas (1999) define cooperative learning or collaboration as an interactive process that enables groups or teams of students with different ideas to generate creative solutions to problems. The outcome produces solutions that are different from those of any individual team member would produce independently (p. 2).

Cohen (1972) studied the videotapes of 36 lessons in 16 classrooms. Her research has found that classroom interaction is dominated by the talking of the teacher. Many students in my research felt that they could not freely express themselves in the classroom. Classrooms are organized so that only a central communication group existed with the teacher as the most frequent emitter and target in that central group (Cohen, 1972, p. 443). Students in the front and center of the classroom are more likely to interact with the teacher than other students. If children who participate actively learn more than those who don't, then something drastic needs to be done to redesign the classroom task structure and the role of the teacher so as to increase the level of active participation (Cohen, 1972, p. 444).

Cohen (1994) reviewed the research on the effects of cooperative learning. It was an inductive and conceptual review of research rather than a meta-analysis. In general, she found that cooperative learning has gained increasing acceptance in classrooms in the United States and abroad as a strategy for producing learning gains, the development of higher order thinking, prosocial behavior, interracial acceptance, and as a way to manage academic heterogeneity in classrooms with a wide range of achievement in basic skills (Cohen, 1994, p.1). Students' learning is supported when they have opportunities to describe their own ideas, hear others explain their thoughts, speculate, question, and explore various approaches. One student commented, "Classroom discussion is the best way to share ideas." Another student said, "having many people's ideas," is the most helpful part of cooperative learning. To provide for

this, learning together in small groups gives students more opportunities to interact with concepts than do class discussions. The majority of the 8th grade class felt more confident in small groups than they did in the whole class discussion. Not only do students have the chance to speak more often, but they may be more comfortable taking risks of trying out their thinking in the setting of a small group.

Mitchell, Reilly, Bramwell, Solnosky, & Lilly (2000) researched 139 students in five science classes. Overall, the research does support the student perspective that previous positive social relationships enhance the effectiveness of group work. Students who know and like each other tend to benefit most from cooperative learning groups. According to the students of the 8th grade class, they would like to work with someone who is friendly and with whom they get along. One student commented that the person they would like to work with is one who is “hard working, I get along with, and understands what I say.” When choosing their own groups, students often create groupings that promote or reinforce status hierarchies (Mitchell, Reilly, Bramwell, Solnosky, & Lilly, 2000, p. 21).

Researchers have tried to express their beliefs of the effectiveness of small groups in classrooms. Students have an abundance amount of energy, yet the normal learning environment requires students to sit quietly and listen to the lecture of a teacher. Students and teachers have strong desires for contact and communication with others. Many students come to school in order to be with friends. Each student, teacher, and community member has a strong desire to be accepted, to belong, and sometimes influence others. Effective collaboration emerges out of concerns by individuals who are like-minded in some ways and very different in others (Korinek, McLaughlin, & Walther-Thomas, 1999, p. 2).

Cohen, Lotan, Abram, Scarloss, & Schultz (2002) studied five sixth-grade classrooms, all using the strategies of complex instruction. They found cooperative learning can be effective when students and teachers take on their roles within the classroom. Successful cooperative learning groups will 1) have more talk that evaluates the group product; 2) show less off-task behavior; 3) have better group products; 4) write better final essays on the academic content of the unit (Cohen, Lotan, Abram, Scarloss, & Schultz, 2002, p.1049). Other research has shown that effective collaboration is neither easily nor quickly achieved. Initially it is labor-intensive. Productive partnerships develop from time spent together exchanging ideas, opinions, and information, as well as solving problems together. Time and practice are necessary to build trust and to develop the informal and formal operating procedures that enable teams to work together effectively (Korinek, McLaughlin, & Walther-Thomas, 1999, p. 3).

This research project differs from the published literature in several ways. For instance, this research involved students in the eighth grade, while the students in the literature were from elementary grades. Also, while this research investigates oral communication, most of the literature studied student communication through writing. In almost all the literature, students were researched using journals, whereas in this research, students were questioned by survey and face-to-face interviews.

Purpose Statement

The purpose of my project is for my students to work in groups and use exploratory talk to improve their mathematical understanding. I will be examining the variables of talking in a constructive manner, self-evaluating group work, and the perception and understanding of math in seeking to answer the research questions:

- 1) How does the discussion of mathematics change the student's perception of math?

- 2) What effect does group work have on the students' ability to discuss and understand math?
- 3) How does the grouping of students affect their discussions and perceptions of math?

Through investigation, the research will help me to understand how the students learn best. I will teach the students, through experience, the importance of careful reasoning and disciplined understanding. The classroom will become a better learning environment and will improve the learning opportunities for the students. The classroom will become more student-centered where students take responsibility for their own ideas and provide evidence to support them. The students will be given direction, as well as freedom, but not too much of either.

Method

On the first day of research, students were divided into groups of two by random selection (e.g., numbering). The students remained in these groups for a one week unless a group proved to be academically weak. Every day that a homework assignment was due, students began the class in their groups. They reviewed the assignment together and were expected to answer each other's questions. Simply giving an answer was unacceptable. The students must explain how to arrive at the correct solution. During these conferences, I visited the groups to take attendance and checked for completion of their homework. I continued from group to group answering only those questions which the students were unable to answer. Most of my time was spent listening to explanations and discussions, since someone in a group or neighboring group could usually answer any questions.

At the end of each week or two of cooperative learning, I wrote notes in a teacher journal. I evaluated what I saw and heard coming from the groups of students throughout a week or two. I commented on how the groups were chosen and how the students reacted to it. At times, some

groups would be close friends, and I commented on how they worked together compared to a couple of classmates. The journals were a collection of what things were done well and what things could be improved.

I also spent time in whole-class discussions where the class and I could give feedback on how things were working. Students shared incidents that occurred in their groups and how they were solved. Students did not learn from experiences on which they did not reflect. The class reflected on how their actions may be more effective and discussed how to be even more skillful during the next cooperative learning session.

After two weeks of cooperative learning (February 19), students filled out the survey in appendix A. The cooperative learning continued to the end of March. The students filled out the same survey again on April 5th, 2007. The results for each question were averaged and compared. Along with the surveys, four students were randomly selected and interviewed following the completion of the research. Each student was asked to spend approximately ten minutes answering the questions found in appendix B.

Findings

There are many benefits when students work in cooperative learning groups. I have found that cooperative learning changes the students' perceptions, their ability to discuss, and their perception of working with one another in math.

First, the use of cooperative learning has changed the perception of some students in the class. The students are enjoying class much more when they can work together. I have had a couple of students say they feel more comfortable asking their partner questions in small groups. One student stated, "I can ask questions in my group without being made fun of." Also, as I moved around the room, students made comments on how much better math is when they work

together. “Class is over already?” “We were working, but it didn’t seem like it.” “Can we do this again tomorrow?” My overall perception of the class is better. Students listen when others are speaking. Constant reminders to be quiet are not necessary.

While taking notes, students ask questions that indicate their understanding of the concepts. Many students would stop the lecture and ask “Why?” or “Is this the correct way to look at it?” I found that students in cooperative learning groups are more active and involved in the learning process and, conversely, less bored. I am able to manage a successful learning environment of 22 students because I have the aid of 22 teaching assistants. I am able to spot students who struggle and help them without hindering the rest of the class. With cooperative learning groups, I am able to establish a more relaxed and comfortable classroom environment. A comfortable classroom environment reduces the fear of math so commonly found in the mathematics classroom.

Second, students are becoming more confident in their ability to discuss mathematics. After a couple of lessons in which cooperative learning was used, students were more willing to answer questions for the whole class. Students also said they felt more confident since they had already discussed it with someone else. Question number eight in the survey reflects the students’ confidence. When answering the questions, a “1” represented that the student strongly disagrees and a “5” represented that the student strongly agrees. The question improved on the average score from a 3.74 to a 4.16 or a 0.42 increase in points. They are not as insecure since they have someone else’s opinion to fall back on. One student commented, “Class discussions let me hear the different points everyone has.”

In cooperative learning groups, all students are participants. The two students are actively participating at one time. I have observed various group members explaining the concepts to

each other and to other groups. As the school year progressed, I began to notice that the more confused students preface their questions with statement of what they already know, so the other students know exactly where the misunderstanding lays. They can then construct a logical explanation. Consequently, more class time is available to go on to the next section.

Last, students are more likely to work together when grouped randomly. In one session, I numbered the students from 1 to 22. I then rolled two dodecahedral dice to pair students up. The students did not have anything negative to say about their groups. After they were grouped, students worked quietly and diligently together. Some students stated they did not like their group, but knew it was random and next time could be better. The students knew the work was more important than with whom they were working.

On another occasion, I gave the students two minutes to find one or two partners to form a group of two or three. After the two minutes, half of the class had partners. The class spent the next five minutes sorting things out. Finally after a total of nine minutes, the class was organized into groups of three or four. One student stated, "We cannot pick our own groups. I will not be chosen by anyone." The students felt as if they were being forced to work with others. "I do not want to work with anyone. Nobody likes me." was mentioned by another student. The success of students choosing their own groups was minimal.

With cooperative learning, groups that were assigned randomly or teacher-generated often had the best results. The students were mixed in ability level which gave an optimal combination of students. Having students select their own groups was not very successful. Student-selected groups were homogeneous with high-ability students working with other high-ability students, girls working with other girls, and boys working with other boys. Often there was less on-task behavior in the student-selected groups than in the teacher-generated groups.

Conclusion

Cooperative learning is essential if math teachers are to change the students' perceptions, their ability to discuss, and their perception of working with one another in math. Cooperative learning involves more than simply assigning students to groups and telling them to work together. There are many ways that groups can be nonproductive. In order to be cooperative, a lesson must be well-defined, open for discussion, and have positive face-to-face interaction. The cooperative learning groups should be teacher-generated rather than student-selected. When done correctly, cooperative learning tends to promote student relationships, more positive attitudes toward mathematics and the teacher, and greater self-confidence in a student's mathematics abilities.

Cooperative learning within my 8th grade classroom supports the findings of numerous researchers. Time and practice are necessary to build trust and to develop the informal and formal operating procedures that enable teams to work together effectively (Korinek, McLaughlin, & Walther-Thomas, 1999, p. 3). When choosing their own groups, students often create groupings that promote or reinforce status hierarchies (Mitchell, Reilly, Bramwell, Solnosky, & Lilly, 2000, p. 21). Cooperative learning can be effective when students and teachers take on their roles within the classroom. Successful cooperative learning groups will 1) have more talk that evaluates the group product; 2) show less off-task behavior; 3) have better group products; 4) write better final essays on the academic content of the unit (Cohen, Lotan, Abram, Scarloss, & Schultz, 2002, p.1049).

Implications

Implications for teaching practice include providing training to students in small group processes and effective member roles in order to maximize a group's success, creating

appropriate ground rules, and developing students' skills in facilitating each other's learning.

Training for students must go beyond simple good group skills and should include the benefits of group diversity so that they can cooperate in a more equitable manner.

After using cooperative learning strategies, I am excited about continuing to teach using cooperative learning groups. My new goal is to better implement the cooperative learning groups. Students do not come to class understanding how to work cooperatively in groups. The students need to be instructed on how to properly work together. Students need to feel comfortable working with other members of the group. To help students get acquainted with each other, a team-building activity will be conducted before actually lessons are taught. Such activities will be continued throughout the year.

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Appendix A

Student Survey

5 = Strongly Agree 4 = Agree 3 = Don't Know 2 = Disagree 1 = Strongly Disagree

Circle the number that best represents your opinion.

1. Working in groups helps me learn specific facts or concepts.

5 4 3 2 1

2. Working in groups helps me learn specific skills or algorithms.

5 4 3 2 1

3. Working in groups improves my relationship with my classmates.

5 4 3 2 1

4. When I work in a small group, everyone is encouraged to contribute.

5 4 3 2 1

5. When I work in a small group, ideas and opinions are treated with respect.

5 4 3 2 1

6. When I work in a small group, the group works toward agreement before an action is taken.

5 4 3 2 1

7. Classroom discussion helps me understand math.

5 4 3 2 1

8. I can freely voice my opinions during classroom discussions.

5 4 3 2 1

9. Classroom discussion is understood to be a way of learning.

5 4 3 2 1

Please comment on the following.

10. What helps me most in mathematics class is ...

11. I get frustrated in mathematics class when ...

12. The part of mathematics that scares me most is ...

13. When working in groups, I wish I could work with a person who is ...

Appendix B

Student Interview

1. When do you think is the best time to work in groups? Why?
2. What part of working in groups is most helpful?
3. What part of working in groups is least helpful?
4. Does classroom discussion help or hinder your understanding of math?
5. What do you listen for when you and your classmates are discussing in small groups?
6. Do feel comfortable correcting your classmate in small groups? In class as a whole?
7. What type of person makes a good group mate? A bad group mate?
8. What has helped you the most this year in mathematics? The least?
9. What do you like best about math? What do you like least about math?
10. What is the best way to learn how to work through a math problem that is “new” to you?