The Benefits of Using STAD in a Middle School Mathematics Classroom

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Abstract

Twenty-four eighth grade students enrolled in a Midwest school participated in the study. The purpose of the study was to examine the benefits of incorporating a cooperative learning strategy, Student Teams-Achievement Divisions (STAD), in a middle school mathematics classroom. The instruments used to collect data included teacher interviews, student surveys, course grades, and scores from the state-level achievement test. The data was analyzed to determine the benefits of implementing STAD in the middle school mathematics classroom.
I wish to acknowledge all the people who lent their support, guidance, and effort toward the successful completion of this project. A deep sense of gratitude is expressed to my advisor, Dr. JoAnn Burkhardt, for her constant direction and patience that were necessary to complete the project by the deadline. Special thanks are also extended to my wife, Katie, who wholeheartedly supported my decision to return to college to pursue a career as an educator. Finally, I would like to thank my parents who instilled the importance of education from the very beginning of my life.
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Chapter I: Introduction

As a licensed substitute teacher and graduate student in mathematics education, the researcher was preparing for student teaching and looking for a strategy that would increase productive student-to-student interaction. In addition, the graduate student was looking for ways to increase student scores on the state achievement test. After reading about teachers who had been successful implementing cooperative learning strategies in mathematics classrooms, the researcher wanted to determine if the positive results described by the researchers might be duplicated in his student teaching classroom. In addition, the notion of using cooperative learning strategies as a tool in the classroom was addressed in the professional literature. According to Johnson, Johnson, and Stanne (2000), when students worked in groups, student learning of academic content was maximized. Furthermore, Slavin (1991) found that students learned as well if not better with cooperative learning when compared with traditional learning. As a pre-service instructor, the researcher looked for a valuable instructional tool like cooperative learning to evaluate during his time as a student teacher that might have applications for him as a full time professional educator.

Statement of the Problem

The purpose of this project was to determine the benefits of implementing the cooperative learning strategy, Student Teams-Achievement Divisions (STAD), in a middle school mathematics classroom.

The research questions were:

1) According the professional literature reviewed, how were cooperative learning strategies defined and implemented?
2) What were the benefits of implementing cooperative groups according to the professional literature reviewed?

3) What were the benefits of implementing STAD in a middle school mathematics classroom?

_Justification_

The value of this study to the researcher was that it enabled the researcher, as a pre-service instructor, to develop his mathematical pedagogy. In addition, the researcher wanted to determine effective ways in helping students increase achievement on state-level achievement tests. The researcher wanted to determine if cooperative learning would have positive impacts on areas such as academic achievement, self-esteem as a learner, and inter-group relations if it was incorporated into his student teaching experience (Davidson, 1990). In addition, the researcher chose to evaluate cooperative learning to determine the benefits for his colleagues with similar classrooms.

_Definition of Terms_

- Cooperative Learning – the instructional use of small groups so that students work together to maximize their own and each other’s learning (Johnson, 1993).
- Pedagogy – The art or profession of teaching.
- Pre-service Instructor – An instructor with no previous experience in fulltime classroom instruction.

_Limitations_

The project was implemented in a middle school classroom in a rural school district in a Midwestern state. There was limited ethnic diversity in the classroom as the school district contained a population primarily of Caucasian students. The majority of the students lived
within middle-class or working-class families with a small percentage of students receiving a free or reduced lunch. Additionally, the class size was small and the research was limited to one class over a period of 8 weeks due to the nature of student teaching. Furthermore, the pre-service instructor had limited experience using cooperative learning strategies in the classroom. Due to rural setting, limited ethnic diversity, small class size, short research time, and the inexperience of the researcher, the results may not be applicable to other classrooms.
Chapter II: Review of the Literature

*Introduction*

The purpose of this project was to determine the benefits of implementing the cooperative learning strategy, Student Teams-Achievement Divisions (STAD), in a middle school mathematics classroom. Three research questions were asked when constructing the project: 1) According to the professional literature reviewed, how were cooperative learning strategies defined and implemented?; 2) What were the benefits of implementing cooperative groups according to the professional literature reviewed?; 3) What were the benefits of implementing STAD in a middle school mathematics classroom?

*Research Question # 1: According to the review of literature, how were cooperative learning strategies defined and implemented?*

*Definition*

In order to answer the first part of research question number one, a review of literature was conducted. According to Jacobs, Power, and Inn (2002), the idea of cooperative learning had been present in the public schools for at least 100 years but the term cooperative learning was not widely used until the 1970’s. Since then, cooperative learning has become one of the most widely used and researched areas of education (Johnson, Johnson, & Stanne, 2000). As part of this large movement in the 1970’s, Robert E. Slavin was credited as one of the creators of modern day cooperative learning (Johnson, et al., 2000). Slavin (1991) defined cooperative learning as instructional programs in which students work in groups to maximize each other’s learning of academic content. Most researchers and developers of cooperative learning shared similar definitions of cooperative learning but emphasized certain aspects more than others.
Components of Cooperative Learning

According to Davidson (1990), three components included in most cooperative learning strategies were a specifically designed task for group discussion and resolution, face-to-face promotive interaction in small groups, and individual accountability. Some researchers advocated for other components such as heterogeneous grouping, explicit teaching of social skills, and structured mutual interdependence (Johnson & Johnson, 1994; Slavin, 1996).

Specifically designed task.

According to McManus and Gettinger (1996), two types of tasks were possible for cooperative learning; group study or specialized individual tasks. In group study, group members worked together to solve problems and learn new material. For specialized individual tasks, each group member was responsible for learning a certain area of material and teaching it to the rest of the group (McManus & Gettinger). Johnson and Johnson (as cited in McManus & Gettinger) concluded that neither type of task was more effective than the other.

Face-to-face promotive interaction in small groups.

As stated by Johnson and Johnson (1996), promotive interaction was defined as students encouraging and facilitating each other’s efforts to succeed, complete tasks, and produce results in order to reach the goals of the group. In addition, Slavin (1987) stated that students typically provide extra attention and assistance to one another in order to achieve the group goal.

Individual accountability.

Slavin (1996) stated that a team’s success depended on the individual learning of all team members. In addition, McManus and Gettinger (1996) declared that students were more likely to work to ensure all other members had learned the material and were prepared for assessment due to this type of accountability. Furthermore, Johnson and Johnson (1994) stated that by sharing
individual scores on quizzes and tests group members would know the areas in which to assist their team members. Equally important, individual accountability prevented students from "hitchhiking" their way on the scores of team members (Johnson & Johnson, 1994).

**Heterogeneous grouping.**

Heterogeneous grouping was defined by Davidson (1990) as teacher-selected groups based on academic performance, race/ethnicity, and gender. Researchers such as Slavin (1990; 1996) advocated for heterogeneous grouping to be used for the strategies that he developed. Furthermore, Jacobs, Powers, and Inn (2002) stated many benefits from using heterogeneous grouping. Not only did Jacobs, Powers, and Inn notice that the quality of work improved due to the different perspectives but discipline improved as well because students were more likely to behave when they were with their friends. In addition, students had opportunities to increase social skills when working with people different from themselves (Jacobs, et al.).

**Explicit teaching of social skills.**

Davidson (1990) added to Jacobs, Powers, and Inn (1996) statement concerning the social skills learned from using heterogeneous grouping. Davidson conveyed the idea that some social skills should be modeled and practiced during cooperative learning depending on the current social skills of the students. Johnson and Johnson (1994) went further by stating that students must be taught the social skills required for high quality collaboration and be motivated to use them if cooperative learning is to be effective.

**Positive interdependence.**

Johnson and Johnson (1994) testified that students must believe that they “sink or swim together” in order for any cooperative learning method to work. Moreover, they stated that
positive interdependence was a result of when students realized that their work benefited their group members and the work of their group members benefited them (Johnson & Johnson).

Strategies for implementing cooperative learning

Johnson, Johnson, & Stanne (2000) identified the top ten cooperative learning strategies that received the most attention in the professional literature reviewed. Four of those strategies were Student Teams-Achievement Divisions (STAD), Teams-Games-Tournaments (TGT), Jigsaw (I & II), and Team Accelerated Instruction (TAI). Although different cooperative learning developers created TGT and Jigsaw I & II, Slavin (1990; 1991; 1996) incorporated and described these strategies in many of his publications.

Student Teams-Achievement Divisions (STAD).

Student Teams-Achievement Divisions was developed in the late 1970’s by Robert E. Slavin (Slavin, 1991). He designed STAD so that students would be assigned to heterogeneous or random groups based on academic achievement, ethnicity, and sex. In addition, Slavin instructed that groups be given a task and the students be responsible for making sure that all team members mastered the material. Slavin then advised that individual quizzes be administered each week. After the quiz, Slavin recommended awarding team scores from points based on individual improvements from previous tests. He added that this technique would allow each student an equal opportunity to achieve success in the group. Finally, Slavin suggested giving team rewards in the form of certificates or recognition in a newsletter. Slavin added that STAD would be most appropriate for content areas with well defined objectives with single correct answers.
Teams-Games-Tournaments (TGT).

In the early 1970’s, DeVries & Edwards developed a cooperative learning strategy called Teams-Games-Tournaments (TGT) (Johnson, Johnson, & Stanne, 2000). DeVries & Edwards designed TGT with the same principles of STAD except for the weekly quizzes (Slavin, 1996). They replaced the quizzes with games or tournaments as an alternate form of assessment. As part of the tournaments, DeVries and Edwards recommended having members of one team compete with members of another team with similar past achievements to earn points. As with STAD, Slavin (1991) prescribed Teams-Games-Tournaments for content areas with well defined objectives with single correct answers.

Jigsaw (I & II).

The Jigsaw method was originally designed by Elliot Aronson and his colleagues in the late 1970’s (Slavin, 1996). For the Jigsaw method, Slavin instructed teachers to assign students to six-member teams and break down academic material into five sections. Next, he said that each student be assigned a section of material to read. Slavin stipulated that if every student was present, then two students work together on the same material. Then, he stated that students meet with members from other groups who shared the same section and become an “expert group” to discuss the material. After students return to their original groups, Slavin advised to allow students time to take turns teaching the other members the material from the “expert groups”. Slavin affirmed the idea that each team member has a vital piece of information each team members depend on one another to learn the necessary information.

The Jigsaw method was later modified by researchers at Johns Hopkins University and accordingly named Jigsaw II (Slavin, 1990). Slavin stated that instead of team members reading certain sections of the text, all group members read the same material. Slavin said each group
member be assigned individual parts of the text to master. As with the original Jigsaw, Slavin instructed teachers to use expert groups and allow time for original groups to learn the material from each expert group. Slavin also recommended using the same scoring system with quizzes and team scores as Student Teams-Achievement Divisions. Slavin suggested implementing the Jigsaw methods in classrooms where students learn from narrative materials.

Team Accelerated Instruction (TAI).

In the early 1980's, Slavin (1990) and his colleagues developed another cooperative learning strategy called Team Accelerated Instruction specifically for K-8 mathematics classrooms. As with STAD, TGT, and Jigsaw, Slavin advised placing students in heterogeneous groups but not have all group members study the same material or move at the same pace. Slavin prescribed having teammates check the work of other teammates using answer keys. He then said to base team scores on the average number of units completed in a week and the accuracy of the work completed. Slavin recommending using the same team recognition methods incorporated in STAD, TGT, and Jigsaw. Furthermore, Slavin prescribed Team Accelerated Instruction for heterogeneous math classes that contained mainstreamed, low-achieving students and/or gifted students.

According to the professional literature reviewed, cooperative learning was defined as instructional programs in which students work in groups to maximize each other’s learning of academic content. Components of many cooperative learning strategies were a specifically designed task, face-to-face promotive interaction, individual accountability, heterogeneous grouping, explicit teaching of social skills, and structured mutual interdependence. Using these components, developers of cooperative learning created a number of strategies such as STAD,
TGT, Jigsaw I & II, and TAI to implement cooperative learning principles in the classroom (Johnson, Johnson & Stanne, 2000; McManus & Gettinger, 1996; Slavin, 1990, 1996).

Research Question # 2: What were the benefits of implementing cooperative groups according to the professional literature reviewed?

The second research question was answered through a review of the professional literature. Davidson (1990) summarized research projects pertaining to cooperative learning and indicated that cooperative learning had positive effects on academic achievement, self-esteem as a learner, and social interaction with peers. While some researchers such as Slavin (1987, 1991, 1996, 1999) and Johnson and Johnson (1979, 1982, 1994, 2000) described benefits of cooperative learning in all content areas, other researchers such as Nichols (1996), Ross (1995), Leikin and Zalaslky (1999), Whicker, Bol, and Nunnery (1997), Mulryan (1995) and Davidson (1990) focused on the benefits in mathematics classrooms only.

Academic achievement

According to a meta-analysis of research performed by Johnson, Johnson, and Stanne (2000) on cooperative learning strategies, academic achievement was higher in cooperative learning when compared to competitive or individualistic methods. In addition, research studies conducted by Slavin (1991) showed that students learned as well if not better with cooperative learning when compared with traditional learning. In the mathematics classroom, Nichols (1996), Whicker, Bol, and Nunnery (1997), and Davidson (1990) agreed that increased academic achievement was observed when cooperative learning was implemented. In comparison, Leikin and Zalaslky (1999) stated from their research that student achievement was at least as good as the students who learned the traditional way.
Self-esteem as a learner

Johnson and Johnson (1994) and Slavin (1996) both stated that students' self-esteem as learners were increased because cooperative learning, through positive peer interaction, aided students in accepting themselves as competent. McManus and Gettinger (1996) found the same results and also found an improvement of students' attitudes towards school. From a different study, Nichols (1996) noticed increased student motivation to learn in the high school geometry class. In contrast, Mulryan (1995) found that lower achieving students were more passive during class and warned other teachers to promote more active involvement by all students.

Social interaction with peers

Several social skills benefits were noticed by researchers when cooperative learning strategies were implemented in the classroom. Johnson and Johnson (1982) conducted a study and determined that cooperative learning, when compared with competitive and individualistic teaching methods, increased interaction and friendships between students with different ethnic backgrounds. Slavin and Cooper (1999) maintained that the increase in social skills were of particular importance due to the increased diversity in the classrooms. According a research study performed by Gillies (2004) on the effects of cooperative learning in junior high classrooms, students developed a stronger sense of social responsibility and were more willing to help and assist other peers. Furthermore, Ross (1995) added that student behavior and positive social interactions would improve if feedback was provided on a more regular basis to students. In mathematics, Whicker, Bol, and Nunnery (1997) found that students enjoyed having the opportunity to work with and receive help from their peers.

According to the professional literature reviewed, positive increases in academic achievement, self-esteem as a learner, and social interactions with peers were observed when
cooperative learning was implemented into classrooms. Most of the researchers agreed that students who participated in cooperative learning activities performed, as well, if not better than students in classrooms where cooperative learning was not implemented. In addition, researchers found that students engaged in cooperative learning experienced an increase in self-esteem, improved attitude toward school and more productive interaction with peers. (Davidson, 1990; Johnson and Johnson, 2000; Slavin, 1991.)

Conclusion

In order to answer the first two research questions, a review of literature was conducted. According to the professional literature reviewed, cooperative learning was defined as instructional programs in which students work in groups to maximize each other’s learning of the academic content. Most researchers agreed that the main components of cooperative learning were a specifically designed task, face-to-face promotive interaction, individual accountability, heterogeneous grouping, explicit teaching of social skills, and structured mutual interdependence. Using these components, developers of cooperative learning created a number of strategies such as STAD, TGT, Jigsaw I & II, and TAI to implement cooperative learning principles in the classroom. According to the professional literature reviewed, benefits of cooperative learning included improvements in academic achievement, self-esteem as a learner, and social interactions with peers. In order to answer research question number three, methods and procedures for implementing cooperative learning and collecting data were developed. (Davidson, 1990; Johnson and Johnson, 2000; McManus & Gettinger, 1996; Slavin, 1990, 1991, 1996.)
Chapter III: Methods and Procedures

Introduction

The purpose of this project was to determine the benefits of implementing the cooperative learning strategy, Student Teams-Achievement Divisions (STAD), in a middle school mathematics classroom. Three research questions were asked when constructing the project. They were: 1) According to the professional literature reviewed, how were cooperative learning strategies defined and implemented?; 2) What were the benefits to implementing cooperative groups according to the professional literature reviewed?; 3) What were the benefits of implementing STAD in a middle school mathematics classroom?

Participants

Twenty-four eighth grade students participated in the study. They were enrolled in a heterogeneous, pre-algebra classroom in a small rural school located in a Midwest state. Eleven students were males and thirteen were females.

Treatment/Intervention

For this project, the researcher incorporated STAD into the Pre-algebra classroom as the intervention. According to the professional literature, STAD was defined as a cooperative learning instructional program in which students work in groups to maximize each other's learning of academic content. In addition to determining the benefits of STAD, the intervention was used in preparation for the state mandated 8th Grade Ohio Achievement Test. The teacher followed the guidelines for incorporating STAD into the classroom by its developer, R. E. Slavin. The five main components of STAD were class presentations, teams, quizzes, individual improvement scores, and team recognition.
Class Presentations

According to Slavin (1991), the class presentations for STAD were designed to be very similar to the lecture/discussion method already used by many teachers. As suggested by Slavin, the researcher presented the material to the students through lecture or audiovisual means. The students followed the class presentations with their assigned achievement test review booklet designed by a manufacturer.

Teams

Slavin (1991) also gave specific instructions for grouping students in a classroom. Each team consisted of four or five members that represented a cross-section of academic achievement, race, and gender. The main purpose of the team was to work together to improve individual performance on quizzes by practicing problems and correcting any misconceptions of the material. After the material was presented, groups were given time to work on homework problems and ask questions about the material.

Quizzes

After a few periods of class presentations and practice, Slavin (1991) directed to give individual quizzes over the covered material. The purpose of the quizzes was to determine what the students know from the class presentations and team practice. In this research study, quizzes were given on a weekly basis after related sections of the material were covered. Following the principle of individual accountability, students were not allowed to help one another when taking a quiz.

Individual Improvement Scores

Slavin (1991) designed the scoring system so that each team member can contribute equally to the team score but only by working hard to improve over past performances. In this
system, students were given a base score ranging from one to ten that was determined by past academic performances. When a student took a quiz, his/her team earned points based on the how many points the student scored above his/her base score. In order to continually challenge each student or readjust those base scores that were initially set too high, base scores were recalculated after every two quizzes. Improvement scores were displayed on a bulletin board throughout the research study as a form of motivation and recognition.

**Team Recognition**

According to Slavin (1991), both individuals and teams needed to be recognized in some way for their efforts in the classroom. Slavin emphasized the use of recognition in showing the class members the importance of working together as a team. A weekly newsletter was incorporated into this project for use as team and individual recognition. This newsletter included the teams with the highest scores and individuals who showed the most improvement or received perfect grades.

**Instruments/Protocols**

In order to determine the benefits of incorporating STAD in a middle school mathematics classroom, several types of instruments were developed to collect data. These instruments included teacher interviews, student surveys, past and current course grades, and results from the Ohio Achievement Tests. A variety of data collection methods were used because they allowed the researcher to cross check and triangulate results for accuracy and credibility of results. According to the review of literature, three main benefits of incorporating STAD in a classroom were improvements in academic achievement, self-esteem as a learner, and social interactions with peers.
Academic Achievement

To determine the benefits of STAD related to academic achievement, course grades from the second nine weeks grading period were compared on a spreadsheet to the course grades from the third nine weeks grading period when STAD was introduced in the classroom. For each participant, the change in academic performance was the difference in scores between the second and third nine weeks grading periods. In addition to comparing individual course grades, the students' scores from the previous year's state mandated 7th Grade Ohio Achievement Test were compared to the following year's 8th Grade Ohio Achievement Test. The two scores were compared on a spreadsheet to easily determine the difference in scores from the two years and notice any change in academic performance.

Self-Esteem as a Learner

In order to evaluate self-esteem as a learner, the classroom teacher was interviewed at the end of the study using open-ended questions developed by the researcher. This classroom teacher was also the researcher's mentor during his student teaching semester. These questions included: 1) Did you observe any changes in individual self-esteem? What did it look like?; 2) What evidence did you observe that demonstrated positive self-esteem in group interactions?; 3) What did you observe that might have indicated negative self-esteem? (see Appendix A for a complete list of interview prompts).

In addition to the teacher interview, students in the class were given a two question survey to allow them to self-report regarding their self-image while working in groups. According to the review of literature, Johnson and Johnson (1994) and Slavin (1996) connected self-esteem to accepting oneself as competent. The two questions developed to examine this student attitude were: 1) When you worked in groups, how did you view yourself as a math
student?; and 2) Were you a "good" group member? If yes, give an example of how you were a "good" group member. Both survey questions were designed to examine the responses for indications of positive feelings of competency. The survey questions sheets were developed with one question per page so that each student would have ample space to respond to a question (see Appendix B for survey questions).

Social Interactions with Peers

Two forms of evidence were collected for studying the possible benefits of STAD regarding the social interactions of the students in the project. The first form of evidence was part two of the previously mentioned interview with the mentor teacher. The three prompts developed by the researcher and asked of the cooperating teacher were 1) Tell me what you observed about how students got along in groups. 2) What did you notice about student communication? 3) Based on your observations, has the quality of students' social interactions changed or improved during the time of the project? As with the prompts for evidence of change in students' self-esteem, the mentor teacher was given ample time to respond and was asked for clarification on answers to ensure evidence quality.

The data collection instrument used to determine a change in social interactions was in the form of a two question survey for the students. According to the review of literature, Johnson and Johnson (1982) found an increase in student interaction and friendship when involved in cooperative groups. The question developed to examine this benefit was “When working in groups, how did you view others?” In addition, Gillis (2004) stated that students gained a deeper sense of social responsibility and were more willing to help and assist their peers when in cooperative groups. The question developed to examine a change in this student behavior was “Were you ever a leader in your group? If yes, give an example of how you were a
leader.” Similar to the self-esteem questions, students were given one page per question to respond (see Appendix B for survey questions).

Student Perspectives

In order to determine the students’ perspectives on the benefits of cooperative learning, one more student survey question was filled out by the students. This question was “List two good things about working in groups.”

Procedures

The researcher used the specific instruments to collect data regarding the three main benefits of incorporating STAD in a classroom mentioned in the review of literature. Procedures were developed to be used when administering these instruments.

Academic Achievement

In order to study any change in academic achievement during the use of STAD, the researcher first recorded each student’s individual course grade prior to the start of the project. During the implementation of the project, the students were administered teacher prepared tests which were calculated into their course grades. In addition to the weekly tests, homework completion was also used in determining their course grade.

In addition to comparing course grades, scaled scores from two years of the Ohio Achievement Test were used to check for a difference in academic achievement. Scaled scores for the students involved in the project were found and recorded from their 7th Grade Ohio Achievement Test taken one year prior to the project. When the results from the 8th Grade Ohio Achievement Test were released, scaled scores for the same students in the project were recorded for comparison.
**Self-Esteem as a Learner**

The two instruments used to analyze any change in the self-esteem of the participants were an interview with the mentor teacher and the student survey questions. At the conclusion of the project, the researcher asked questions of the cooperating teacher regarding differences in the self-esteem of the students. The cooperating teacher was given ample time to respond and was asked for clarification on answers to ensure evidence quality. Students participating in the project were given a two question survey at the end of the project that required a written response. Each student was encouraged to be specific with their answers and take their time in responding to the questions. The students were asked to return the questions in twenty-four hours but were given more time if it was needed. Although twenty-four students participated in the project, only twenty-three responses for all student survey questions were collected due to the planned transfer of one student at the conclusion of the project.

**Social Interactions with Peers**

As mentioned previously, the two instruments used for observing changes in the social interactions of the students were an interview with the cooperating teacher and a two question student survey. The second part of the cooperating teacher interview mentioned earlier was concerned with changes in the social interactions within the groups. The teacher’s answers were recorded and used in conjunction with the two question student survey.

**Student Perspectives**

The survey asking students for their personal view of the benefits of cooperative groups was also administered as well. At the end of the project, students were permitted to take the surveys home to complete and were asked to return the questions in twenty-four hours.
**Timeline**

The research study began in late January and continued until late March. The intervention began on Monday, January 23 and ended on Wednesday, March 8 when the 8th Grade Ohio Achievement Tests were administered. From the start of the intervention, the students were given a unit test every week for six weeks. Data was collected for the project until the end of March.

**Data Analysis**

*Academic Achievement*

When the intervention was completed, the course grades were recorded and compared with the previous second nine weeks grading period. The individual scores from the two years of Ohio Achievement Tests were also recorded. Both sets of scores were compared in graphs.

*Self-Esteem as a Learner*

In order to determine if the use of STAD had any impact on self-esteem, the student surveys were reread and themes were established to categorize student responses. In addition, the responses from the cooperating teacher interview were examined for changes in students' self-esteem. These noted changes were categorized into different themes.

*Social Interactions with Peers*

The researcher recorded the responses from the mentor teacher interview to determine any change in number or quality of social interactions of the students involved in the project. The student surveys were also reviewed for themes and the student responses were categorized in order to discover differences in the social interactions within the groups.
Student Perspectives

Responses to the final student survey regarding student’s opinion of the benefits of cooperative groups were counted. The responses were then categorized into reoccurring themes.

Conclusion

In order to determine the benefits of incorporating STAD into a middle school mathematics classroom, several instruments for data collection were developed as well procedures for collecting the data. Past and current course grades and scores from Ohio Achievement Tests were used to examine the changes in academic achievement. Interviews with the cooperating teacher and responses from student survey questions were used to determine any changes in self-esteem as a learner and social interactions with peers. The data was collected and analyzed in order to answer research question three, “What were the benefits of implementing STAD in a middle school mathematics classroom?”.
Chapter IV: Results

Introduction

The purpose of this project was to determine the benefits of implementing the cooperative learning strategy, Student Teams-Achievement Divisions (STAD), in a middle school mathematics classroom. Three research questions were asked when constructing the project. They were 1) According to the professional literature reviewed, how were cooperative learning strategies defined and implemented? 2) What were the benefits to implementing cooperative groups in a mathematics classroom according to the professional literature reviewed? 3) What were the benefits of implementing STAD in a middle school mathematics classroom?

Academic Achievement

In order to determine any changes in academic achievement from the use of STAD in the classroom, course grades from the second nine weeks were compared to course grades from the third nine weeks. According to the data, eighty-eight percent of the students’ course grades increased with the introduction of STAD into the classroom. The average percent difference of the class was an increase of 4.9%. Figure 1 displayed the percent difference of the course grades between the two nine weeks.
Figure 1: Individual student percent differences in his/her course grades from the second nine weeks to the third nine weeks.

The data showed that twenty-one of students' course grades increased after participation in STAD.

The second instrument used to determine changes in academic achievement was the 7th and 8th Grade Ohio Achievement Tests. Individual student scores from the year previous to the project were recorded. Three student scores from the 7th Grade Ohio Achievement Test were unavailable to the researcher. When the results from the 8th Grade Ohio Achievement Test were released, the scaled scores for the same set of students involved in the project were compared to the previous year. Sixty-five percent of the students saw an improvement in their scores. The overall increase in points of the group of students was 158 points. Figure 2 displayed the difference in scaled scores between the two years.
As shown in Figure 2, more than half of the students improved or had higher scores on the 8th Grade Ohio Achievement Test as compared to the 7th Grade Ohio Achievement Test.

Self-Esteem as a Learner

In order to determine any changes in students' self-esteem from the beginning of the research study to the end, an interview with the mentor teacher was conducted. The mentor teacher noted that at the end of the project, more students raised their hands, asked more questions, and had more confidence in their abilities. In addition, the mentor teacher also stated that when students worked in groups, they were more willing to explain their answers and encourage other group members. However, the mentor teacher stated that a few students became more quiet during class instruction and group discussion indicating, according to the literature
reviewed, a lower sense of confidence and self-esteem. All of the responses to the interview questions are shown in Figure 3.

Responses to “Did you observe any changes in individual student self-esteem? What did it look like?”
- Raised hands more often
- Asked more questions during teacher instruction
- Had confidence that if they paid attention, they would understand material

Responses to “What evidence did you observe that demonstrated positive self-esteem in group interactions?”
- Explained their answers to group members
- More willing to argue their point
- Uplifted other members
- More engaged during class time

Responses to “What did you notice that might have indicated negative self-esteem?”
- Became more quiet during class instruction and group discussion

Figure 3: Responses from part one of the cooperating teacher interview regarding students’ self-esteem

As stated by the mentor teacher in response to the interview questions, a change in self-esteem was observed in the some of students.

Responses from the student survey question “When you worked in groups, how did you view yourself as a math student?” were categorized into the following themes: positive, negative, and no change. Examples of responses indicating a positive self-image included “I feel that I work better in groups” “I think I learned a lot more than just sitting there by myself” “I viewed myself as a better math student”. An example of a response indicating a negative self-image included “I thought the other members were smarter than I am.” Examples of responses indicating no change in self-image included “I viewed myself as an OK math student” and “I viewed myself no better or no worse than I do now when we worked in groups. Eighty-seven of the responses were positive while nine percent indicated no change in self-esteem. Only four
percent of the responses indicated a negative self-esteem while working in groups. The percentages of each theme are represented in Figure 4 (see Appendix C for a complete list of responses).

Figure 4: Percent of positive, negative, and no change responses to student self-esteem question “When you worked in groups, how did you view yourself as a math student?”

According to the data, the majority of students held a positive self image of themselves as learners at the conclusion of the project.

The other student survey question developed to determine students’ self-esteem at the end of the project was “Were you a “good” group member? If yes, give an example of how you were a “good” group member.” One hundred percent of the students stated that they felt that they were “good” group members. Of the 100%, eighty-seven percent of the respondents stated that helping others made them “good” group members. The other thirteen percent stated that they put forth effort for the group which caused them to be considered as “good” group
members. The percents of the reasons for being a “good” group member are displayed in Figure 5.

![Pie chart](image)

*Figure 5: Reasons why students felt they were “good” group members*

(100% of the respondents indicated they were “good” group members)

According to the data, students viewed themselves as “good” group members because they helped others and put forth effort.

*Social Interactions with Peers*

In order to determine changes in the social interactions of the students from the beginning of the research study to the end, an interview with the mentor teacher was conducted. The mentor teacher noted that at the end of the project, a feeling of “shock” at how well the students interacted with one another. The mentor teacher added that although it took time for some students to open up, more students talked and tried to help one another. Overall, the mentor
teacher indicated the interactions among the students improved as time progressed. All of the responses to the interview questions are shown in Figure 6.

Responses to “Tell me what you observed about how students got along in groups.”
- Shocked at how well the students acted with one another
- Equal contribution among group members
- Students mixed well with one another
- Large sense of responsibility to the group

Responses to “What did you notice about student communication?”
- More students talked to one another
- Always tried to help each other
- Took a little while for quiet students to open up

Responses to “Based on your observations, has the quality of students’ social interactions changed or improved during the time of the project?”
- Improved over time

*Figure 6: Responses from part two of the cooperating teacher interview regarding social interactions of the students*

As described by the mentor teacher, social interactions of the students changed during the use of STAD in the classroom.

Responses from the student survey “When you worked in your groups, how did you view others?” were divided into the following themes: positive, negative, and neutral. Examples of a positive attitude toward group members included “I viewed others in my group as people, or friends, that I could talk to” and “I viewed others as people who could help me when I didn’t understand”. An example of a neutral response was “I viewed others depending how they acted and worked”. An example of a negative attitude included “I viewed them as better math students than me.” Eighty-seven percent of the students indicated positive feelings towards others while nine percent held neutral feelings towards their group members. Only four percent of the
surveys specified a negative attitude towards group members. The percents of the themes were represented in Figure 7.

![Pie Chart](chart.png)

Figure 7: Percent of student responses that indicated a positive, negative, or neutral response to survey question, “When you worked in groups, how did you view others?

According to the data, the majority of students had positive feelings of friendship towards their group members at the end of the project.

Responses from the survey question “Were you ever a leader in your group? If yes, give an example of how you were a leader” were divided into “yes” and “no” categorized. Fifty percent of the responses indicated that the student was a leader at some time during the research study. Examples of responses that indicated a leadership role were “I was a leader when no one knew the answer but me and I explained it to them” and “I went through problems with my members and helped them try to understand the lesson”. Forty-one percent of the total responses indicated they were leaders because they helped others. Nine percent of the total responses stated they were leaders because they performed assigned tasks for the group. Examples of responses indicating no leadership were “No, I was never a leader” and “No, I wasn’t a leader
because all of our group members worked together as one so we didn’t have leaders.” Nine percent of the responses indicated that they were not leaders because the positive group dynamics did not require any particular leaders. The other forty-one responses simply stated “no” with no additional comment. The data is represented in Figure 8.

![Figure 8: Percent of student responses to survey question “Were you ever a leader in your group? If yes, give an example of how you were a leader.”](image)

While fifty percent of the students indicated a sense of social responsibility by answering “yes” to the survey question, nine percent stated there was no need for leaders because of the group dynamics.

**Student Perspectives**

The final student survey question was developed to determine the students’ perspectives of the benefits of STAD. The responses were divided into categories based on the stated benefits in the professional literature: academic achievement, self-esteem as a learner, and social interactions with peers. Examples of responses in the academic achievement category were
"There are usually better scores because others may know the answer" and "It made it so homework was easier." Examples of responses from the self-esteem category included "Class wasn’t as boring" and "Only a few people would see your homework grades." Examples of responses in the social interactions category were "You get to help others" and "You get to make new friends." Sixty-three of the responses were in the academic achievement category while twenty-two percent of the responses fell in the social interactions category. In addition, fifteen percent of the respondents indicated the benefits of self-esteem while working in groups. The data was represented in Figure 9 (See Appendix A for a complete list of responses in the themes).

![Pie Chart]

*Figure 9: Percent of student responses by answer from the survey question “List two good things about working in groups.”*
As shown in Figure 9, students viewed academic achievement as the primary benefit of working in cooperative groups.

**Conclusion**

In order to examine the benefits of incorporating STAD in a middle school mathematics classroom, a number of data collection instruments were used. These instruments included teacher interviews, student surveys, past and current course grades, and results from the Ohio Achievement Tests. Results showed an increase in academic achievement in the majority of students. In addition, an increase in students' self-esteem and an improvement in social interactions among the group members were also observed. According to the students, the main benefit of working in groups was an increase in academic achievement.
Chapter V: Discussion

Introduction

The purpose of this project was to determine the benefits of implementing the cooperative learning strategy, Student Teams-Achievement Divisions (STAD), in a middle school mathematics classroom. Three research questions were asked when constructing the project. They were 1) According to the professional literature reviewed, how were cooperative learning strategies defined and implemented? 2) What were the benefits to implementing cooperative groups in a mathematics classroom according to the professional literature reviewed? 3) What were the benefits of implementing STAD in a middle school mathematics classroom?

Meaning of Findings

Academic Achievement

The data collected and analyzed for the project might suggest that academic achievement increased slightly following the use of STAD in the classroom. Mean course grades from the second nine weeks to the third nine weeks increased an average of 4.9%. This could be attributed to the use of STAD or other aspects of the research study might have had an impact on academic achievement. For example, prior to the start of the project, homework was collected and graded daily. During the project, homework was checked by the group and given a completion grade that was incorporated into the nine weeks course grade. However, a large amount of the content material was new to the students and was covered very quickly.

In addition to the increase in course grades, the scores from the Ohio Achievement Tests demonstrated an overall increase of 158 points across all students. This increase was not due to small improvements by all students but by very large increases from a small percentage of the
students. This might suggest that the use of STAD has a dramatic impact on how some students take standardized tests. In addition, students viewed academic achievement as the primary benefit from working in groups. Increases in students’ academic performance might have been a result of a change in the perception of the difficulty of the material.

**Self-Esteem as a Learner**

According to the mentor teacher interview, more students appeared to have confidence in their abilities by the end of the research study. The mentor teacher indicated more students raised their hands and asked more questions during instruction and group time. This data might suggest that because students were part of a group dynamic he/she had less fear about appearing uninformed about the content material. Responses from the student surveys indicated that most students viewed themselves as math students in a positive manner by the end of the project. Specific responses stated that students were more comfortable asking questions to peers than the teachers and they worked better in groups. Another indication of students’ feelings of competency was seen in response to the student survey question asking if they felt that they were “good” group members. The eighty-seven percent of students who stated they were “good” group members because they helped others. It might be suggested that for students to help others, they first must view themselves as somewhat competent in the material.

**Social Interactions with Peers**

The data collected to examine the changes in social interactions of the students indicated an improvement in how students communicated with one another. The mentor teacher stated her shock in how well the students interacted with one another. This data was relevant due to the mentor teacher’s experience with these students prior to the start of the project. Even with low expectations of performing well in groups, these students surprised the mentor teacher at their
ability to achieve the goals of working in groups. Moreover, the mentor teacher stated that students had a larger sense of responsibility to their group members. No data was collected to determine if this social responsibility extended outside of the classroom but the data might suggest that some students’ view of others changed significantly following the research study.

Students responded in a positive manner when asked to describe their group members. Eighty-seven percent of the responses indicated a positive view of other students in their group. Comments were made such as “I made friends with people I probably wouldn’t have.” This data might indicate that by allowing students to work together in groups they also learn valuable social skills such as communication and tolerance of others. However, students’ positive attitudes towards working in groups might be attributed to the change in teaching methods which allowed them more interactions with their friends.

Student Perspectives

From the student surveys analyzed, it appeared that students perceived the main benefit of working in groups was academic achievement. The largest number of responses stated that having people who can help was the main benefit of working in groups. Students did not give any more details on the survey response sheet to further explain the response but this might suggest that working in groups created a support system that allowed students to question their learning for deeper understanding. In addition, some students found the homework easier and scored better on tests. On the other hand, a number of students indicated that being able to talk during homework was the best part of working in groups. This data might indicate the importance of students at that developmental level to communicate ideas and thoughts to their peers. Another response that was repeated in this survey question stated that class was not as
boring. This data might indicate that even though the content material did not change, the students were more engaged because of the nature of the classroom.

Summary of Study

Twenty-four eighth grade students enrolled in a Midwest school participated in the study. The purpose of the study was to examine the benefits of incorporating a cooperative learning strategy, STAD, into the classroom. According to the professional literature reviewed, the three main benefits were improved academic achievement, self-esteem as a learner, and social interactions among peers. The instruments used to collect data included teacher interviews, student surveys, past and current course grades, and scores from the Ohio Achievement Test. The data was analyzed to determine if the same benefits would be reproduced in this particular setting. Slight increases were noted in academic achievement while improvements in self-esteem as learners and social interactions were also found.

Recommendations

It is recommended that further research be performed pertaining to the benefits of incorporating STAD into any academic classroom, such as language arts and social studies. In addition, it is suggested that a number of changes to the methodology be considered. First, the length of the research study should be extended in order to collect more types and quantity of data. The second recommendation is to increase the number of students in the project and use students from a more diverse population. It is also recommended that the content in the classroom follow a more standard pace of instruction. As stated earlier, the content material for this research study was covered quickly in preparation for the Ohio Achievement Test. The final recommendation is to use more widely accepted and professional instruments of data collection.
Evidence from this project suggests further research be done pertaining to the benefits of STAD in certain areas. It is recommended that research should be conducted in more culturally diverse populations to determine if the same benefits in social interactions would occur. It is also recommended that more research be conducted on the benefits of STAD with various levels of content material difficulty. The final recommendation is to conduct more research with students that have behavior issues. It might be suggested that by increasing self-esteem and giving a sense of social responsibility, those students will also show improvements in academic achievement.

Conclusion

The purpose of this paper was to determine the benefits of incorporating the cooperative learning strategy, Student Teams Achievement Divisions (STAD), into a middle school mathematics classroom. The data from this research study suggested a slight increase in academic achievement and improvements in students’ self-esteem as learners and their social interactions with their peers.
References


Appendix A

Prompts for Mentor Teacher Interview

Self-Esteem as a Learner:

Did you observe any changes in individual student self esteem? What did it look like?

What evidence did you observe that demonstrated positive self esteem in group interactions?

What did you observe that might have indicated negative self esteem?

Social Interactions with Peers:

Tell me what you observed about how students got along in groups.

What did you notice about student communication?

Based on your observations, have the quality of students' social interactions changed or improved during the time of the project?
Appendix B

Student Survey Questions

Self-Esteem as a Learner

When you worked in groups, how did you view yourself as a math student?

Were you a “good” group member? If yes, give an example of how you were a “good” group member.

Social Interactions with Peers

When you worked in groups, how did you view others?

Were you ever a leader in your group? If yes, give an example of when you were a leader.

Student Perspectives

List two good things about working in groups.
Appendix C

Responses to Student Survey Questions

Self-Esteem as a Learner

Responses to the student survey question “When you worked in groups, how did you view yourself as a math student?”

<table>
<thead>
<tr>
<th>Type of Response</th>
<th>Number of Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive</td>
<td></td>
</tr>
<tr>
<td>Was a better math student</td>
<td>4</td>
</tr>
<tr>
<td>Worked hard, did good</td>
<td>6</td>
</tr>
<tr>
<td>OK</td>
<td>3</td>
</tr>
<tr>
<td>Helped others</td>
<td>4</td>
</tr>
<tr>
<td>Confident</td>
<td>3</td>
</tr>
<tr>
<td>No Change</td>
<td></td>
</tr>
<tr>
<td>Same grade</td>
<td>2</td>
</tr>
<tr>
<td>Negative</td>
<td></td>
</tr>
<tr>
<td>Others were smarter than I am</td>
<td>1</td>
</tr>
</tbody>
</table>

Types and number of responses to the student survey question “Were you a “good” group member? If yes, give an example of when you were a “good” group member?”

<table>
<thead>
<tr>
<th>Type of Response</th>
<th>Number of Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>23</td>
</tr>
<tr>
<td>No</td>
<td>0</td>
</tr>
<tr>
<td>Yes, because I ...</td>
<td></td>
</tr>
<tr>
<td>Helped others</td>
<td>19</td>
</tr>
<tr>
<td>(Examples of how they helped others)</td>
<td></td>
</tr>
<tr>
<td>Tried to understand others</td>
<td>2</td>
</tr>
<tr>
<td>Made sure everyone had homework done</td>
<td>2</td>
</tr>
<tr>
<td>Put forth effort</td>
<td></td>
</tr>
<tr>
<td>(Examples of how they put forth effort)</td>
<td></td>
</tr>
<tr>
<td>Asked questions</td>
<td>1</td>
</tr>
<tr>
<td>Paid attention</td>
<td>1</td>
</tr>
<tr>
<td>Completed homework</td>
<td>3</td>
</tr>
<tr>
<td>Attended every class</td>
<td>1</td>
</tr>
</tbody>
</table>
Social Interactions with Peers

Types and number of responses to the student survey question “When working in groups, how did you view others?”

<table>
<thead>
<tr>
<th>Type of Response</th>
<th>Number of Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive</td>
<td></td>
</tr>
<tr>
<td>Willing to help each other</td>
<td>8</td>
</tr>
<tr>
<td>Friends</td>
<td>6</td>
</tr>
<tr>
<td>Team members</td>
<td>4</td>
</tr>
<tr>
<td>Hard working</td>
<td>1</td>
</tr>
<tr>
<td>Teachers</td>
<td>1</td>
</tr>
<tr>
<td>Neutral</td>
<td></td>
</tr>
<tr>
<td>Depends on how they acted</td>
<td>2</td>
</tr>
<tr>
<td>Negative</td>
<td></td>
</tr>
<tr>
<td>Better math students</td>
<td>1</td>
</tr>
</tbody>
</table>

Types and number of responses to the student survey question “Were you ever a leader in your group? If yes, give an example of how you were a leader.”

<table>
<thead>
<tr>
<th>Type of Response</th>
<th>Number of Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes, because I helped others</td>
<td>9</td>
</tr>
<tr>
<td>Yes, because I wrote names on the board for homework</td>
<td>2</td>
</tr>
<tr>
<td>No, because our group didn’t need leaders</td>
<td>2</td>
</tr>
<tr>
<td>No (with no additional comment)</td>
<td>9</td>
</tr>
</tbody>
</table>
**Student Perspectives**

Types and number of responses to the student survey question “List two good things about working in groups.”

<table>
<thead>
<tr>
<th>Type of Response</th>
<th>Number of Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Academic Achievement</strong></td>
<td></td>
</tr>
<tr>
<td>There are people who can help</td>
<td>17</td>
</tr>
<tr>
<td>Better scores</td>
<td>2</td>
</tr>
<tr>
<td>Don’t have to wait for the teacher to get help</td>
<td>1</td>
</tr>
<tr>
<td>Homework was easier</td>
<td>1</td>
</tr>
<tr>
<td>Homework was faster</td>
<td>2</td>
</tr>
<tr>
<td>More time for homework and questions</td>
<td>2</td>
</tr>
<tr>
<td>Understood more</td>
<td>1</td>
</tr>
<tr>
<td>Get to ask more questions</td>
<td>1</td>
</tr>
<tr>
<td>More points of view on the material</td>
<td>2</td>
</tr>
<tr>
<td><strong>Self-Esteem as a Learner</strong></td>
<td></td>
</tr>
<tr>
<td>Not as boring</td>
<td>6</td>
</tr>
<tr>
<td>Only a few people would see your grades</td>
<td>1</td>
</tr>
<tr>
<td><strong>Social Interactions with Peers</strong></td>
<td></td>
</tr>
<tr>
<td>You get to help others</td>
<td>2</td>
</tr>
<tr>
<td>Make new friends</td>
<td>3</td>
</tr>
<tr>
<td>Don’t have to be quiet when doing homework</td>
<td>5</td>
</tr>
</tbody>
</table>