Effectiveness of Working Individually Versus Cooperative Groups: A Classroom-Based Research Project

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Abstract

This purpose of this mathematics classroom-based research study is to answer the following question: Will allowing students to work in groups improve their understanding, or will working individually lead to greater understanding? I have been at a crossroads trying to determine if and when to allow students to work together or to make them work alone because students do not always manage the social aspects of group work so that it will be advantageous to them. Half of the class was instructed that they would complete their work by working in groups; the other half of the class would complete their work by themselves. I compared students' pretest results to their post-test results. In both categories there was not much change in understanding from the beginning of the unit to the end of the unit, making it difficult to conclude which student category showed better improvements in understanding. Finally, conclusions about further research are discussed.

Background

This study investigates students' understandings about mathematics. The purpose of the research is to answer the following question: Will allowing students to work in groups improve their understanding, or will working individually lead to greater understanding? This idea of group dynamics has been studied and researched, but in my experience, I have had mixed results. In some situations, students help each other, their time is spent on task and they benefit from peer interactions. At other times, students spend their time chatting about things that are not relevant to the topic at hand, and do not get much work done at all. When students in my class do their work independently, most students tend to complete their work, or they will come ask for help if they cannot continue. I have been at a crossroads trying to determine if and when to allow students to work together or to make them work alone because students do not always manage the social aspects of group work so that it will be advantageous to them.

I know why group work is not always a positive experience in my classroom. A major element that must be considered is the difficulty of the work that students are expected to complete. Often times, it may be too difficult for students to complete without guidance from the teacher, leading to group and individual frustration. This is a realistic concern despite the fact this mathematics program is mandated by our district for all students at this grade level. Students are expected to complete the coursework with a certain level of independence and success, however, this issue is debatable, as many educators who teach this mathematics program readily express that they dislike it and/or that their students have difficulty doing the work alone. Another valid concern that can affect group work is management of student behavior. Making students stay focused can be better maintained in my classroom if there was more structure and guidelines about the norms and expectations of group work from the onset of the school year as well as continuous monitoring of group dynamics and progress.

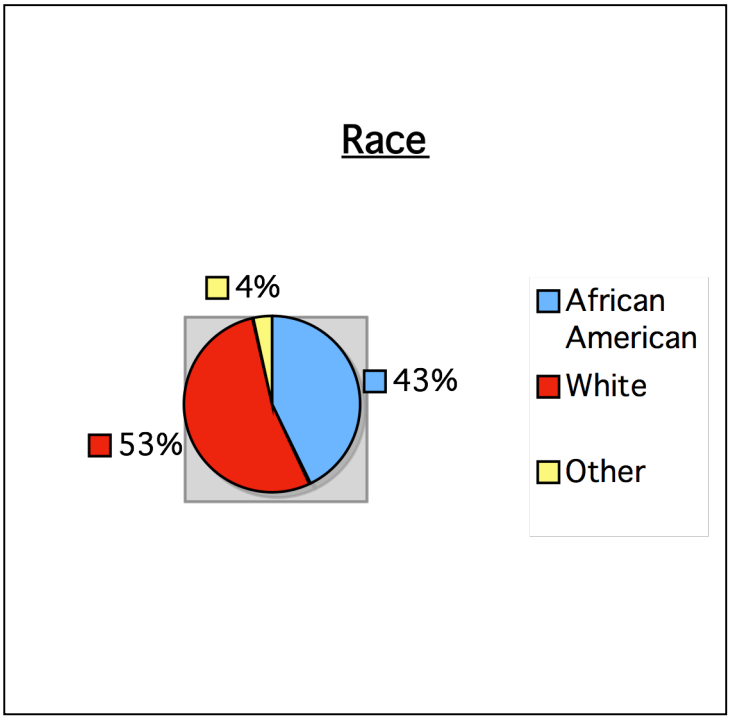
The participants in this study are from one of the 7th grade math class that I teach. The study was conducted during the 75-minute math periods. There are 28 students, and I am the only teacher in the class. The classroom has 5 large tables where up to six students can sit. Most often, there are usually four or five people at a table and the other students will sit at other places around the perimeter of the room. For example, students will sit at the computer table, two smaller tables, and on a rug. The seating arrangement is important to this study since they were

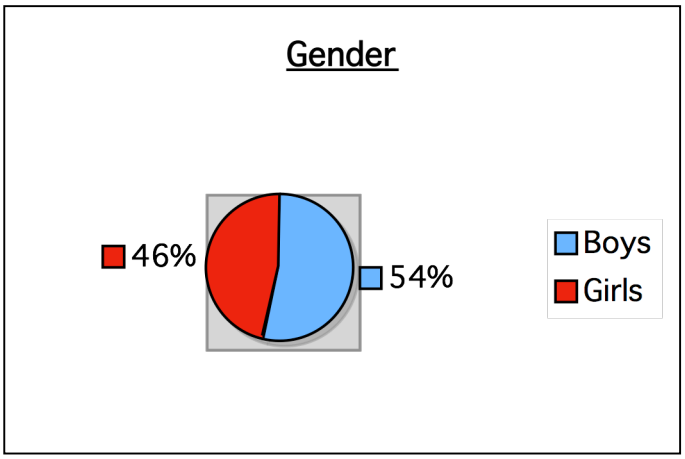
assigned to work independently, and would need to sit alone, and others worked in groups and sat at the large tables.

All classes in the school are organized by our school's principal with the intention to have the students as equally balanced as possible, considering race, gender, academic achievement, and behavior as the criterion. The socio-economic status of the school is mainly middle class; about 30% of the school qualifies for a free or reduced lunch. The tables and graphs below show the number and percentage of students in each category.

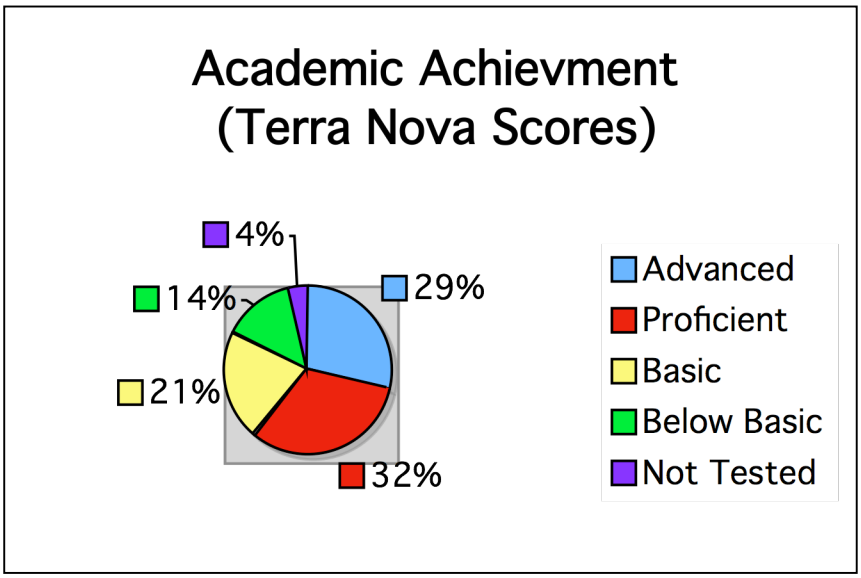
RACE	African American	Caucasian	Other
	12/28= 43%	15/28=53%	1/28=4%

GENDER	Boys	Girls
	15/28 = 54%	13/28 = 46%





Academic Achievement (Terra Nova, 2006)	Advanced	Proficient	Basic	Below Basic	Not Tested
	8/28 = 29%	9/28 = 32%	6/28 = 21%	4/28 = 14%	1/28= 4%



Literature Review

There is an abundance of research regarding grouping of students as an educational practice. Grouping can be classified into two major types: homogenous- or heterogeneous-ability groups. In either situation, students can work independently or cooperatively. There have been many studies regarding each of these areas that favor heterogeneous-ability groups and cooperative learning groups.

Homogenous grouping, or "tracking", has been widely used in America's educational history, and continues to be used today, but studies show that this type of grouping does not benefit students any more than heterogeneous groups (Esposito, 1973; Mills, 1999; Slavin, 1993; Slavin & Karweit, 1985). Kulik's (1992) analysis of the research noted that when positive gains are made, they should be attributed to adjustments in instruction and curriculum, not because of the grouping arrangement. When the top, middle and bottom groups use the same curriculum,

despite their differing ability, there are no academic gains. When students are placed in homogenous classes, the "top" students show a slight drop in their confidence levels, while the "bottom" students show a slight increase. When classes used different curricula, there were some positive changes in achievement. The greatest increase noted is when students are put into enrichment or accelerated classes, mainly because of the additional resources and change in curricula offered. A variation of homogenous grouping by class is homogeneous semi-groups within a heterogeneous class. Slavin & Karweit (1985) cited that many researchers found that the latter has more positive academic results than traditional whole-class instruction.

Cooperative learning has been a popular alternative method of grouping students instead of tracking. There is empirical evidence that cooperative learning is effective for students (Gokhale, 1995; Slavin, 1995; Yackel, Cobb & Wood, 1991) but Johnson and Johnson (as cited in Northwest Regional Educational Laboratory, 2005) find that, "the successful application of cooperative grouping in classrooms still eludes many educators." Therefore, researchers continue to investigate this topic, specifically trying to identify the different variables that make cooperative learning successful and effective (Cohen, 1994; Slavin, 1995; Yackel, Cobb & Wood, 1991). Without certain elements, cooperative learning is no more effective than traditional methods of instruction and learning (Cohen, 1994; Northwest Regional Educational Laboratory, 2005).

One element that has been under research is the effectiveness of cooperative learning based on the type of task the group has to complete (Cohen, 1994). Many tasks can be done individually and do not really require cooperation for understanding. Other tasks, like those that are "ill-structured" and those where process is more important than outcome, should be used as cooperative learning tasks.

Another element that can affect how beneficial cooperative learning can be is the type of interactions that occur between the group members. Cohen (1994) cited many studies that conclude that students' discussions in groups are good indicators of the achievement that the group will have. In addition, the groups that ask specific questions while working proved to show more gains.

Slavin (1995) identified other elements that make cooperative learning beneficial, and those elements are present because of certain theoretical perspectives. The "motivational perspective" includes group goals and awards as a cornerstone of cooperative learning. This

theory acknowledges that the objective of group work is for individuals to achieve as a result of being a part of a group. Therefore, in practice, the group can only benefit when the individuals of the group are successful. External rewards are given to groups when the individuals in the group are successful. This is a key element in this theory, and empirical evidence shows that this is a key factor in the effectiveness of all group work. Cohen (1994) acknowledges a compromise of sorts, stating that extrinsic motivational tactics should be used under certain circumstances where group interaction is not enough, for example, when group work is not challenging and could be completed without the group. Other evidence shows that when carefully structured interactions are implemented then cooperative learning can be effective even if there are no extrinsic rewards (Slavin, 1995).

Another perspective of cooperative learning labeled "social cohesion" is more rooted in the interpersonal influence that cooperative learning entails (Slavin, 1995). Under this lens, an extrinsic reward for the group's achievement is not necessary because it is believed that the interactions that occur within the group are rewarding enough. This theory is strong in establishing group norms and roles for the members of the group as to enhance group interactions. Slavin's studies did not find any evidence to support that this perspective on group work produces higher academic gains than traditional instruction, unless it was combined with extrinsic rewards.

Other perspectives are also identified that account for mental processing of information that takes place in a cooperative learning setting. The "developmental perspective" is based on Vygotsky's and Piaget's work (as cited in Slavin, 1995) believing that students learn when they interact with others, as long as they are within each other's zone of proximal development. Large gaps in students' ability within a group did not yield academic growth. These beliefs alone have not been shown to increase learning, but they do provide the rational behind why cooperative learning is effective. An extension of this belief is the "cognitive elaboration perspective" which is based on students either providing or listening to detailed explanations of content. O'Donnell & Dansereau and Webb (as cited in Slavin, 1995) found that students who provide elaborate explanations increase the most academically.

Methodology

The purpose of my research was to determine whether my students gain a better understanding of the mathematics content when they work in groups or when they work individually. I used pretests and posttests as the instrument to determine which situation would be more productive (see Appendix). Questions on the tests were selected from the Mathematics in Context series, which is the mathematics series that my school district has mandated that we use, and from the Philadelphia Math Benchmark, a bi-monthly citywide test. The assessment questions chosen aligned to the objectives and goals of the topic taught during the time frame of this study. They are open-ended questions in which students are told to provide an answer as well as an explanation. I normally use the assessments at the end of a section or unit of study.

All participants had to give written parental consent to participate in the study. All students were requested to participate in this study, therefore, before the research was conducted, forms were distributed to the students (see Appendix). I verbally explained to them that I was a student at a university, and needed to use their work in a project that I had to complete for my courses. Their work would be used to help me determine what teaching strategies worked well. I informed them that their names and other personal information would not be used, just their answers from regular classroom tests and assignments. I went on to say that I needed their and their parents' permission to use their work in my reports, and it was fine if they did not want to give their permission. If I did not have their permission to use their results, they still had to do all the assignments and assessments, except their answers would not be used in my reports. I asked the students to let their parents know what my intentions were, and for them to return their consent forms promptly.

The study began at the same time as a new mathematics topic. I had never taught the math content before, but students had been exposed to the content in previous grades. Before I did any instruction, I administered a pretest with two open-ended questions (see Appendix). The students were advised that this was a test to see what they were able to do before I taught them anything, and that this would not count toward their grade. I also told them that at the end of the lessons, they would take another test to see if they had progressed (the post-test, see Appendix).

Over the course of the lessons (which lasted about 2 weeks), I followed the Madeline Hunter model of lesson design. Each day the lesson was structured to include: standards,

objectives, anticipatory set, teaching, guided practice, closure, and independent practice (Allen, 1998). It was during the "guided practice" portion of the lesson that half of the students either worked independently or in random groups (explained below).

Half of the class was instructed that they would complete their work for this unit by working in groups; the other half of the class would complete their work by themselves. The students were randomly assigned to work either individually or in groups using Random Sequence Generator, a program that allows you to generate a random list of a sequence of numbers without repeating any numbers (Haahr, 1998). At the beginning of the school year, each of my students was given a number (the number has no academic correlation) from 1 to 28 since there are 28 students in the class. The images show how the program lets you choose your sequence of numbers (Figures 1), and will then put those numbers in a random order (Figure 2); I chose from 1 to 28 to represent the 28 students in my class. The first 13 students to appear on the list were assigned to work individually; the other 15 students would work in groups of 3 for the duration of the unit. In cases of absence, groups would work as dyads. To eliminate any concerns about ability, gender, social grouping, which are variables that were not included in this study, students who worked in groups were shifted daily into different groups throughout the duration of the lessons. I managed that by putting each of the 15 students' numbers on slips of paper and pulling three students at a time to form groups for that day.

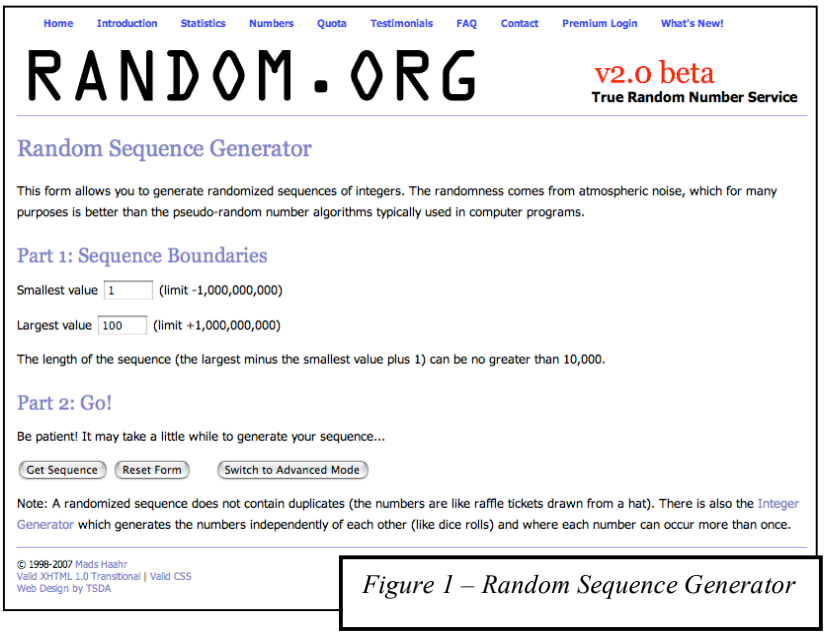


Figure 1 – Random Sequence Generator

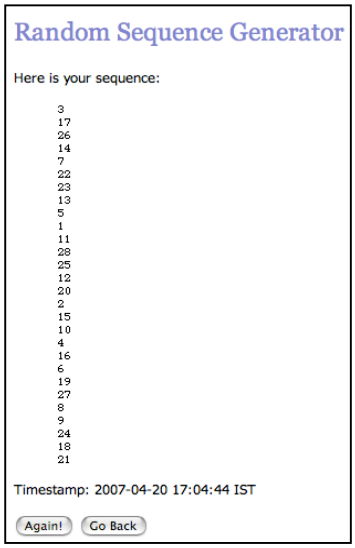


Figure 2 – Random Sequence Generator List

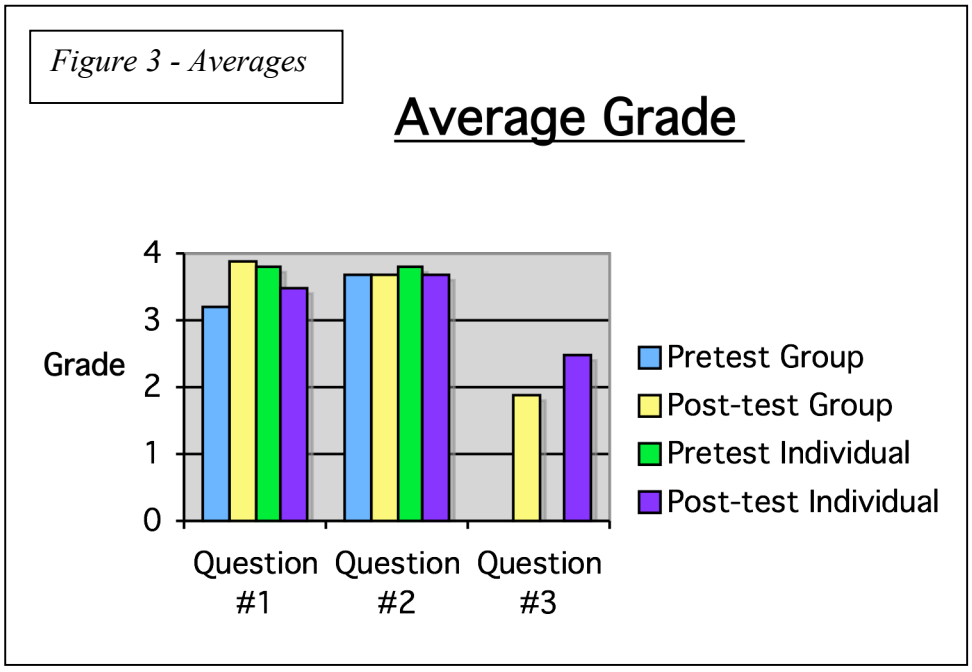
At the end of the unit, students were given a post-test as a means to measure their progress. The post-test included the same two questions that were on the pretest and one additional open-ended question (see Appendix). All questions were chosen from the Mathematics in Context series and the Philadelphia Math Benchmark, as explained above. The objective was to determine what students could do before instruction on the pretest, and compare the results to those on the post-test.

Findings

Investigating if there is a difference in understanding when students work alone or if they work in groups naturally led to comparing students' work. There were several comparisons that are made below, for example, pretest to post-tests, and individuals' grades to groups' grades. My expectations before I conducted any research were that most of the students would show some type of growth from the pretest to the post-test whether they worked individually or in groups. I anticipated that those students who worked in groups would be better able to explain their answers than students who worked alone.

My conclusions about the cause of change in student understanding from the beginning of the unit to the end is based on analyzing the change from the pre-test results to the post-test

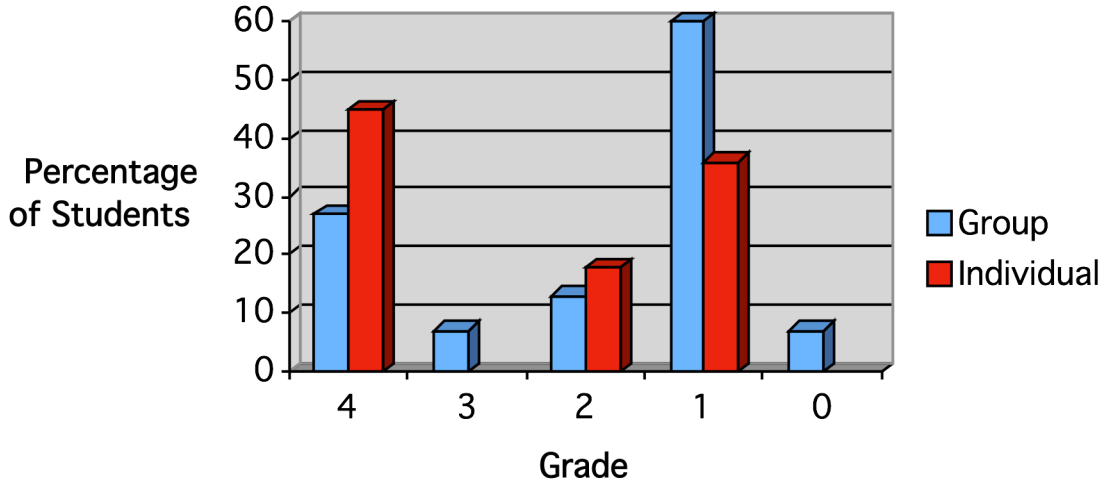
Figure 3 - Averages



results (see Figure 3). The pretest had two questions, while the post-test repeated those same two questions plus one additional question. I compared the pretest results to the post-test results according to the averages for each question. It is difficult to conclude which student category showed better improvements in understanding because everyone started out with such high pretest averages. I expected much lower pretest scores so this was surprising and very much unexpected. In both categories, the students' results for the first two questions show that there was not much change in understanding from the beginning of the unit to the end of the unit, although, those who worked in groups did show a slight increase in their understanding for question 1.

Question #3 of the post-test reveals the most interesting and perhaps confusing results. This question was not included on the pretest. The average grade for those who worked individually is higher than those who worked in groups (see Figure 3), but neither category of students showed a proficient level of understanding. Again, this was surprising and unexpected. A closer look at this question reveals that students' results varied whether they worked in groups or individually (see Figure 4). Neither group showed a strong tendency to score in any specific grading category. However, the students who worked individually did have a greater

Figure 4 – Question#3



percentage that got the question correct by showing and/or explaining their work, and therefore received an "advanced" grade. Furthermore, those who worked in groups had a higher percentage that got the question wrong, receiving a "below basic" grade. Based on this data, the students who worked individually did have a better understanding of how to solve this problem than those who worked in groups.

Conclusions

Based on the results of my research, it is difficult for me to conclude whether having students work in groups or individually helped improve students' understanding in my classroom. The data I collected did not show that there was a strong improvement in understanding for either group dynamic. One question did favor those who worked individually, but that conclusion cannot be extended to the other questions.

There are a few statistical factors that caused my results to be inconclusive. The students' pretest scores were high, showing that they understood those particular objectives before any instruction took place. In order for the data to show some type of conclusions, one or both of the following things would have had to happen. There would have to be growth from the pretest to the post-test, or the post-test results would have to consistently favor the group workers or the individual workers. My data did not do this.

In retrospect there are several things that I would do differently. The first thing would be to vary the pretest and post-test questions. Gokhale (1995) did a similar research study and used different questions in order to prevent students from becoming "test-wise". I would also extend the length of the study so that I could repeat the study over several units. I do not think that I had enough data to draw sound conclusions. Both of these changes would make me feel more comfortable and more confident about the results of this study; however they would not necessarily alter my findings. The research about cooperative learning offers suggestions that might yield different results.

Research shows that my question about the effectiveness of cooperative learning needs to be modified to investigate whether certain factors of cooperative learning are effective. The research shows that certain elements can or cannot exist which will probably affect whether cooperative learning is working. Certain things like external rewards, group interactions, ability

levels within the group, group tasks, group structure and norms, and elaboration/explanation are influential variables that can be studied.

Based on the research about cooperative learning and on my results from my study, I conclude that group work in my classroom is not beneficial to my students' achievement. I am one of those educators that was eluded as to how to make cooperative learning work. My class falls into the category where group work is no more effective than traditional methods. I am not satisfied with this position, and many teachers may be in this same situation. To further my practice, and perhaps other teachers' as well, I would make adjustments to the way I structure cooperative learning in my classroom to include elements suggested from the current research. A good place to begin would be to analyze the theoretical perspectives suggested by Slavin (1995) to see what perspectives best match my own philosophy of teaching. I would then apply some of the fundamental elements that are associated with that belief and repeat my study. Instead of comparing individuals to students that worked in groups, I would investigate which elements of cooperative learning were more effective in my classroom.

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