Cooperative Study Groups: Give Your Students the Home Team Advantage

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In this article I discuss the factors that led me to implement study groups in the teaching of mathematics. An important influence in this decision began with an experimental study conducted with two College Algebra classes in which students were randomly assigned to treatment groups. While there was no statistical difference between the study groups on the posttest that was used to measure achievement, it is important to note the positive effect on the students. In addition, suggestions are given on how to implement cooperative study groups in your mathematics classroom.

At the age of 39, Jimmy Connors advanced to the semifinals of the 1991 U.S. Open Tennis Tournament. It was not an easy task as he had to come back from behind on three of his five matches. It was an incredible performance that might not have happened without the New York crowd and his team cheering Jimmy on every point. While Jimmy acknowledged that the New York crowd motivated him, he was quick to credit his entire team which included his coach, trainer, and hitting partners.

On January 3, 1993 the Buffalo Bills faced the Houston Oilers in the first round of the NFL playoffs. In the first half the Oilers played well and the Bills could not have played any worse as they were behind 28 – 3 at the half.

The momentum continued with the Oilers at the start of the second half as they took a 35 – 3 lead. However, with their home crowd cheering them on, the Bills found a way to win in overtime

to complete the greatest comeback in NFL history. Throughout the comeback, the Bills players on the field and those on the bench continued to cheer vivaciously in support. They still had to believe in each other and more importantly execute the plays called in order for the team to win.

On November 6, 2004 the Texas Longhorns came back from a 28-point deficit late in the first half to defeat the Oklahoma St. Cowboys 56 – 35. The momentum generated by the home crowd was a tremendous advantage according to the participants.

Most of the major upsets and comebacks in professional or amateur sports occur in front of home crowds. The home advantage is often clear, with even the potentially weaker teams winning when playing at home. One reason for the home team advantage is the psychological support of the fans in attendance. This support often provides that extra motivation that a team needs in order to be successful. However, players must be committed to the tasks that are assigned to them in order for the team to succeed. In addition, team members must focus on a winning attitude and continue to support each other no matter what the circumstances.

Cooperative Learning

The support and encouragement that an athlete receives can also be advantageous for the student who is trying to succeed in a mathematics course. It is for this reason that I strongly encourage my students to form cooperative study groups in all of my classes. Cooperative learning is the instructional practice of placing students into small groups, or teams, and having them work together toward a common goal. Each member of the team is responsible, not only for learning what is taught, but also for helping teammates learn.

I was not always an advocate of cooperative learning groups. There was a time when I thought that allowing students to work in groups was a way of permitting them to cheat. However, as I experimented with the idea and reviewed the literature, I became a believer.

The American Mathematical Association of Two-Year Colleges (AMATYC) Standards (Cohen, 1995) suggest the need for learner centered approaches, such as cooperative learning groups, in mathematics education.

Cooperative learning has been a subject of interest to researchers for the last several decades and some research findings indicate that cooperative learning is an effective tool for improving academic achievement (Leikin & Zaslavsky, 1997). At the K-12 school levels, instruction using cooperative learning techniques has grown in popularity, and there is a substantial body of research supporting the idea that students can attain higher achievement, especially in mathematics, through working together in small groups (Sutton, 1992).

One very important benefit of cooperative learning is that it enhances a student's self esteem which in turn motivates the student to be more involved in the learning process (Johnson & Johnson, 1989). Cooperative interactions among students result in a higher degree of accomplishment for all participants (Slavin, 1987). By helping each other, students form a support system which raises the performance level of each member (Kagan, 1986). By actively working together to create new understandings and learning, students realize that members will work to help and support their efforts, and it is this sense of group cohesiveness that enhances a student's motivation to achieve both the individual goals and the goals of the group (Johnson & Johnson, 2003).

Through small groups, students are expected to work to maximize their own and each other's learning. Class members are assigned to groups based on academic abilities or through random assignment. They then work through the assignment until all group members successfully understand and complete it. Cooperative efforts result in participants striving for mutual benefit so that all group members gain from each other's accomplishments. In cooperative learning situations there is a positive interdependence among students' goal attainments; students perceive that they can reach their learning goals if and only if the other students in the learning group also reach their goals (Deutsch, 1962; Johnson & Johnson, 1989).

Students have told me that when they participate in cooperative study groups, they are part of a huge support system. Just as athletes are encouraged by their teammates and the cheering fans, students also encourage each other to succeed. As the instructor, I am the biggest fan because I want all my students to be successful.

The Experiment and Model

While I initially recommended that my students form study groups to prepare themselves for tests, I took a more structured approach toward cooperative study groups when I conducted an experimental study with two college algebra classes in order to examine the effects of cooperative study groups upon achievement in College Algebra. The model that I used for the study is given below.

1. Students are randomly assigned to work and learn together in small groups of four members. The groups are expected to stay intact for the entire semester.
2. Each group submits one set of solutions to an assignment and each member of the group receives the same score on the assignment. This applied to all homework assigned during the semester and occasional in-class assignments.
3. Each member of the group is expected to contribute.
4. Cooperation is an essential element and is strongly encouraged.
5. Group members are expected to submit informal periodic reports discussing the group's activities. The reports are submitted every other week. Members take turns with this responsibility. It was through these reports that I collected most of the information concerning the group members' attitudes toward cooperative learning and whether there were any issues that needed my attention.
6. Group members can vote to remove a member from the group who is not doing his/her share of the work.
7. Individual grades are also assigned. Students are expected to work individually on major exams.

The Subjects

Students in two College Algebra classes were randomly assigned to treatment groups. The random assignment to groups was done after the twelfth class day. There were three groups of four students in each class. Twenty-four students comprised the experimental group. Twenty-six students not assigned to a cooperative study group comprised the control group. Therefore, each class consisted of students that were members of a study group and some that were not. Most of the work accomplished by the study groups was done in sessions outside of class. This consisted of working on homework assignments and studying for tests.

Methodology

Each student in the experimental study was exposed to the same instructional approach. This consisted of a lecture-discussion delivery where students took notes and asked questions. Both classes were given the same homework assignments and chapter tests. It is important to note that each student was aware that some individuals were working in a group and some were not. I was the instructor for both College Algebra classes involved in the experimental study.

The Results and Notes

The statistical analysis indicated no significant difference in the mean scores of the experimental and control groups on the posttest that was used to measure achievement at the .05 level (t = -0.381, p = .706). The descriptive statistics for the posttest means of the study groups are presented in Table 1. The mean given is the number correct out of 34 problems.

Table 1
Descriptive Statistics for Posttest Results

	Mean Grade	Standard Deviation
Experimental Group	24.44	2.85
Control Group	25.13	6.10

While there was no significant difference in the means, the standard deviation does suggest that there was less variability in the

posttest scores of the experimental group. This can be attributed to the fact that these students spent more time working problems and studying together. In general,

- Students who worked in study groups seemed to be more involved in class discussions.
- Students who worked in study groups reported positive experiences.
- Some students who worked in study groups reported that the support that they received from the other members was an important factor in not dropping the class.

In subsequent semesters, I continued to encourage my students to form study groups to help each other with homework assignments and to study for tests.

During a three-semester period, I continued to collect data in several classes where students were strongly encouraged to form cooperative learning study groups. This data was compared to similar classes that were not encouraged to form cooperative study groups.

The data was collected from four courses that I taught on a regular basis, Math 1314 (College Algebra), Math 1325 (Business Calculus), Math 1332 (Math for Liberal Arts), and a developmental course, Math 0422 (Intermediate Algebra). The success rates for classes that utilized cooperative learning groups and for those that did not are compared in Figure 1. The success rates reflect the percent of students that made at least a C in the course. This includes results for all students registered after the twelfth class day.

As indicated in Figure 1, the study group classes had a higher success rate. Furthermore, those students that did work in study groups appeared to enjoy the class more and were more active in class activities. In addition, the periodic reports submitted and comments made on the student evaluation of the instructor included positive comments. The only negative comments were made by a few students concerning the issue of appropriate meeting times for the group. Initially the groups encountered conflicts with work schedules and/or class schedules. However, these issues were eventually resolved.
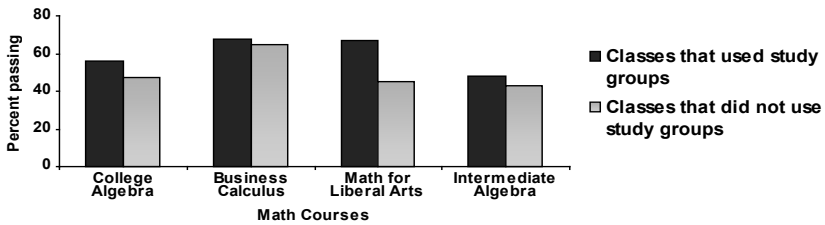
Figure 1. *Comparison of the use of study groups in several math courses*

One very important fact that I have noticed during this period of encouraging my students to form cooperative study groups, is the improvement in the retention rate. In the classes in which students formed cooperative study groups, the retention rate improved by about 5%. Comments made by students indicated that the early success that they experienced because of the group activities and the support given by the group members was an important factor in not dropping the class. Early success in the course led to an increased level of confidence.

Students in general reported that
- Their study skills improved.
- They felt more comfortable asking questions in a group setting.
- Explaining mathematical concepts to each other helped them become better learners.
- Support from group members encouraged them to stay focused.
- They counted on each other for help.

IMPLEMENTING STUDY GROUPS

There are a few things to keep in mind if you plan to implement cooperative study groups in the teaching of mathematics. Groups should consist of three or four students. Mix the students within a group according to academic abilities. This can be done by assigning a student to a group based on the performance on a pretest or exam. I usually wait until the twelfth class day before creating the groups. I use a pretest to determine the composition

of the groups. I have also randomly assigned students to groups.

Once the groups are formed, students are given class time to obtain contact information from each other and select a group leader. The group leader is responsible for deciding on the most appropriate time to meet and for scheduling the group sessions. I recommend to my students that this responsibility should be rotated throughout the semester. I keep the groups intact for the entire semester.

My main responsibility in the cooperative learning process is to provide guidance and ensure that each student is participating in the group's activities. However, there were situations where I had to take a more active role so that the study group could perform more efficiently. For example, in the experimental study discussed earlier, one of the study groups had a problem with one student who was either always late or not showing up to the study sessions. They reluctantly kept the student in the group and allowed him to benefit from the group's work. However, the time came when they had enough and reported the situation to me. While the group had the authority to remove the student from the group, they left it up to me to do the dirty work.

Once a student is removed from a group, that student is on his/her own for any remaining assignments. The student, however, retains any grades received earlier while a member of the study group.

The periodic reports mentioned earlier, serve as minutes for the group's sessions and keep me updated on the group activities. These informal reports are submitted every other week by one of the group members and must be signed by all members. The reports simply detail the activities of the group sessions such as time and place where the group met, duration of the meetings, a brief overview of the meetings, and problems or concerns that the group encounters. Members take turns submitting these reports to me. I used the data from these reports to determine the role of each student during the study sessions.

Most of group sessions are held outside of class where the study groups work on homework assignments or study for tests. Occasionally, I do assign group projects in class. This allows me to have first-hand knowledge of the level of participation of each student.

The in-class projects count as homework grades which accounts for 30% of the semester grade. The in-class project usually involves solving three or four problems from the lecture and is assigned the last 15 or 20 minutes of the class period. Each group member receives the same grade on all group assignments, however all students work individually on the exams. If a student is not doing his/her share of the work during the group session, it will be evident when I grade their exam.

CONCLUSION

Having students form study groups has been advantageous for me. With some of the students from the study groups taking such an active leadership role, it is like having teaching assistants. Furthermore, I have fewer papers to grade and thus more time to prepare for class.

During the period that I have been implementing the use of cooperative learning groups in my classroom, I have noticed that most students enjoy the opportunity to work together in groups. In addition, there is a vast improvement in students' attitude, attendance, completion of assignments, and class participation. Students in study groups realize that they are not alone and appreciate the help, support, and motivation that they receive from their group members.

Cooperative learning is based on the belief that learning is most effective when students are actively involved in the sharing of ideas and work cooperatively to complete the assigned tasks. I have found that a student working in groups is provided with a sense of support and I will continue to provide this type of learning environment for my students.

Just like the athlete coming from behind, the task is made easier when there is someone cheering you on. In cooperative study groups, the teammates and instructor cheer for each other as they work together. Give your students the support system that will give them a better opportunity to succeed by giving students the home team advantage!

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