DOCUMENT RESUME

ED 362 273 PS 021 687

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TITLE The Impact of Cooperative Learning on Suzy and Janie's Attitudes about Math.
PUB DATE [91]
NOTE 54p.
PUB TYPE Reports - Research/Technical (143)

EDRS PRICE MF01/PC03 Plus Postage.
DESCRIPTORS *Attitude Change; Comparative Analysis; Conventional Instruction; *Cooperative Learning; *Elementary School Students; Females; Grade 6; Intermediate Grades; *Mathematics Instruction; *Student Attitudes; Teaching Methods
IDENTIFIERS Positive Attitudes

ABSTRACT

This study examined the effect of cooperative learning on two female sixth-grade students' attitudes toward mathematics. The students (one Caucasian, one African-American) were individually interviewed to obtain background information relevant to the study. An initial survey was also given to 17 sixth-graders to obtain general attitudes of sixth-grade females towards mathematics. The two girls were then observed in three learning environments: working on mathematics problems in an individual, competitive, and cooperative setting. A final survey was administered to the two girls, asking them to compare the three methods of instruction and to indicate which of the three they felt most positive about. Findings indicated that the two subjects had more positive attitudes about math in a cooperative setting. This finding was supported by reports and observations of increased enjoyment, increased time on task, and overall positive affective reactions during the cooperative learning situation. (MM)

The Impact of Cooperative Learning on Suzy and Janie's Attitudes About Math

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Running head: COOPERATIVE LEARNING AND MATH ATTITUDES

Abstract

Gender differences in mathematics has become a popular subject over the last few years. Extensive research has been done on various factors that are assumed to affect mathematic achievement among males and females. This study of gender differences, however, examines the affect of a specific method of instruction on the attitudes of two females. More specifically, the study examines the impact of cooperative learning on Suzy and Janie's attitudes about math. Suzy and Janie are two sixth grade students who attend a local middle school. These two females were interviewed and observed working in an individual, competitive, and cooperative setting. Findings from the study indicate that these two females do, indeed, have a more positive attitude about math in a cooperative setting. Reports and observations of increased enjoyment, increased time on task, and overall positive affective reactions during the cooperative situation support this finding.

CHAPTER I

Introduction

Need for Study

Research shows that there is a disparity in mathematics achievement between boys and girls (Berliner, 1987, p. 10). This disparity, however, is most often attributed to the attitudes of males and females towards mathematics, not to a lower aptitude for mathematics by females (Kober, 1991, p. 20). While many groups have been identified as having a strong influence on the attitudes of students' towards mathematics, teachers have especially been noted as primary sources of the development of gender differences in mathematics. Studies have suggested that teachers should examine the amount of interaction as well as the type of interaction present in the classroom. Teachers must be aware of their patterns of interaction, and they must make a conscious effort to ensure equitable opportunities for girls as well as boys.

When examining the type of instruction used in mathematics classes, teachers are advised to vary their teaching styles and activities in order to provide every student with opportunities to do well (Berliner, 1987, p. 10). This means that teachers should attempt to balance the number of competitive and cooperative activities that take place in the classroom in order to give boys and girls equal opportunities for success.

While these suggestions may help to create a more balanced level of mathematics achievement among males and females, they do not mention any possible effects on the attitudes of each of these groups towards mathematics. Researchers repeatedly report that females do not have a lower aptitude for math skills. They focus on the attitudes that females have towards math, and they provide reasons for how these attitudes may be shaped. It would follow, then, that researchers would want to show how the attitudes of females towards mathematics may be changed in a positive way. Follow-up research, however, only shows how cooperative math activities help the achievement of females. How do such activities affect the attitudes of females towards mathematics?

Purpose of Study

The purpose of this study was to examine the potential impact of cooperative learning on the attitudes of two females towards mathematics. It is predicted that females will show higher achievement levels as a result of cooperative math activities. Can we also assume, however, that females will have more positive attitudes towards math as a result of such cooperative activities? More specifically, will Suzy and Janie show more positive affective reactions, increased enjoyment, and higher levels of engagement in a cooperative setting?

Origin of Study

I chose to do my project on the impact of cooperative learning on Suzy and Janie's attitudes about math for several reasons. First, the issue of gender differences has always been an area of interest for me. I enjoy reading research about the differences that exist between males and females in all facets of life. Since I will be beginning my career in education shortly, I am especially interested now in the types of gender differences that exist in the school setting. I have seen much literature about the potential differences in ability based on gender, but I have yet to see much information on differences in attitudes between males and females.

Another reason that I chose my specific topic is because I enjoy mathematics. I was able to teach math to sixth graders during my teaching associateship, and I really enjoyed the experience. I also found that many of the noted gender differences in academic areas were in math and science. Therefore, math was an ideal subject to use in order to examine the different attitudes of females.

Finally, I chose to focus on cooperative learning because this is becoming a popular method of instruction. Many benefits of cooperative learning have been documented already, and I was curious to see if "improving attitudes about mathematics" could be added to this list.

While examining existing literature on gender differences in math, I noticed that many studies made generalized statements about females. Statements such as, "males tend to be more competitive and aggressive," "girls are more likely to drift into social activities," and "females hold more negative attitudes about math," are all examples of the categorization of individuals into gender specific groups. This type of categorization of all females into specific groups regardless of their individual characteristics is very unrealistic and has a deceiving affect on the results of various studies. It is for this reason that I chose to focus my study on two individual females. By obtaining specific background information on each female, I was able to see the factors that directly influenced their particular attitudes.

Overview

Through this study, I examined the impact of cooperative activities in math instruction on the attitudes of Suzy and Janie towards math. While I expected to find that cooperative learning had a positive affect on Suzy and Janie's attitudes about math, I could not make such an initial hypothesis for this type of study. Chapter II will review some of the existing literature related to both gender differences and cooperative learning as they relate to mathematics.

Recognizing that each person has individual characteristics

and past experiences that make them unique, I chose to focus on two specific female students. Because these students differed in many areas, it was necessary to gather accurate background information on each student. Chapter III will provide this information about the informants.

It was also necessary to carefully examine the attitudes of each female following the individual, competitive, and cooperative situations in which they were placed. In order to obtain the most accurate information possible, I videoed each of these situations and I analyzed not only the verbal responses of each female, but their indexical shifts as well. Chapter III provides a more detailed description of the data collection procedures and the design of the study.

An analysis of the results will be presented in Chapter IV. By synthesizing all of the information, I was be able to obtain the most accurate analysis of the impact of cooperative math activities on Suzy and Janie's attitudes about math. The final summary and conclusions will follow in Chapter V. Suggestions for further study will also be included in this section.

CHAPTER II

Literature Review

Gender Differences

Gender differences in mathematics achievement has long been an area of concern for educators, students, parents, and the nation as a whole. Numerous studies have been conducted in order to show that an actual disparity exists in the achievement of boys and girls, and researchers have searched for possible reasons for such a disparity. The majority of available research on the topic of gender differences in mathematical ability shows that "in the United States, girls generally don't do as well in mathematics as boys" (Berliner, 1987, p.10). Even though this assumption is widely accepted as truth, however, there is still no evidence that females as a group have less aptitude for math than males (Kober, 1991, p. 20). Therefore, researchers have focused their energy on identifying potential causes for such gender differences.

Social Influences

When examining the potential causes for gender differences, many social influences both inside and outside the school setting are repeatedly noted. In her work, Fox (1977) specifically identifies the influence of

significant others such as parents, peers, teachers, and counselors. Upper elementary grade girls (grades four to six) are found to be more susceptible to peer influences than boys, and particularly in adolescence, girls may perceive real peer pressures against achievement in mathematics (Fox, 1977, p.11). Some evidence also shows that support and encouragement from parents are crucial for girls in their decisions to take math courses in high school. In general parents are less likely to notice and encourage math talent in female offspring, and therefore, girls are correct in perceiving less parental support.

Inside the school setting, the most frequently noted influences on gender differences are teachers and methods of instruction. Teachers are often viewed as the primary source of the transmission of negative or stereotyped messages about gender differences in math. Kober (1991) notes that "women teachers who themselves may not be comfortable with mathematics, can foster inequities by sending out negative signals about math or treating males and females differently in the classroom." Numerous researchers have found that during math lessons, teachers interacted with boys more often than with girls (Berliner, 1987, p. 10). Research also shows that teachers give different types of feedback to male and female students. When dealing with females, teachers are more likely to focus on their intellectual abilities or work

habits, whereas with males, they are more apt to criticize such non-intellectual aspects as neatness and effort (Kober, 1991, p. 20). Thus, through the amount and type of interaction used, teacher attitudes and expectations are being conveyed to the students and are influencing the students' attitudes.

Instructional Influences

Common methods of instruction in mathematics are also seen as important influencing factors in gender differences. Kober (1991) claims that "an emphasis on drill and practice, paper-and-pencil exercises, and standardized multiple-choice tests makes mathematics seem dull and sterile" (p. 6). Even students who seem to be doing well in mathematics may be turned off by this type of instruction. Another important aspect of the methods of instruction used by teachers is the type of math activities that commonly take place in the classroom. According to Berliner (1987), teachers often teach using timed tests and instructional games. Boys tend to excel in these type of activities, where the loudest and quickest student wins the game. "Because males tend to be more competitive and aggressive, in such a situation they have an advantage over females" (Berliner, 1987, p. 11). Such competitions frequently hurt the achievement of females, because they tend to lose.

Berliner (1987) also found in his research that when teachers used cooperative learning in their math instruction, girls achieved more than boys. This raises the question of the impact of cooperative learning in mathematics instruction. Recent research on the topic of cooperative learning shows that "cooperative learning can result in higher achievement, greater self-confidence, better group relations, more cross-cultural integration, improved acceptance of mainstreamed children, and enhanced social skills" (Kober, 1991, p. 14).

Personal Contribution to Research

While this information may provide insight about the impact of cooperative learning on math achievement, it does not mention anything about how cooperative learning may influence attitudes or feelings about mathematics. Most research has not looked at the possible differential effectiveness of the small-group organization in terms of gender (Fennema, 1990, p.142). Some literature does exist, however, that suggests that cooperative math activities may be more beneficial to females than competitive ones (Fennema, 1990, p. 145). But what is meant by "beneficial?" Does this only refer to the mathematic achievement of females, or is there some "beneficial" affect on the attitudes of females towards math? The purpose of this paper is to examine the potential impact of cooperative learning on the attitudes of

two females towards mathematics. Do cooperative math activities, indeed, have a positive affect on Suzy and Janie's attitudes about math?

Because this study was designed as two specific case studies, all of the individual components that contributed to the formation of the specific attitudes that Suzy and Janie have about math could be carefully examined. This study can be helpful in two ways. First, the findings of this pilot case study can be an impetus for future studies. Important issues and concerns may become apparent and further research may be conducted to gain further knowledge in these areas. Second, the findings of this study, although limited to two sixth grade girls in a small urban community school, may be transferable to other girls in similar settings.

CHAPTER III

Methods

Informants

The main focus of this study was on two specific sixth grade females. These females were given the opportunity to choose their own pseudonyms for this study, but they were unable to come up with names on their own. Therefore, I chose the names "Suzy" and "Janie" as their pseudonyms for this study.

Suzy and Janie were selected as informants for this study because there were many differences between these two individuals. Race, achievement level, and personality are a few of the differences that exist. Many other, more subtle differences also exist, and were recognized and considered during data analysis. An informant comparison chart is included following the background information in order to outline some of these differences. Since previous research on this topic often fails to acknowledge such differences among individuals, it is important that these influencing factors be remembered in this study.

Each of the informants were interviewed in order to gain background information relevant to the study. The following are summaries of the information obtained from each of these interviews.

Suzy

Suzy is an African-American sixth grader who thinks math is boring. She said it is boring because "you do division." She does, however, enjoy doing experiments in math, especially "when you get to eat." When asked if she learned anything by doing these experiments, she said that she learned about measuring. Besides that, she did not know what else she learned. When asked about past math experiences, Suzy said that they were boring, but they are getting better. "Why are they getting better?" I asked. "Because you get more kids in the class and that makes it fun," she replied. In talking about the other students in her math class, Suzy said that some liked math and some did not. She cited one particular female who liked math. She then added that this student did not ever talk and acted like she paid attention. Suzy believed that all students want to do well in math, including herself. She also added that her teacher wants her to do well and often helps her. She said she has to do her math work to do well, and her eleven year old sister helps her with this type of homework. Finally, she reported getting a "B" in math for the last six week grading period. This grade shows improvement from the beginning of the school year.

Janie

Janie is a Caucasian female who is also in the sixth grade. She said she enjoys math most of the time, and she especially likes solving word problems. She also enjoys working on math problems in a group because it "is sort of like team work" and "you can learn things from other people." She prefers for groups to be selected by the teacher so there will be more variety in the people she works with. Regarding past math classes, Janie has had all female teachers whom she described as good teachers. She thought her past classes had been easy. She believes that her current math teacher wants her to do well in math and helps her when she has problems. When discussing other students in her math class, Janie said she thought most of them did not like math. When asked why, she replied, "Because they don't like a challenge... they don't want to have to think to do it." She did say, however, that there were other girls in her class who like math. Janie said she often makes careless mistakes in math. She did not think she would use math in her job one day, but she believes she needs to know math. At home, her dad helps her with her homework unless he is on a business trip; then her mom helps her. Finally, Janie reported getting an "A" in math for the last six week grading period. She said that she usually gets "B's," and she attributed this improvement to the fact that they just did fractions, which she really likes.

Informant Comparison

Suzy	Janie
. Afro-American	. Caucasian
. less affluent	. more affluent
. outspoken	. shy
. active	. quiet/reserved
. sense of humor	. serious
. athletic	. intellectual
. average achiever	. high achiever
. low motivation	. high motivation
. externally motivated	. internally motivated
. low parental support	. high parental support
. college questionable	. college bound
. socially confident	. socially insecure
. questioning/confrontational	. agreeable
. pessimistic	. optimistic
. happy	. happy

Data Collection Procedure

Survey

An initial survey was given to a sixth grade math class containing eleven females and six males (see Appendix A). The purpose of this survey was to gain a broad view of the attitudes of sixth grade females towards mathematics. The first set of questions on this survey dealt with general attitudes towards math: motivation to do well in math, self-perception of mathematical ability, usefulness of math, desire to take future math courses, and perceived teacher expectations. The following section contained questions related to the preferred method of instruction for math activities. Additional portions of the survey restated previous questions, introduced questions aimed at eliciting affective reactions to math, and provided the opportunity for students to list specific classmates that they would prefer to work with in different situations. All completed surveys were reviewed, excluding those belonging to Suzy and Janie. Suzy and Janie's surveys were not reviewed until the end of the study in order to prevent the formation of initial biases. An item analysis of male and female attitudes may be found in Appendix A.

The remainder of the methods in this study were used only with the two selected informants. These methods included observations, interviews, and a final survey. All of the

methods, as well as the math problems used in each situation (see Appendix B), were originally developed specifically for this study.

Observations

Observations were an important aspect of data collection for this study. Each time the informants were placed in a different situation, I observed and videotaped their actions. Extensive field notes were taken during each session and while reviewing the tapes. All actions by the informants were recorded for future analysis.

Interviews

As noted previously, an initial interview was conducted with each informant in order to obtain background information. Informants were also interviewed following each of the three situations, individual, competitive, and cooperative. The purpose of these interviews was to gain information relevant to the informants' attitudes about the situation they just experienced. Informants were first asked to give their initial reaction the problem. They were also asked whether they thought the problem was easy or hard, if they became frustrated at any point, and which specific parts of the problem gave them trouble. Another important question that the informants were asked is whether they enjoyed solving the

problem in the particular way that they were instructed to solve it. Answers to this question were especially useful in determining the informants' attitudes or feelings about specific methods of instruction.

A standard list of interview questions (see Appendix C) were asked in each of the three sessions. In most instances, the initial protocol of asking the entire set of questions was followed. Occasionally, however, the informants would offer further explanations or comments related to the questions. In these cases, normal protocol was slightly altered and related discussions took place.

Final Survey

A final survey was given to the two informants in the study (see Appendix D). The purpose of this survey was to encourage the informants to compare the three methods of instruction and indicate which of the three they felt the most positive about. A positive attitude toward a specific situation was noted when the informant indicated that she enjoyed doing math in this type of setting. The survey also asked the informants to note their specific preferences for the type of math activities they engage in and how often each type of activity should be used in the classroom. Finally, the informants were asked to list in order the ways they enjoyed doing math.

Design of Study

Informed Consent

Following the selection of the two informants for this study, a note was sent home in order to explain the procedure of the study. The parent or guardian of the informant was asked to sign and date the form giving permission for their child to participate in the study. The informants themselves were also asked to sign this form agreeing to participate. After these forms were signed and returned, arrangements were made to meet with the two informants for three one hour sessions over a two week period.

Session One

For the first session only, the informants were observed individually. This session began with a short interview in order to gain important background information and to establish the general attitude of each informant towards math. Next, the informants were given a math problem which they were instructed to solve on their own. The math problems used in all three sessions were problems dealing with simplifying and adding fractions. Students needed some knowledge of factors, multiplication, division, and finding the least common denominator in order to solve these problems. They were given as much time as was necessary to solve the problem. Upon completion of the problem, I then discussed

with the informant the answers they got, how they arrived at these answers, and the correct answer to the problem. Finally, I asked the informants a set of questions relating specifically to the situation that they just encountered.

Session Two

For the second session, the informants were observed together. The problem they were asked to solve this time was a different problem than the one used in the first session, but the content was similar. The informants were again instructed to work on this problem individually, but this time the situation was set up as a competition between the two informants. The "winner" was the one who got all the right answers first. At the conclusion of "the race," the informants answers and thought processes were discussed, and the correct answers were provided. Finally, this session concluded with the informants again answering the prepared set of questions, this time relating their answers to the competitive situation which they just experienced.

Session Three

For the final session, the informants were again observed together. Again they were given a different problem of similar content, but this time they were instructed to solve the problem together. The informants were told that

they could work together and help each other in order to find the correct answers. Discussion and questioning similar to the first two sessions took place after the informants completed this final problem. A concluding survey was then given to the informants in order to summarize their individual preferences for specific types of math instruction.

Analytic Methods

Interpretive Inquiry

Much of the data for this study was collected through observations. The actions of the informants were observed in two ways. I observed each situation and recorded all actions at the time of their occurrence. Also, the informants were videotaped in each situation, and I reviewed the tapes and noted any actions that may have been unintentionally overlooked the first time. In both instances, I was the person who listened to the words of the informants and observed their actions. Therefore, I was also the person responsible for reading the meaning in the words and actions of the informants.

Observations

When observing the actions of the informants in each situation, a domain analysis (Spradley, 1980) was done in order to classify the actions into specific categories of

meaning. For example, fidgetiness and excessive movement were seen as a kind of nervousness or disinterest. Sighing and putting ones hand on the head were viewed as a kind of frustration. Smiling and laughing were noted as a kind of enjoyment.

Interviews

Along with interpreting the actions of the informants through observations, their words and statements were also interpreted through interviews. Conversational analysis (Schegloff, 1991) was done on the informants answers to questions as well as on their dialogue with myself and with each other.

Surveys

Finally, data obtained from informant responses on the surveys was analyzed in order to determine the attitudes of the informants. When a check was placed in the "Agree" category, the informants were assumed to have similar feelings to the ones in the statement. This was especially important when the statement dealt with the enjoyment of a particular type of instruction. The surveys also provided opportunities for the informants to write in their own responses. These answers gave clear insight into the preferences of the informants for one type of instruction over another.

Person as Instrument

Because a large amount of interpretation was done in this study, it is important to know about the person who was the instrument of interpretation. I am a twenty-three year old female who is receiving my Master of Education this spring. I enjoy mathematics and I have had many positive math experiences throughout my formal education. The majority of my math teachers in the past have been females, and they have all been what I would consider excellent teachers.

While I do not remember ever using cooperative learning in my math classes personally, I have used this method of instruction during my teaching associateship. When such an activity is well organized and clearly presented, I have found that the majority of the students enjoy participating in this type of cooperative group instruction. Overall, I enjoy math and I want to encourage students, both male and female, to do the same.

Steps

Data analysis for this study was done chronologically. After all of the data was collected, it was then categorized according to individual, competitive, and cooperative groups. When reviewing the data for each situation, four steps were followed. First, the actual math problem that the informant was asked to solve was examined. Next, the video and field

notes of the situation were reviewed and specific actions were noted and interpreted. Third, the video and field notes were reviewed again, this time noting verbal responses and dialogues. Finally, the answers to the interview questions at the end of each session were reviewed. After each of these steps were followed for the three situations, a comparison was then made between them all. The purpose for such comparison was to note redundant themes that were present in all three instances. Differences between the situations were also noted. After interpreting all of the data and drawing conclusions, the final survey was analyzed and compared to the present findings. Similarities and differences were again noted, general conclusions for the study were drawn, explanations for discrepancies were offered, and suggestions for further research were made.

Credibility and Dependability

Credibility

The information obtained through this study may be seen as ecologically valid (Circourel, 1986) because of three important factors related to the study. The first factor is prolonged engagement. Because I worked with Suzy and Janie on a daily basis for seven weeks during my teaching associateship, I began this study already having a lengthy engagement with these individuals. I continued my engagement

through initial discussions about the study with the informants, approximately five hours of data collection, and concluding discussions to wrap up the informant portion of the study.

Another factor related to the credibility of this study is persistent observation. Having worked with these students before, I was able to observe them both in and out of the classroom setting. These previous observations gave me the base knowledge to select these particular individuals as informants for my study. I continued my observation of the informants through one-on-one interaction and group work with them during the various sessions of the study.

The final factor to consider is triangulation (Lincoln and Guba, 1985). Taking a case study approach in this study, I used the triangulation method of having different means of data collection from the same source. The means of data collection that were included in this study were observations, surveys, interviews, and discussions.

Dependability

Dependability, or confirmation that the study has quality, can be found in the extensive field notes that were taken during this study. All aspects of data collection were carefully observed and recorded in an organized manner. This information was then viewed against the previous body of data

that exists on this topic. Comparisons were made between the general conclusions of this study and those of previous research. If differences were found, possible alternative explanations were considered. Peer debriefing also took place with people of similar and different backgrounds and fields of expertise in order to establish inter-coder reliability.

CHAPTER IV

Findings

Initial Survey

Since the purpose of this study was to examine the impact of cooperative learning on Suzy and Janie's attitudes about math, it was necessary to find out what attitudes existed in these individuals at the onset of the study. This information was obtained through an initial survey given to all students in Suzy and Janie's sixth grade math class. In order to avoid being biased by this information, however, I did not look at Suzy and Janie's completed surveys until the conclusion of the study.

Both Suzy and Janie agreed that they *wanted to do well in math*, they *could pass math if they worked hard*, and they *were willing to work to do well in math*. They also both chose *working with one friend* as the preferred way to do math. Suzy and Janie also thought that they did *pretty good* in math. Janie, however, felt frustrated *sometimes* and nervous *sometimes*, while Suzy felt frustrated *sometimes* and nervous *never*. Janie also likes doing math and would like to take more math, while Suzy only likes math sometimes and she does not want to take more math.

Initial Interview

From the information obtained in the initial interviews, I gained great insight into the attitudes and experiences of the specific informants. One of Suzy's most noticeable attitudes was that she thought math was boring. She labeled her past as well as her present math experiences as boring, but she added that they were getting better "because you get more kids in the class and that makes it fun." She also noted that she enjoyed doing math experiments. Even though she may not always enjoy math, Suzy did say that she wants to do well in math.

Janie, on the other hand, liked math and especially enjoyed solving word problems. She said that her past math teachers have been good and the classes have all been easy. Janie thought that most of the other kids in her present math class didn't like math "because they don't like a challenge. They don't want to have to think to do it."

Observations

Observations were done throughout this study. The actions of the informants were recorded and interpreted. As noted earlier, I was the person responsible for interpreting and providing meaning for the actions of the informants. The observational findings were categorized by sessions.

Session one was the individual setting. The informants

were observed separately in this situation. While observing Suzy I found that she was very fidgety. She was always moving around, playing with her pencil, or looking around the room. These actions were interpreted as a sign of nervousness or disinterest. Janie, however, showed little physical activity and kept her eyes focused on the problem for the majority of the time observed. While she may also have been nervous, she was apparently able control these feelings by focusing on the math problem.

Session two was the competitive setting. During this situation, the informants were observed together. Even though they were seated next to each other, they did not interact or even look at each other for the majority of the time. Suzy showed similar actions in this situation as she did in the individual setting. She was a little less fidgety than in the previous situation, but again she was easily distracted by outside noises. One different action noted in this situation was that Suzy did not spend as much time trying to solve the problem. Janie also showed actions in this situation that were similar to the previous setting. She was quiet and still, but this time she also appeared to be frustrated. Near the end of the problem, she was observed to frequently put her hand on her head and sigh. This was interpreted as a type of frustration and nervousness about getting the right answer to the problem.

Finally, session three was the cooperative setting. During this situation many interesting observations were made. Suzy and Janie interacted and exchanged ideas throughout the session. They had frequent eye contact with each other and they physically turned their bodies to face each other. While working this problem cooperatively, neither informant showed signs of nervousness, frustration, or disinterest. No actions such as putting a hand on the head, sighing, fidgeting, or ceasing to work on the problem were noted about either Suzy or Janie. In addition, much laughter and joking was observed in this situation. These actions were seen as a type of enjoyment.

Interviews

Each informant was interviewed at the conclusion of each of the three different situations. Informant responses to the interview questions were a very important source of data for this study. The responses were also categorized by sessions. Particular attention was paid to responses concerning the difficulty of the problem, the desire to do well, and the overall enjoyment in each situation. Responses from each session were then compared and similarities, differences, and changes between the sessions were noted.

Session One

Upon completion of the problem in the individual setting, each informant was asked if they felt the problem was easy or hard. Suzy said the problem was "easy, but I had to think about it." Janie's response was that "it was hard at first, but then it got easier." Suzy also added, "If it's easy math, I want the right answers. If it's hard and I don't understand, I don't care about doing well." Both informants were then asked if they enjoyed solving this problem on their own. Suzy said "yes, but I wish I had Evan in my group. He's smart, he knows more. I do easy ones by myself, but hard ones in a group." Janie answered "yes, I liked doing it alone, but if it were harder I'd want a group."

Session Two

After completing the problem in the competitive situation, both Suzy and Janie said they thought the problem was hard. Suzy said it was hard because "you had to add fractions." Janie, however, said, "It took longer. There were more problems. I didn't think the adding fractions was hard." Each of the informants was then asked if they liked competing. Suzy answered, "I guess. It's like being in the classroom." Janie, however, said, "No. I would be more relaxed if it wasn't a competition." Janie continued to say that she also felt like she was competing in the classroom and

she didn't like that. Finally, Suzy and Janie were asked if they were concerned about getting the right answers all the time in this situation. Suzy replied, "No. They may give bubble gum, then I want to get the right answer. That's why kids get wrong answers, because they have competitions and they try to beat the other person - try to get some prizes." Janie answered the same question by saying, "In a competition, rather than get it right, I'd rather get it done."

Session Three

Finally, at the end of the cooperative situation the informants were again asked if they thought this problem was easy or hard. This time, Suzy said, "It was complicated. There were too many steps," while Janie answered, "It wasn't very hard. It was just long - overwhelming, sort of." Both informants reported being frustrated at some point during this problem. Suzy said she felt frustrated for "the whole thing." She also said, "I felt like giving up. I would have given up if Janie wasn't helping." Janie, on the other hand, was frustrated "when I heard that I got that one wrong." Suzy and Janie also had different responses when asked if they were nervous about getting the right answer. Suzy said, "No. This doesn't go on the report card." Janie said, "Yes. If I didn't finish this I would worry all day. It's not just getting it done, it's getting it done and getting it right."

Finally, Suzy and Janie were asked if they enjoyed solving this problem together. Suzy answered, "Yes, because I like the problems and you could help somebody who really needs help." Janie's response was, "Yes. I did because I sort of learned what [Suzy] thought of these."

Final Survey

A final survey was given to each of the informants in order to assess their overall feelings about math in each of the three settings, and to force them to make comparisons between these situations and note their personal preferences.

Suzy listed her preferences for how to do math activities in the following way: (1) in groups (2) by myself (3) competition. Janie's list looked like this: (1) by myself (2) in a group (3) competing.

The survey also included many statements comparing the three situations to each other. This method forced the informants to rank their preferences of math instruction by comparing each type of instruction to the other and then comparing all three of them. The informants were asked to respond to each statement by checking the blank for either *Agree*, *Not Sure*, or *Disagree*. The following chart provides a small sample of their responses to particular statements.

	Suzy	Janie
I enjoy math more in small groups than in competitive situations.	Agree	Not sure
I enjoy math more in small groups than when I have to do it individually.	Agree	Disagree
I enjoy math more when I work by myself rather than in a competition.	Agree	Agree
I would like to work in small groups all of the time.	Disagree	Disagree
I would never like to do math as a competition.	Disagree	Disagree
I always like to do math on my own.	Disagree	Disagree
I like a combination of individual, competitive, and cooperative math activities.	Agree	Agree

Overall, Suzy and Janie agreed that they would prefer a combination of individual, competitive, and cooperative math activities in the classroom. They both also noted that they would rather work individually than in a competition. One notable difference, however, is that Suzy said she enjoys small group work more than individual work, while Janie disagreed with this statement.

Literature

Because there is little literature that deals directly with the impact of cooperative learning on female math attitudes, there are few comparisons that can be made between the findings of this study and existing research. One common finding between these two sources that does not relate specifically to this study is that females were found to show higher achievement levels in cooperative situations. When examining Suzy and Janie's solutions to the problems presented in each situation, there were fewer errors found in the cooperative situation than in the individual or competitive situations.

Another area of comparison is the general attitude of females towards math. Most of the literature on this topic claims that females usually do not like math. In this study, Suzy was found to fit with this generalized attitude, but Janie was in opposition to such a view. Janie actually enjoyed doing math and wanted to continue to take math classes in the future. This highlights the importance of examining individual females and considering their specific situation instead of making blanket statements that assume similarities among all females.

While the findings of this study may provide some insight as to the impact of cooperative learning on Suzy and Janie's attitudes about math, the lack of sufficient data points

prevents any definite conclusions from being drawn. I would like to have had more extensive exposure and research opportunities in order to have obtained a larger body of information. It is only through detailed research and data analysis of a variety of informants that adequate conclusions can be drawn.

CHAPTER V

Conclusion

Implications

I started this study with the intent to learn how two sixth grade girls, Suzy and Janie, felt about math. More specifically, I was interested in examining the possible impact of cooperative math activities on Suzy and Janie's attitudes about math. This chapter will discuss the conclusions of this study, implications of the results, and possible future studies related to this topic.

After careful examination of the data obtained from surveys, observations, and interviews in this study, it appears that cooperative learning has a positive impact on Suzy and Janie's attitudes about math. The positive impact includes increased enjoyment in math activities, increased level of engagement or time on task, and an overall positive affective reaction towards cooperative math activities. These results were found after reviewing the actions and words of Suzy and Janie in an individual, competitive, and cooperative situation.

In the cooperative setting, both Suzy and Janie showed very few actions that were interpreted as a kind of

frustration, nervousness, or disinterest. Their verbal responses to interview questions following this situation also confirmed their enjoyment of the activity. While both informants seemed less nervous in the cooperative setting, this may have been due to other outside factors. Suzy and Janie may have been more comfortable with the overall situation and working with me because this was the third time that we met. Having had previous encounters, they may have been more relaxed and familiar with the procedure that had been established.

Also, Suzy and Janie may have been more comfortable with the specific type of math problem that they were expected to solve. Practice effects may have played a role in their apparent decrease in nervousness and frustration. Since I reviewed the correct procedure and answer for each problem immediately after it was solved, Suzy and Janie may have picked up on important facts or processes from previous problems and applied them to the problem in the cooperative setting.

An interesting difference was noted between Suzy and Janie when they listed their preferences for specific types of math activities. Although Janie had said previously that she enjoyed working in the cooperative setting, on her final survey she listed working by herself as her most preferred way to do math. I found this apparent contradiction puzzling. My

initial explanation for this situation was that since Janie was a slightly higher achiever than Suzy, maybe she felt that in the cooperative setting she was giving Suzy a lot of the answers to the problem. In order to clarify this question, I spoke to Janie again and asked her what her favorite way to do math was. She again replied, "By myself." I asked if she had said once that she liked small groups, and she said, "I did. I might have changed my mind." "Why do you think you changed your mind," I asked. Janie answered by saying that "sometimes working in groups can be frustrating. It's frustrating when someone doesn't understand the problem or you both don't, or when one person understands and the other one doesn't and you have to explain it to them over and over." Janie added, "I do like groups though, just not all the time."

This scenario as well as written responses from the informants provide evidence that a combination of different types of math activities is preferred in the classroom. This finding is consistent with what researchers suggest to classroom teachers. Researchers claim that a combination of competitive and cooperative activities should be implemented in order to give every student an equal opportunity for success. By varying teaching styles and activities on a regular basis, teachers more effectively eliminate overreliance on any one teaching style that may favor one group of students over another (Berliner, 1987, p. 10).

Finally, this study shows that it is important to assess the individual attitudes of female math students. Many of the studies performed so far have looked at females as a group instead of looking at individual females. Past experiences, family composition, and personality are only a few of the important factors that influence individual students and affect their reactions to specific situations. It is, therefore, important for teachers to know their students and attempt to use methods of instruction that are beneficial to all students.

Future Studies

Since this study was a pilot study, future studies of the same type could be augmented in order to further validate the findings of this study. If I were to replicate this study, I would spend more time getting to know the informants. I would shadow each informant for a day in order to gain greater insight into their specific personalities. Having a more detailed knowledge base about each informant would be very helpful in interpreting their words and actions. I would also repeat the individual, competitive, and cooperative situations many times using different math problems each time. This would ensure that the findings of the study were not dependent on the math content of the problems. Finally, I would try to observe the informants participating in these three situations

in their regular classroom to be sure that their actions and feelings carried over to a large group setting.

Classroom teachers could do their own simplified version of this study by using individual, competitive, and cooperative math activities in their classrooms and taking time after each activity to interview particular females in the class. This type of student feedback would allow teachers to find out which types of instruction are most beneficial and enjoyable for particular individuals.

Another topic for future studies is the perceived usefulness of math by females. In this study, I found that even though Suzy and Janie had more positive feelings about math in a cooperative setting, they still did not view math as a practical and useful subject. Janie even said once, "There's no use for math except for, well I mean there is, but there isn't. What do you do with math? I mean unless you're going to be an accountant or something." This quote shows that math is still not perceived as a relevant or practical subject, especially to many females. While this attitude is presently documented in much of the research on the topic, little work has been done to find out how to make math more useful for students with this attitude. Future studies may be conducted on this topic and provide suggestions about how to make math more relevant to students.

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Appendix A

Survey Item Analysis

	Girls				Boys			
	A	NS	D		A	NS	D	
I.								
1.	11				5	1		
2.		1	9	(1 blank)		2	4	
3.	10		1		6			
4.	5	6			3	2	1	
5.		4	7			3	3	
6.	7	3	1		5	1		
7.	10	1			5	1		
8.		1	10			1	5	
9.	11				5	1		
10.	2	6	3		3	2	1	
11.	9	2			5	(1 blank)		

II.	Yes - 7 Sometimes - 4	Yes - 3 Sometimes - 2 No - 1
III.	rated themselves in top 5 : 4	top 5 : 2

	1	2	3	4	1	2	3	4
IV.								
14.	1	1	8	1	1		4	1
15.	2	9				5	1	
16.		9	1	1	2	3		1
17.		1	8	2		1	2	3
18.	3	7	1		3	2	1	
19.	2	4	3	2	2	2	2	

V.		
21.	8 chose <u>all</u> other girls 3 same people as in #20 (team)	4 chose <u>all</u> other boys 1 "someone with same ability" 1 "someone to help me"

This is how I feel...

I. Put a check in the column that tells how you feel about each statement.

	Agree	Not Sure	Disagree
1. I want to do well in math.	_____	_____	_____
2. I don't care about math.	_____	_____	_____
3. I can pass math if I work hard.	_____	_____	_____
4. I am as good in math as others in my class.	_____	_____	_____
5. I dread math.	_____	_____	_____
6. I think math is useful in my everyday life.	_____	_____	_____
7. I believe that I need to know math in order to get a job.	_____	_____	_____
8. I don't think I need to know math to get a job.	_____	_____	_____
9. I am willing to work to do well in math.	_____	_____	_____
10. I would like to take more math.	_____	_____	_____
11. I believe that my teacher expects me to do well in math.	_____	_____	_____

II. Answer the following questions the best you can.

12. Do you ever like to do math? _____

Describe a place and a time when you like math? _____

_____

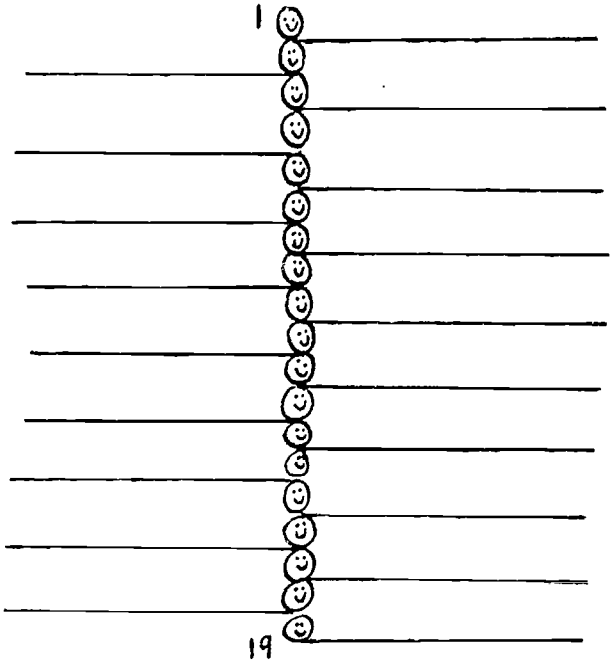
13. Describe when and where you like math least. _____

_____

14. What was your grade in math for the last six week term? Circle the answer.

A A- B+ B B- C+ C C- D+ D D- F

III. Color in the face to show where you would be in relation to your classmates based on your math ability. Fill in as many names as you want.



IV. Circle the number that best answers how you feel about each question.

15. How <u>well</u> do you do in math?

1	2	3	4
not too hot	ok	pretty good	awesome!

16. How <u>useful</u> is math in your life <u>now</u>?

1	2	3	4
very useful	useful sometimes	rarely useful	not useful at all

17. How often do you feel <u>frustrated</u> in math?

1	2	3	4
never	sometimes	most of the time	always

18. How <u>hard</u> is math for you?

1	2	3	4
impossible	pretty tough	so-so	piece of cake

19. I feel <u>nervous</u> when I do math:

1	2	3	4
never	sometimes	most of the time	always

20. I would <u>prefer</u> to do math:

1	2	3	4
by myself	with 1 friend	in a small group	with the whole class

V. Answer the following questions as completely as possible.

21. If you were going to be in a math contest and you could choose your own team (5 people per team), who would you choose? Why?

1 - yourself

2 - _____ because _____

3 - _____ because _____

4 - _____ because _____

5 - _____ because _____

22. If your teacher gave you time in class to complete your homework in groups, who would you choose to work with?

_____

_____

_____

Thank you for taking the time to thoughtfully fill out this survey. I appreciate your help.

Appendix B

Project Problems

Problem #1

Ms. Patterson made 3 dozen cookies, but she burnt half of them. Ms. Barbour made 4 dozen cookies and didn't burn any! Between the two, how many unburnt cookies do they have? _____

If they need to have at least 100 cookies, how many more unburnt dozens must they bake? _____

Problem #2 *** remember to simplify (reduce) any fractions that you can before you begin working ***

In Ms. Barbour's class,
1/2 of the students **love** chocolate chip cookies
1/3 think they're **ok**
and 1/4 **don't** like them at all.

In Ms. Patterson's class,
7/28 of the class **love** chocolate chip cookies
12/24 think they're **ok**
and 6/18 **don't** like them at all.

What is the fraction of both classes together that:

love chocolate chip cookies _____

think chocolate chip cookies are **ok** _____

don't like chocolate chip cookies _____

Now find the least common denominator between these numbers, convert each fraction, and decide which is the largest fraction.

largest fraction: _____

Problem #3 *** remember to simplify (reduce) any fractions that you can before you begin working ***

Ms. Patterson and Ms. Barbour each have part of a recipe for chocolate chip cookies. If they want to make a complete batch of cookies for their 6th grade students, Ms. Patterson and Ms. Barbour need to combine their recipes. You can help them by finding the total amount of each ingredient necessary and writing the answers in the blanks of the new recipe.

Ms. P's recipe:
- 3/12 cup butter
- 1/4 cup shortening
- 4/8 tsp. vanilla
- 3/18 cup sugar
- 3/2 cup flour
- 1 egg
- 3/4 cup brown sugar
- 8/32 tsp. baking soda
- 1 1/4 cups chocolate chips

Ms. B's recipe:
- 6/24 cup butter
- 1/4 cup shortening
- 9/18 tsp. vanilla
- 1/3 cup sugar
- 1 cup flour
- 1 egg
- 4/16 cup brown sugar
- 2/8 tsp. baking soda
- 3/4 cup choc. chips

New Combined Recipe

_____ cup butter

_____ cup shortening

_____ tsp. vanilla

_____ cup sugar

_____ cup flour

_____ eggs

_____ cup brown sugar

_____ tsp. baking soda

_____ cups chocolate chips

Appendix C

Interview Questions

What did you think of this problem?

Was this problem hard or easy for you?

Were you frustrated while you were trying to solve it?

Which part(s) gave you trouble?

Were you nervous about getting the right answer?

Did you want to do well?

Did you enjoy solving this problem on your own/as a competition/cooperatively?

How would you rather have solved it?

Do you think your teacher would expect you to get the right answer to this problem?

Could you solve other problems like this?

Do you think the other kids in your math class could have solved this problem?

Do you feel like it is important for you to know how to solve this kind of problem? If yes, why?

Do you think you will ever encounter something like this in real life?

Appendix D

Final Survey

	Agree	Not Sure	Disagree
1. I enjoy math more when I am able to work in small groups.	_____	_____	_____
2. I don't enjoy math when I must work in small groups.	_____	_____	_____
3. I enjoy math the most when I can solve problems on my own.	_____	_____	_____
4. I don't like math when I must solve problems in a competitive situation.	_____	_____	_____
5. I enjoy math when I am competing with other students.	_____	_____	_____
6. I enjoy math more in small groups than in competitive situations.	_____	_____	_____
7. I enjoy math more in small groups than when I have to do it individually.	_____	_____	_____
8. I enjoy math more when I work by myself rather than in a competition.	_____	_____	_____
9. I enjoy math more when I compete with other students instead of when I solve problems on my own.	_____	_____	_____

10. I would like to work in small groups all of the time. _____ _____ _____

11. I would never like to do math as a competition. _____ _____ _____

12. I always like to do math on my own. _____ _____ _____

13. I like a combination of individual, competitive, and cooperative math activities. _____ _____ _____

List in order the ways you enjoy doing math:

like most: _____

_____

like least: _____