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# Individual learning versus cooperative learning in a competitive classroom

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# Individual Learning Versus Cooperative Learning in a Competitive Classroom

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# Chapter 1

## Introduction

Students with exceptional needs come to classrooms with a large variety of strengths and weaknesses. The challenge for classroom teachers is to design lessons and curriculum to fit the individual needs of each student while simultaneously maintaining and raising standards. Cooperative learning structures are thought to benefit students by having students learn from their peers. Cooperative groups generally assign roles to individual students based on strengths and weaknesses ensuring everyone in the cooperative group contribute to a class activity or project. While a cooperative learning may facilitate better classroom management, one may question if these structures will benefit students that are not already performing at grade level. Also, if students learn from each other in cooperative groups, what role does the level of class content and student prior knowledge play in the strength of cooperative grouping?

Using competitive structures in the classroom is seen as a negative because they are perceived to produce "winners" and "losers." Usually there are few winners and many losers of these competitions. However, the view of competitions may change if instead of focusing on "winning" and "losing," the focus is on overall student achievement. Competition can also be viewed as a motivating factor. Students may engage more in learning in order to win the competition.

There is a role for cooperative learning groups in competition. Team sports are an example of both cooperative learning and competition working together. The team

cooperates in order to win and not to lose. This concept can be moved to the classroom. Cooperative groups in the classroom can compete with other cooperative groups in order to win a competition.

Individual students also compete against each other in a variety of educational situations. Students compete for class rank, scholarship money, SAT scores, and admission to colleges that have a limited number of seats for incoming freshmen. It is appropriate that competition be addressed in a classroom setting. We may tell our students that cooperation is the best way to learn, but in fact, they are competing for scores, grades, and rank.

**Purpose of the Study**

The purpose of this study was to use a competitive structure with extrinsic rewards (gift cards) to discover if students competing in cooperative groups or competing individually would achieve higher posttest percentages. The study asked whether a student working as an individual in a competitive structure learned and retained more than a student working in a cooperative learning group in a competitive structure.

If a teacher wants to ensure retention of content, will having students work in cooperative groups be more effective than individual learning? If students truly learn from each other, will a student in cooperative group learn more? Or, if students are asked to work individually and are responsible for each component of an activity or project, will they learn more by having done each component themselves? The answers are important for teachers.

The use of incentives adds another element to the classroom dynamic. Do teams work better than individuals? This study sought to find the effects of tangible incentives as they related to performance of cooperative groups versus performance of individual students.

**Scope and Limitations**

Two separate self-contained 10th and 11th grade biology classes participated in this study. There were 16 African American participants from 16 to 18 years of age, 10 in one class and 6 in the other. One class had 6 males and 4 females. The second class had 3 females and 3 males. Each of the students was identified as having an educational disability. Combined, 85% of the students received free or reduced price lunch. Each student was on track to graduate on time. This research was conducted over a four week period in the spring of 2011. The students resided in two north side Milwaukee zip code areas.

Each group was taught the same lessons and given the same activities. In the first class, Class A, students worked on assignments as individuals in teacher lead instruction. In Class B, students worked on the assignments in cooperative learning groups of three or four. Students in both groups were given a pretest before the intervention and a posttest after the intervention and rewards were given high performance.

**Definitions**

*Competition* refers to a contest in which a winner is selected from among two or more students (American Heritage Dictionary of the English Language, 2000).

Slavin describes *cooperative learning* as teaching methods in which students work together in small groups to help one another learn academic content (1996).

*Individual learning* means students were given classroom projects that they had to work independently on with help from the teacher.

An *incentive* refers to any award, prize, or reward outside of grades that a student receives for a successful test, project, or activity.

**Summary**

It was assumed in the development of this study that extrinsic rewards would act as a motivator over a four-week period. Individual learning was assumed by the researcher to be the best model in which students learn. The study attempted to determine if cooperative learning groups or individual learning were the best way to improve student learning in the context of a competitive structure. Students in two groups were given pretests before the competition and then given posttests after four weeks of four different competitions.

This study examined two groups of students. One group of students competed against each other in cooperative groups and another group competed against their peers as individuals. The question this study attempted to address was how learning in cooperative groups compared to individual learning in a competitive structure.

# Chapter 2

## Problem Statement

Cooperative learning and competition have been sees as rival philosophies in education. Yet most classroom teachers use both approaches, sometimes without realizing it.

## History and Theory

David and Roger Johnson have been researching the relationship between cooperative and competitive learning since the 1960s. In their book, *Learning Together and Alone*, first published in 1987 and last updated in 1994, they lay out their case for the virtues of cooperative learning and how to incorporate competition positively into this educational practice. Johnson and Johnson focus on group goal setting and interdependence. They write that every "cooperative lesson begins with positive goal interdependence" (p. 109). For the Johnsons, in order for interdependence to work, the group must establish goals together and then plan as a team how to achieve those goals. They hold that this strategy can work over numerous content areas with different student ability levels.

Since Johnson and Johnson (1994) argue that cooperative learning works best when the group sets goals projects are assessed and the group receives a grade. They (1997) also point out that cooperative learning "is the oldest research tradition in American social psychology" (p.16). According to the Johnsons cooperative learning encourages students to be positive influences on each other because members of the groups are allies. This increases positive interdependence among members of the group.

Johnson and Johnson (1999) identified five basic elements that make cooperative learning effective in the classroom. The first is positive interdependence referred to above. The second is verbal, face to face interaction. The third element is individual accountability, the forth is social skills. Finally, the fifth element is "group processing" (p. 70) which refers to how well the group is getting along together. These five elements, they argue, extended outside the classroom. Teacher to teacher relationships, principal to principal relationships, all should incorporate these five elements into professional collaborations.

Spencer Kagan is another highly regarded researcher that studied cooperative learning. Kagan (1989) distinguished between cooperative activities and cooperative structures. Cooperative activities are used within lessons in specific content areas while cooperative structure "may be used repeatedly with almost any subject matter (and) at a wide range of grade levels" (p. 12). Examples that Kagan has developed are Number Heads Together, Three Step Interview, and variations of Jigsaw.

Kagan (1977) also identified three types of social orientation. The first is cooperation, and entails three sub-categories: equality; group enhancement; and altruism. The second is competition with two sub-categories, superiority and rivalry. The third is individualism, where a player tries to increase his gains without considering the gains of others. Kagan (1989) argues that of the three types of orientation, cooperation has as its objectives "teambuilding, class building mastery, concept development" (p. 13). Cooperative learning sets itself in the cooperative social orientations. Teachers use of cooperative structures results in "lesson designs that are richer in the academic, cognitive, and social domains" (p.15).

Robert Slavin has written extensively on the role of cooperative learning in the classroom and how that relates to reward structures. Slavin (1987a) identified four elements of effective instruction. They are quality of instruction, appropriate levels of instruction, incentive, and time. The acronym he uses for these four elements is QUAT. Slavin attempts to builds his models so that districts, schools, and even individual teachers can have more direct control over instruction while at the same time providing a framework for educators to work within. Slavin (1987a) argued that for effective instruction, all four elements must be addressed. At the same time, the emphasis put on each of them needs to be appropriate to the class.

Slavin put cooperative structures into the QUAT. Cooperative grouping speaks to quality of instruction, incentive, and time in natural ways. Determining appropriate levels of instruction becomes difficult because not everyone in diverse cooperative groups will be at the same entry point. In such cases, in order to provide appropriate instruction, students may need to be grouped by ability level (Slavin, 1987b).

Slavin (1996) wrote, "Cooperative learning, especially when groups are rewarded based on the individual learning of all the group members, is an instructional approach that is congruent with those developmental needs of adolescents"(p. 202). He and his colleges emphasized individual accountability in his models. For groups to be rewarded, each individual in the group must achieve the educational objective. He called this model Team Assisted Individualization (TAI) (Slavin, Madden, & Stevens, 1989). TAI was a response to individualized instruction. Slavin attempted to bridge the individual education model and wrap it into cooperative learning. The stronger members of the group help the weaker members because everyone's reward depends on each individual's

performance. Each member of the group is now a stake holder in the other member's achievement of the educational objective. For Slavin (1996), successful cooperative learning includes group goals and individual accountability.

**Research**

Qin, Johnson, and Johnson (1995) did a meta-analysis of studies that compared competitive and cooperative activities and problem solving. They looked at studies over a 64-year period starting in 1929. They reached 63 conclusions. A remarkable 87% were in support of cooperation. Yet they also noted that the superiority of cooperative learning over competition did not prove to be strong. However, there were specific areas where cooperative learning out performed competition. In "ill-defined problems, that is problems with open ended solutions and operations, cooperative learning outperformed competitive learning. Also, in nonlinguistic problem solving with math symbols or actions, cooperative learning again had an advantage" (p. 130).

Nembhard, Yip, and Shtub (2009) studied engineering students using computer simulations. They gave pairs of students the choice to compete against each other or cooperate in seven different projects. Before each project the participants could decide which strategy to use. They found that their hypothesis that more participants would learn more in a cooperative setting was only partially supported. Overall, competition resulted in greater overall learning even though the majority of the time students choose to work in cooperation rather than compete against each other. Students preferred to work cooperative many more times than to compete. The result of this was, "the low performer has more to gain through cooperation, while the high performer does nearly as well on average regardless of the strategy" (p. 187). The last point is important. According to this

study, a high performer will achieve the same high scores regardless of working cooperatively or competitively. The lower performing students benefits most from cooperation, presumably because they benefit from higher performing students sharing their knowledge. Nembhard et al. concluded that competitive learning does improve learning; cooperative learning offers, "the full benefit of a teammate's ideas of understanding" (187). They finally concluded that for optimal results, lower performing students be paired with higher performing students.

In the historical research, there was a strong bias toward cooperative learning. Morton Deutsch (1949) argued that cooperative learning led to positive interdependence and competition led to negative interdependence. In cooperative learning, peers are seen as a resource and relationships between the members are valued because each member's success is tied to other members. In negative interdependence peers see each other as rivals or potential rivals. Information is not shared so as not to give a competitor an advantage over a limited resource. Relationships in the long term suffer from a lack of sharing resources. Classroom outputs suffer and these students actually produce less than their cooperative peers.

This idea is not reflected strongly in the current research. Attle and Baker (2007) took a different approach to the question of competitive learning. They assumed that positive learning results can be achieved in both competitive and cooperative learning environments. They devised a model labeled *Cooperation-competition* and defined is as, "an instruction strategy combining components of cooperative learning with the positive aspects of motivational competition through inter-group competition between collaborative teams..." (p.79). Attle and Baker wanted to assure that there students

became both good competitors and cooperative teammates. They conclude that students whose outcomes are generally well above content and application standards benefit most from cooperation-competition. Competitions, seen in this way, best benefit the students that have already mastered the basic standards and use the frame work of the competition to push their work to higher levels not ask for by the teacher.

Comparing Attle and Baker to Nembard, et al. it is clear why the results of cooperation and competition may be mixed. The results of the studies depend on the sample being tested. In both examples higher performing students were included under both cooperative and competitive learning. Cooperation benefited the lower performing students the most because they were able to learn from higher performing peers. Higher performing peers benefited in the same way but not to the same degree. Higher performing students benefited from competitive environments because they were forced to go above and beyond the standard to achieve the reward. Lower performing students who did not have the ability to compete could potentially be discouraged. However, by combining both, cooperation and competition, individuals on both ends of the performance spectrum benefited.

Hwang and Arbaught (2009) reached the same conclusion as Attle and Baker. Their study focused on the use of competitive learning and cooperation in online/hybrid business classes. They measured the amount of online feedback peers would give each other if the groups were working cooperatively or if members of the group were competing against each other. In both cases the researchers measured the feedback and quality of responses to various issues brought up in class and then discussed in an online forum. Their results showed that neither cooperation nor competition could predict

participation across the forums. Yet, participation in competitive groups "predicted the intensity of participation across all forums" (p.289). The students in the competitive groups made more posts across more forums. The researchers postulated that this is "a reflection of the competitive student's drive to get ahead of others by seeking more feedback on the discussion board" (p.289). When the two groups were assessed the students that had the most intensive forum discussions, (i.e., the competitive group), scored higher.

This study puts a twist on the typical criticism of competitive learning. Deutsch(1949) argued that students in a competitive environment sought less group interaction so as not give an advantage to rivals (negative interdependence). This study showed that the competitive environment caused students to engage in intensive peer interactions in order to gain an advantage. Instead of the competitive student fearing peer interaction would give others an advantage, the competitive student sought out peers in order to gain an advantage. Given the implications of this study, Hwang and Arbaught conclude, "The fact that competitive rather than collaborative attitude was directly associated with electronic board discussion and consequent test performances raises questions on the primary...use of collaborative pedagogical approaches in online learning environments"(p. 289). This study showed that competition was the driving force of collaboration.

**Methodological issues**

The methodological issues pertaining to studies in both competitive and cooperative classroom structures directly related to the sample being studied. No two

samples reacted the same way to the same set of learning structures. What research and meta-analysis have shown is that cooperative learning has held up well over 50 plus years of research. Cooperative learning has been shown to elevate lower performing students and have little effect on higher performing students. The conclusion is that higher performing students will succeed under any learning structures so emphasis has been put on the lower performing learner.

Competitive learning structures have been under-evaluated as an independent variable. Studies done on competitive learning usually included a component of cooperative learning. Researchers assumed cooperative learning was a better means of achieving student learning. A multitude of studies examined different types of cooperative structures over a variety of content areas. Competitive learning structures do not have the breath of research and theory that cooperative learning structures do.

**Implications**

Implications of research on the role of cooperative learning and competition encompass all of education. Research indicates that cooperative learning has become an important pedagogical paradigm. Teachers have increasingly been using cooperative learning structures in their classes. Cooperative learning research has also been going on for decades. At various times throughout the 20$^{th}$ century and into the 21$^{st}$ the pendulum has swung toward cooperative learning.

Therefore, the current study attempted to research the relationship between cooperation, competition, and educational achievements. The study examined whether

cooperative learning resulted in an educational advantages when compared to individual learning in a competitive classroom.

**Summary**

Historically, cooperative learning has been shown as an effective learning strategy, particularly for lower achieving students. Studies done in the mid to late 20th century indicated that cooperation leads to more student learning than competition. Slavin, Johnson and Johnson, and Kagan have all been instrumental in bringing this research to classroom practices. Creating cooperative environments where student interdependence is necessary to achieve group created goals is becoming the dominate paradigm in the classroom. If all teachers are not using in cooperative learning, they are utilizing some of its structures in their lessons.

However, newer studies show that certain competitive structures increase the intensity and engagement of students without creating negative interdependence among them (Nembhard, et al., 2009). In other recent studies cooperative learning is not showing the gains it once held over competitive structures (Attle & Baker, 2007). The results are becoming less and less pronounced. Why this is happening is up for speculation. Perhaps the emphasis on cooperation has ignored a need for healthy competition. Many researchers are starting to understand that cooperative learning and competitive classroom environments are not mutually exclusive.

Competitive reward structures are usually juxtaposition to a study on cooperative learning. Lacking in the research are extensive studies of competitive learning structures where competition is the independent variable.

# Chapter 3

## Methodology

This was a quasi-experimental study using two groups of 10th and 11th grade students. For the independent variables, one of the classes was assigned to cooperative learning groups and the other was to complete classroom assignments individually. The dependent variable was the change in percentage of increase in posttest scores after this four week intervention. Each class was competing for rewards (gift cards) based on weekly rubric scores. However, these rubrics where not considered in this data analysis.

## Participants

The participants in this study were 16 African American 10th and 11th graders at in a Milwaukee high school, 7 females and 9 males in a self-contained biology class. They were from 16 to 18 years old. Each participant was on track to graduate on time and . each had been identified with a disability. Thirteen students were categorized as Other Health Impaired; one student had a Specific Learning Disability; and two students had mild Cognitive Disabilities. Specific information regarding socio-economic status for this sample was confidential and unavailable. The students were divided into two separate classes, Class A and Class B. Class A contained three female students and three male students. Class B consisted of six male students and four female students.

## Materials

Instructional materials were used in the science labs the students performed. (See Appendix A) Computers connected to the internet were available for virtual dissections.

Dissection samples for worms, crayfish, frogs, and pigs were used for four different biology labs, one per week. Lab reports required. Lab equipment, such as dissection trays, scissors, as well as safety goggles and rubber gloves was provided.

The assessments used to measure academic achievement was formative and summative (a posttest). Data collected were kept on a password controlled spread sheets.

**Procedures**

Students in both classes were first given a pre-test that was designed by the researcher to measure prior knowledge in the content area of biology. The pre-test consisted of 35 multiple choice questions, a matching section for definitions, and a labeling section. At the end of the four week intervention, a post-test (identical to the pre-test) was given to measure the content knowledge learned by the students (Appendix A).

The classes were studying animal anatomy. During the intervention, students participated in four different weekly projects. Each project involved an animal dissection. In Week One the students studied Clitellata and dissected an earthworm. Week Two, the groups studied Crustacea anatomy and dissected a crayfish. In Week Three the students studied reptiles and dissected a frog. Finally in week Four, the students studied mammals and dissected a fetal pig.

Class A were to work as individuals on the dissection units. Class B students worked in two cooperative groups of three students and one cooperative group of four

students. Students were allowed to choose their groups. It should be noted that the four female students chose to form one group; the other two groups consisted of three male participants each.

Students were rewarded each week with gift cards, either from a fast food restaurant or department store. Class A competed as individuals for the gift cards. The prize for first place in Class A was a $20 gift card, for second place a $10 dollar gift card and third place a $5 gift card. Scores for the prizes were based on the rubrics and were distributed on the Monday after the dissections were completed and the rubric scored.

Class B participated in the identical dissection units. The three cooperative groups in Class B received a combined group score on the rubric for each dissection. Each week, each member of the group with the highest score each received a $10 gift card to a fast food restaurant or department store. Each week Class A and Class B started a new competition. Participants had an opportunity to win gift cards regardless of the previous week's performances.

At the end of the intervention, students were given a post-test which was the same test given as the pre-test four weeks earlier. The post-test score, as well as the four dissection rubrics, provided grades in the biology class.

**Data Collection and Analysis**

Data were collected on each participant's pre and posttest. The researcher determined if members of Class A or Class B made more improvement in class mean. Class median was also computed. Also the researcher identified which individuals made

the most improvement. The researcher then determined if cooperative learning group competitions had a greater effect on learning than individual completions.

Three main questions were asked of the data: 1) did Class A improve their mean on the post-tests more than Class B? 2) did Class A improve their median on the post-tests more than Class B? 3) which individual students improved their scores the most? The pretest-posttest mean comparison showed which class improved in the total number of questions answered correctly. The comparison of pre and post intervention median showed which class improved most as a group once outliers were accounted for. Finally, looking at individual improvement in scores showed the effect of the intervention on individual students.

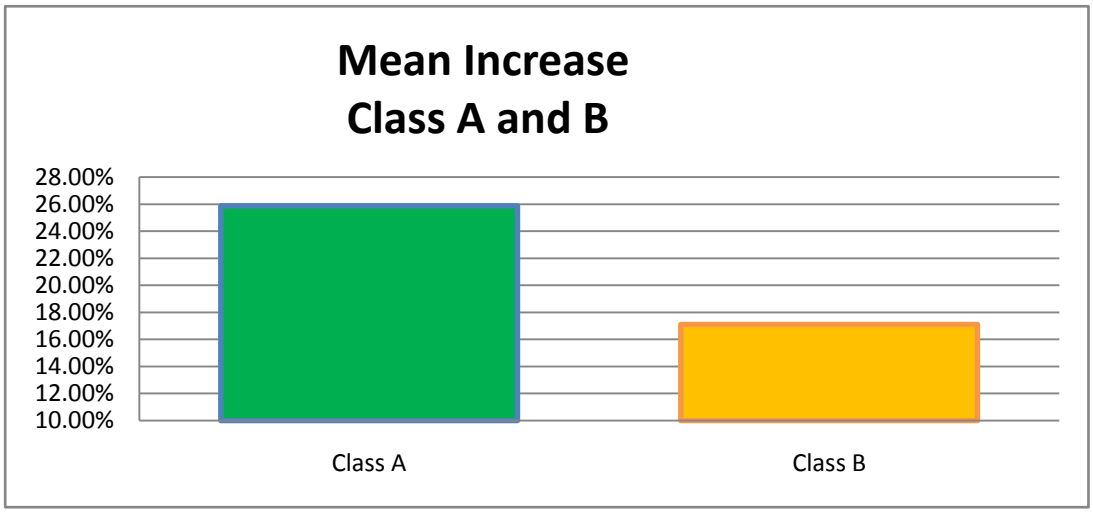
## Chapter 4

### Description of Findings

The purpose of this study was to measure student learning in a competitive classroom. Class A received the intervention working as individuals and Class B received the intervention working in cooperative groups. The data measured which class improved more as well as which individuals improved more. This study attempted to an answer if students that were working as individuals in a competitive classroom would improve their mean and median percentages after a four week intervention.

Each class improved their mean percentage. Class A had a pretest mean of 13.16%. The class posttest mean was 39.03%, an improvement of 25.87%. Class B began with a pretest mean of 13.33% and improved to a posttest mean of 30.44%, or 17.11%. Class A improved 8.77% more than Class B in mean score.

**Figure 1**



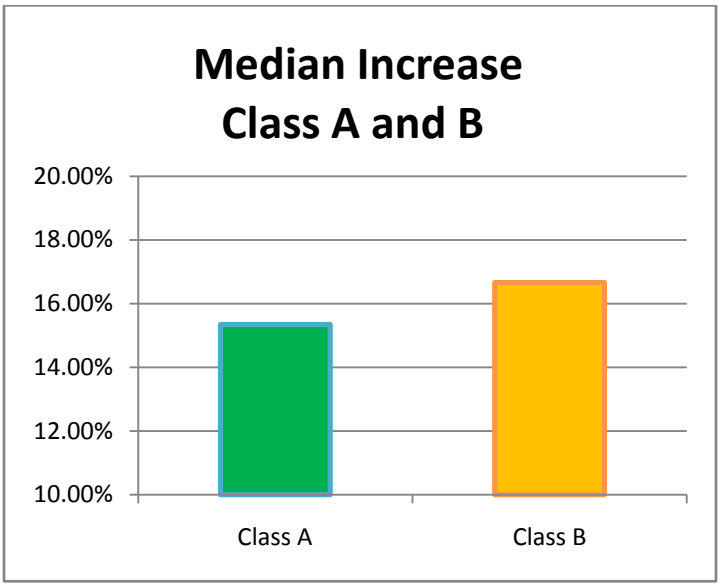
## Table 1

## Pre and Post Scores

| Student # | pre-test 57 total | Pretest % correct | Post-Test 57 total | Post Test % correct | Change in % |
|---|---|---|---|---|---|
| **Class A** | | | | | |
| 35 | 8 | 14.04% | 39 | 68.42% | 54.39% |
| 113 | 4 | 7.02% | 7 | 12.28% | 5.26% |
| 245 | 12 | 21.05% | 44 | 77.19% | 56.14% |
| 530 | 6 | 10.53% | 12 | 21.05% | 10.53% |
| 9096 | 6 | 10.53% | 19.5 | 34.21% | 23.68% |
| 355 | 9 | 15.79% | 12 | 21.05% | 5.26% |
| Mean | 7.5 | 13.16% | 22.25 | 39.03% | 25.87% |
| Standard Deviation | | 4.93% | | 27.22% | |
| Median | 7 | 12.29% | 15.75 | 27.63% | 15.35% |
| Range | | 14.03% | | 64.91% | |
| | | | | | |
| **Class B** | | | | | |
| 691 | 5 | 8.77% | 9 | 15.79% | 7.02% |
| 573 | 5 | 8.77% | 16 | 28.07% | 19.30% |
| 688 | 7 | 12.28% | 24.5 | 42.98% | 30.70% |
| 831 | 5 | 8.77% | 14 | 24.56% | 15.79% |
| 992 | 8 | 14.04% | 11 | 19.30% | 5.26% |
| 8014 | 7 | 12.28% | 18 | 31.58% | 19.30% |
| 146 | 17 | 29.82% | 17 | 29.82% | 0.00% |
| 121 | 12 | 21.05% | 26 | 45.61% | 24.56% |
| 7046 | 3 | 5.26% | 5 | 8.77% | 3.51% |
| 880 | 7 | 12.28% | 33 | 57.89% | 45.61% |
| Mean | 7.6 | 13.33% | 17.35 | 30.44% | 17.11% |
| Standard Deviation | | 7.17% | | 14.87% | |
| Median | 7 | 12.28% | 16.5 | 28.95% | 16.67% |
| Range | | 24.56% | | 49.12% | |

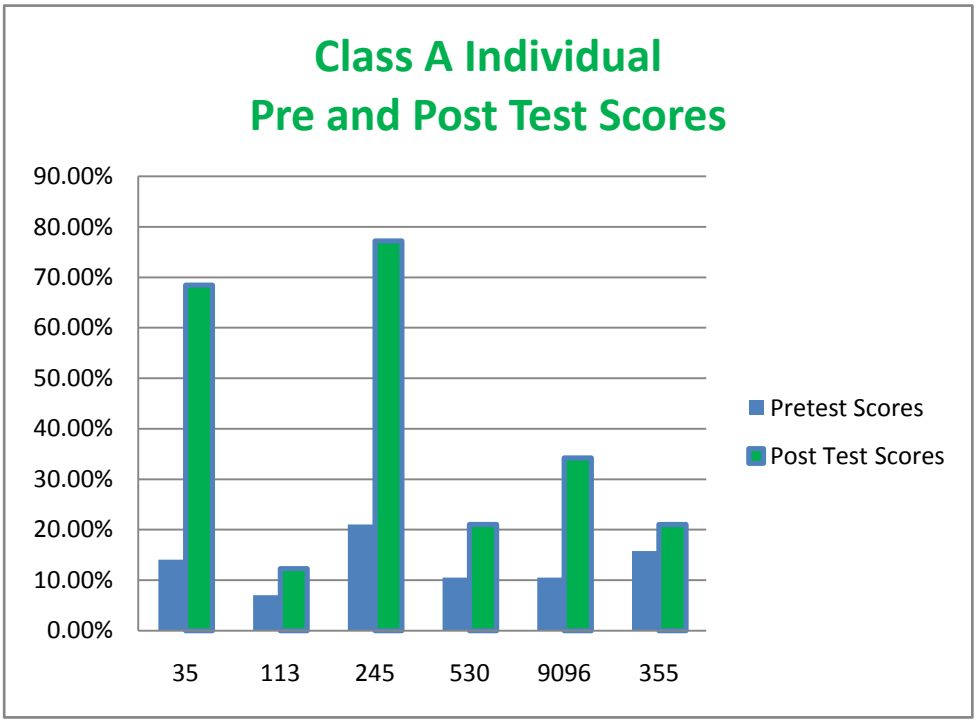
Each class improved their median percentage. Class A had a pretest median of 12.29%. They improved to a 27.63%, or 15.35%. Class B began with a pretest median of 12.28% and improved to a posttest median of 28.95%, or 16.67%. Class B improved 1.32% more than Class A in median score. Remove Average in title of figure 2.

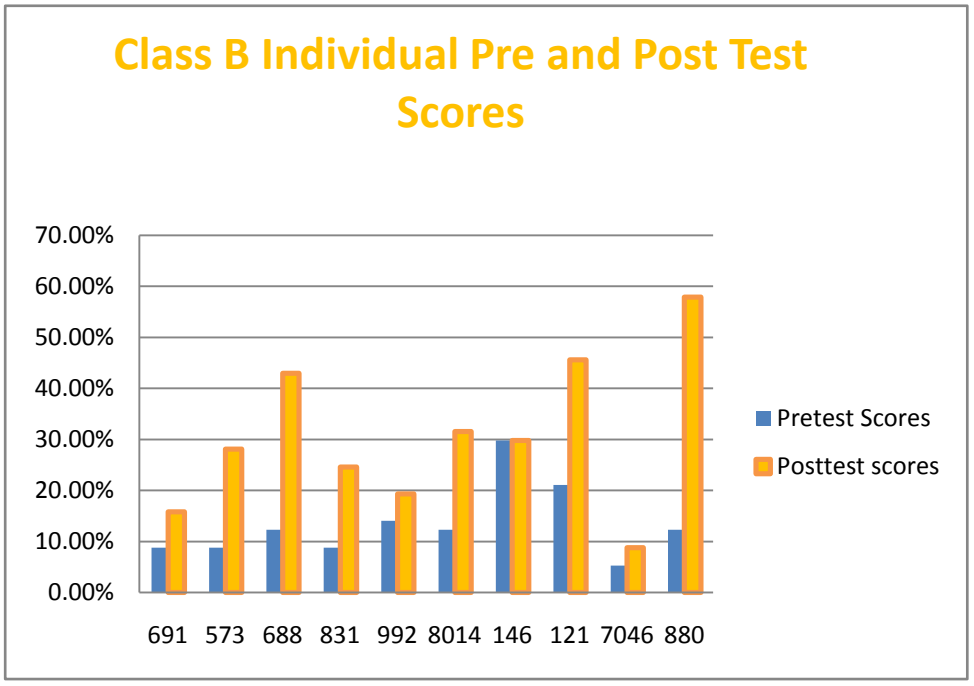
**Figure 2**




Only two students in Class A increased their scores 50% or more. The percentage of student #245 increased from 21.05% to 77.19%, a 56.14% improvement. The percentage of student #35 increased from 14.04% to 68.42%, a 54.39% improvement. These were also the only students in either class to score a total of 60% or better on the posttest assessment.

**Figure 3**


Class A Individual
Pre and Post Test Scores
90.00%
80.00%
70.00%
60.00%
50.00%
40.00%
30.00%
20.00%
10.00%
0.00%
35
113
245
530
9096
355
Pretest Scores
Post Test Scores


Class B Individual Pre and Post Test Scores
70.00%
60.00%
50.00%
40.00%
30.00%
20.00%
10.00%
0.00%
691
573
688
831
992
8014
146
121
7046
880
Pretest Scores
Posttest scores

Two students in Class B improved their scores 30% or more. The score of student #880 increased from 12.28% to 57.89%, a 45.61% improvement. The score of student #688 increased from 12.28% to 42.98%, a 30.7% improvement. No students in Class B scored higher than a 60% on the posttest assessments.

**Significance of Findings**

The study yielded mixed results. The results show that both classes showed improvement. However, Class A outperformed Class B by 8.77%. Based on the mean improvement, it may be concluded that students in Class A who competed as individuals showed more improved learning than students in Class B. However, Class B improved their median percentage 1.32% more than Class A. It may also be concluded that Class B, who competed as cooperative groups, collectively showed more improved learning over Class A based on a higher increase in median percentage on posttest assessments.

Class A had two students that outperformed all of Class B both in improvement and overall percentage on the posttest (Figure 3). It may be concluded that when students compete as individuals, the higher performing students show greater improvement than the higher performing students that competed in a cooperative group.

The results showed the use of both competition and cooperative learning in competitive classrooms improved learning. Students in Class A that worked as individuals retained more of what was taught than those that worked in a cooperative group. Yet when the medians were considered, cooperative groups in Class B improved their learning slightly more than individuals in Class A.

This study showed that in competitive classrooms, there is evidence for the use of both cooperative groups and individual learning. These results could be used to support differentiation in instruction. This study showed that high achieving students will improve more when they are competing against their peers. The majority of the students will improve more when in a competitive-cooperative group. When classroom teachers are setting up competitive structures in their classrooms both individual learning and cooperative groups could be used based on the needs of the student.

# Chapter 5

## Interpretation

The results of the study showed that individuals working in a competitive classroom score slightly better or the same as students working in cooperative groups. One explanation could be that since students in Class A were responsible for all aspects of classroom projects, those students worked more closely with all aspects of the lessons. In Class B, students worked cooperatively and many times played a role in the cooperative group without having been required to engage in the lessons as intensely as members of Class A. As a result, the posttest scores of Class B were lower than those of their peers that competed individually in Class A.

When the medians were taken into account, there was a slight advantage to working as a cooperative group. The students in Class A progressed through the unit at their own ability level. When the ability level was high, scores reflected this. In Class B, the members of the cooperative groups worked at the group's pace. Lower performing students were kept at the pace of the cooperative group and possibly learned from their peers. The overall effect of this was a higher median for Class B. In a competitive class, cooperative groups appear to improve learning for the class as a whole.

In competitive classes, individual learning benefited higher performing students more than cooperative groups. They were free to move through a unit at their own pace and become as engaged as they wanted to be. In a cooperative group, a higher performing student had to consider the progress of the group.

Cooperative leaning groups improved learning over the entire class. They balanced achievement throughout the class. All students, regardless of performance level, learned from their peers. Where cooperative learning was utilized, the class showed more improvement than in the individual learning class.

**Implications**

Individual learning may not benefit every member of a class equally in competitive classrooms but it is more effective in improving learning in higher performing students. When teachers work to improve the learning of each student in a class through completion, higher performing students benefit more from working as individuals than in cooperative groups.

In competitive classroom activities, the class as a whole will improve when cooperative groups are used. Teachers should account for the majority of classroom learning t through cooperative learning teams. The shared knowledge of a cooperative group is more than the knowledge of an individual so students gain knowledge through their peers.

Students that are out competing their peers may not be meeting academic standards if the level of competition does not rise to that standard. Yet even if the competition does not rise to a standard, judgments can be made about which teaching method worked better in the context of this study. Ultimately, it is the goal of the educator to get the students to engage more, learn more, and achieve more. Competitions will create "winners" and "losers," however, competitions also have the potential to be

positive motivators. These motivators contribute to a higher achieving students going beyond the standard in order to outperform their peers. In a cooperative group, in order to "win," students must depend on the other members in order for all of the students to benefit.

**Recommendations**

This study has shown the effectiveness of both individual learning and cooperative groups in a competitive classroom. If teachers are to use competitive structures in their classes, it is recommended that teachers allow higher performing students to compete as individuals yet allow for cooperative groups for the majority of the students in the class. Classes need the flexibility to accommodate all types of learners. There are benefits to both approaches.

Teachers can use competitive structures to improve learning. Cooperative structures can be incorporated into competitive activities. Cooperation and competitions need not be rival approaches to teaching methods but can be used to complement each other. This study showed that using cooperative groups in a competitive activity improved student learning and raised the class median higher than that of a competitive class that had students working as individuals. In this way, cooperative groups in a competitive activity are more effective than individuals in the same competition.

**Future research**

Higher level students have shown increase learning in competitive environments. The trend in education is standards based learning. Higher performing students achieve

the classroom standard easily. Under the cooperative learning model, their role is to play a sort of mentor to the lower performing students through cooperative grouping. This model ignores the possibility that there are alternatives to motivate and encourage higher performing students to achieve much higher sets of standards. Competitive learning structures may provide this opportunity. Yet the research on this is thin and not nearly as supported as cooperative learning. The issue is that the competitive learning structures suffer from toward cooperative structures.

Competitive structures could potentially benefit higher achieving students. Once classroom standards have already been met, nothing more may be asked of the student. Differentiation is usually reserved for lower achieving students. Competitive learning structures, if done correctly, could fill this void. Completive learning structures are usually implemented in extracurricular activities. Examples may include spelling bees, debate clubs, forensics, and robot wars. Yet researchers have not found similar structures useful in the classroom. The bias against competitive learning structures is the assumption that one student, or group of students, must fail for other students to succeed, or win. The point that researchers have missed is that it is our role to best educate the student. The so called "losers" of the competitions can make greater learning gains because of the amount of effort the student must put in to win. Whether a student learns more, workers harder, or develops increased creative problem solving skills is and has been under researched.

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# Appendix A

Last 3 numbers of Student ID Number_____ Date_____

Pre/Post-test (circle one) Animal Biology

Part I: Multiple Choice

Directions: Circle the best response for each question. (1 point each)

1. The circulatory system consists of the following:

a) teeth, stomach, and intestines
b) lungs, nostrils, and throat
c) heart, veins, and blood
d) anus, bladder, and colon

2. An excretory system is important because:

a) it rids the body toxic products.
b) we could not breathe without it.
c) only mammals have it.
d) fish need it to swim.

3. Earthworms are hermaphrodites. This means:

a) they breathe through their skin.
b) earthworms fertilize the soil.
c) they have both female and male reproductive organs.
d) they only breed in the spring.

4. Segmented bodies allow earthworms to:

a) to expand and contract to move through soil.
b) fertilize the soil.
c) find each other in the dark.
d) to eat dead leaves.

5. The dorsal side on most animals is the animal's

a) right side
b) left side
c) front
d) back

6. The opposite of a dorsal side is the _____ side.

a) flat
b) ventral
c) phylum
d) species

7. Earthworms, like birds, do not have teeth. So, they grind their food up using_____.

a) their heads
b) a gizzard
c) a thorax
d) the nervous system

8. A little bag under the liver that contains greenish bile is called a _____.

a) large intestine
b) small intestine
c) lungs
d) gall bladder

9. A large intestine is commonly referred to as a _____.

a) colon
b) stomach
c) anus
d) liver

10. Frogs are a type of _____.

a) invertebrate
b) fish
c) amphibian
d) raptor

11. Which of the following is not in the same class as frogs

a) snake
b) worm
c) salamander
d) newt

12. On a frog, you will find the nictitating membrane on its _____.

a) eyes
b) ears
c) nose
d) mouth

13. Unlike a human heart, frog hearts only have _____ chambers.

a) two
b) three
c) four
d) five

14. A crayfish is a _____.

a) fish
b) crustacean
c) insect
d) spider

15. If a crayfish loses a leg, another one will come back. This is called_____.

a) transubstantiation
b) transmutation
c) regeneration
d) asexual reproduction

16. What organ in the human body will grow back if you cut it in half?

a) brain
b) lungs
c) kidneys
d) liver

17. Crayfish eat both plants and animals so they are _____.

a) omnivores
b) carnivores
c) herbivores
d) alphavores

18. The function of a spleen is to_____.

a) reprocesses undigested food
b) store waste
c) convert glucose to energy
d) create red blood cells

19. The _____ system is responsible for movement.

a) Muscular
b) Skeletal
c) Digestive
d) Nervous

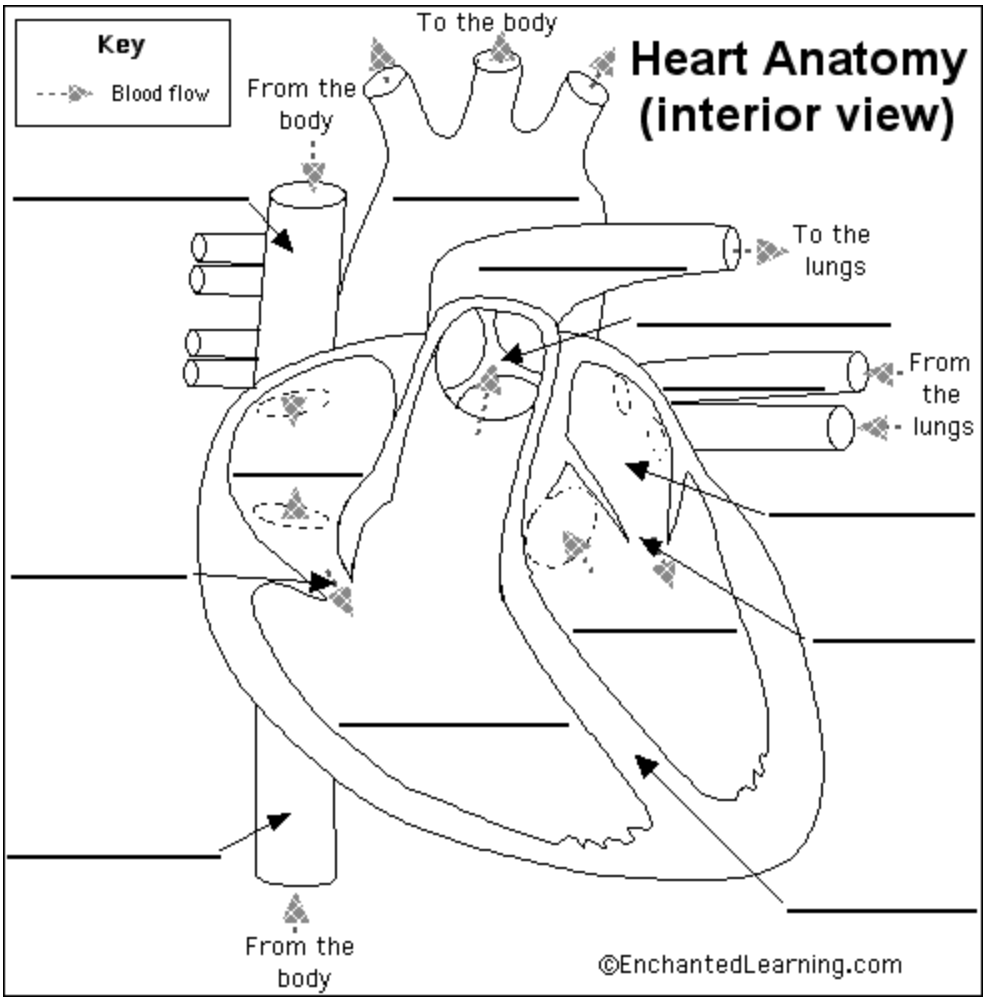
20. Which one is not a trait of a mammal?

a) Has hair
b) Warm blooded
c) Give live births
d) Are invertebrates

Part II Labeling the Heart

Label the follow diagram with the words in the box(1 point each):

| | | |
|---|---|---|
| right atrium | superior vena cava | inferior vena cava |
| right ventricle | pulmonary artery | left atrium |
| pulmonary vein | left ventricle | aorta |
| pulmonary valve | mitral valve | tricuspid valve |
| septum | | |




Part III Vocabulary

You will be given the function of each organ. Please match the correct term to that function. ***SOME ORGANS MAY BE USED MORE THAN ONCE.*** (1 point each)

| Liver | Lungs | Gall Bladder | Stomach | Large Intestine | Esophagus |
|---|---|---|---|---|---|

| 1. | Function |
|---|---|

| | |
|---|---|
| 2. | stores, mixes and digests the food that we eat |
| 3. | moves in wave-like contractions to push food into the stomach |
| 4. | Stores bile that the liver has made |
| 5. | Acts to protect us from infectious organisms we may have ingested. |
| 6. | absorb some nutrients and fluids |
| 7. | paired organs in the chest that perform respiration |
| 8. | to produce substances that break down fats, convert glucose to glycogen |
| 9. | excrete the waste in the form of stools |
| 10. | filter harmful substances from the blood (such as alcohol) |

Part IV Short Answer

Directions: Answer each question in complete sentences. (3 points each)

1. What is the difference between a cold blooded animal and a warm blooded animal?

2. Frogs are amphibians and pigs are mammals, yet each shares many of the same types of organs. Which organs do both pigs and frogs have?

3. What are three differences between mammals and amphibians?

4. What are three ways frogs are best suited to live in their environment?

5. How does an earthworm's digestive system contribute to healthy soil?

## Appendix B

# Weekly Lab Rubric

Week 1

| 0 points | 1 point | 2 points | 3 points | 4points |
|---|---|---|---|---|
| Absent or did not participate. | Lab Report and Data not complete. Reflection questions not answered Dissection was partially completed or directions were not followed. | Lab Report and Data complete. Less than 70% of reflection questions answered correctly. Directions of the dissection were partially followed in order. | Lab Report and Data complete. 70%-89% of reflection questions answered correctly. Directions of the dissection were mostly followed in order. | Lab Report and Data complete. 90% of reflection questions answered correctly. Directions of the dissection were followed in order. |

Week 2

| 0 points | 1 point | 2 points | 3 points | 4points |
|---|---|---|---|---|
| Absent or did not participate. | Lab Report and Data not complete. Reflection questions not answered Dissection was partially completed or directions were not followed. | Lab Report and Data complete. Less than 70% of reflection questions answered correctly. Directions of the dissection were partially followed in order. | Lab Report and Data complete. 70%-89% of reflection questions answered correctly. Directions of the dissection were mostly followed in order. | Lab Report and Data complete. 90% of reflection questions answered correctly. Directions of the dissection were followed in order. |

Week 3

| 0 points | 1 point | 2 points | 3 points | 4points |
|---|---|---|---|---|
| Absent or did not participate. | Lab Report and Data not complete. Reflection questions not answered Dissection was partially completed or directions were not followed. | Lab Report and Data complete. Less than 70% of reflection questions answered correctly. Directions of the dissection were partially followed in order. | Lab Report and Data complete. 70%-89% of reflection questions answered correctly. Directions of the dissection were mostly followed in order. | Lab Report and Data complete. 90% of reflection questions answered correctly. Directions of the dissection were followed in order. |

Week 4

| 0 points | 1 point | 2 points | 3 points | 4points |
|---|---|---|---|---|
| Absent or did not participate. | Lab Report and Data not complete. Reflection questions not answered Dissection was partially completed or directions were not followed. | Lab Report and Data complete. Less than 70% of reflection questions answered correctly. Directions of the dissection were partially followed in order. | Lab Report and Data complete. 70%-89% of reflection questions answered correctly. Directions of the dissection were mostly followed in order. | Lab Report and Data complete. 90% of reflection questions answered correctly. Directions of the dissection were followed in order. |