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The Effect of Cooperative Learning on Students' Achievement and Views on the Science and Technology Course

Sertel ALTUN *
Yildiz Technical University, Turkey

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Abstract

The purpose of this study is to investigate the efficiency of learning plan implementation prepared with the cooperative learning method. In particular, the study addresses the effect of cooperative learning on students' achievement and their views regarding the 'Systems in Our Body' unit of the 6th grade Science and Technology lesson. For this purpose, mixed method was used. The study is conducted in the second term of the 2013-2014 academic year, on a study group consisted of 7 girls and 13 boys, a total of 20 students of a private middle school in Istanbul. An achievement scale was utilized for the quantitative data and focus group interviews were hold for the qualitative data. While t-test was used for the quantitative findings, content analysis technique was used for the qualitative data. The result of the study indicated that CL method had a favorable effect on learning. The cooperation based learning-teaching environment provided cooperation, supported permanent learning, provided opportunities to be successful, contributed to the development of social and personal skills, but also caused worry as it requires students to be successful at all stages.

Keywords: Cooperative learning, science and technology, achievement, student view.

Introduction

In the era what we call information society, one of the most important skills is cooperation. In early days, studying with someone else was defined as an indicator of dependency, but today learning together and asking for help is considered among the best strategies for learning to learn (Chen, 2002). Producing information, theorizing or developing models in a field requires more complicated information and skills. Therefore, common mind is better than the single best mind. The common mind is more effective for the mentioned novelties or, in other words, in creating acceptable change in society. All the systems from health to economics, law to education, information industry to the service industry consider cooperative working among priorities in order to keep up with the times and make a difference in the society. The output of the education system provides the labor force input for other systems. For this reason, the efficiency and

* Sertel ALTUN, Yildiz Technical University, Faculty of Education, sertelaltun@gmail.com

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productivity of the education system is proportional to its ability to raise the desired labor force for other systems. Under these circumstances, cooperative working habit should be brought in to students at all levels of education systems (Slavin, 1987; Johnson & Johnson, 1999).

Cooperative learning cannot be taught through verbal instruction. Students can adopt cooperative learning through a process that involves working together in groups, developing a product at the end and examining both the product and cooperative learning skills. "Cooperative learning" (CL) method emerges in the literature as a method that assists instructors in carrying out this process. CL emerges when students gather in order to reach a common goal (Johnson & Johnson, 1999). Each member of the group reaches his goal only if all the other members reach their own learning goals (Deutsch, 1962). Acikgoz (2002) defines cooperative learning as working of students in small groups and helping each other in the learning process.

There are certain principles and requirements for the implementation of CL. These are;

- Positive Interdependence: Each individual depends on the other members of the group. Each individual complements others.
- Individual Accountability: Individual accountability is the evaluation of each individual's performance and effect of the result on individual and group success.
- Face to face interaction: Group members reach success by helping each other and sharing ideas. As face to face interaction increases in this process, the sense of responsibility and social solidarity increases.
- Social Skills: As the students are in a group in the cooperative learning, they acquire social skills better.
- Evaluation of the Group Processing: At the end of the group work, students gather and discuss the productivity of the project and whether they have reached the goals (Johnson & Johnson, 1999; Johnson, Johnson & Smith, 1998).

What makes CL strong in the literature is its strong theoretical foundation. The method is based on Bandura's Social Dependency Theory, Behavioral Learning Theory (Johnson, Johnson & Smith, 1998) and Vygotsky's (1978) "Zone of Proximal Development" theory. Social Dependency Theory assumes that the way to form social dependency is about how social dependency develops, how individual interacts and what the result will be as a result of the interaction. Accordingly, positive interdependence (cooperative approach) results in such an interaction that the group members encourage, support and improve the efforts of the individuals. Behavioral Learning Theory focuses on the effect of group consolidation and rewards on learning. According to this theory, behaviors, which are rewarded externally, are repeated. While, Skinner (1985), one of the representatives of behavioral cult, focuses on the group coincidences, Bandura focuses on the imitation. Slavin (1987) has recently stated that external "group awards" are needed in order to motivate the individuals to learn in groups based on cooperative learning (Saban, 2005). According to the Vygotsky's Zone of Proximal Development Theory, a student can take his/her learning to the optimum level by asking for help when he/she is stuck. The person to whom he asks for help may be his/her teacher or friend.

It has been found out that CL has important effects on improving academic success of students (Hall, 1988; Tarim, 2003; Kolawole, 2007; Gok. Dogan, Doymus & Karacop, 2009; Ahmad & Mahmood, 2010, Capar, 2011; Parveen & Batool, 2012), developing desirable attitudes toward courses (Yavuz, 2007), providing motivation (Nichols & Miller, 1994; Margolis & McCabe, 2003; Salili & Lai, 2003; Kus, Filiz & Altun, 2014; Yoshida, Tani,

Uchida, Masui & Nakayama, 2014;), adopting cooperative working habit (Rienties, Tempelaar, Bossche, Gijselaers & Segers, 2009), and improving favorable competition skills (Kong, Kwok & Fang, 2012) in studies from different fields.

Although there are many techniques in CL, Jigsaw and Team Game Tournament (TGT) techniques were used in this study. Jigsaw technique was developed by Aronson (2000). Students are divided into groups of 5-6 members in this technique. Each member works on his subject and students from different groups working on the same subject gather and create expert groups. The subject is discussed in depth in the expert groups. Students learn the subject completely in the expert groups and teach their subject to other students when they return to their original groups. Even if the students are graded individually, students need others for a good mark and therefore this technique requires cooperative working (Slavin, 1987; Arends, 1998; Aronson, 2000; Senemoglu, 2012). TGT technique was developed by Slavin and Oickle (1981). After the teacher or students make the presentation related to the courses, students are divided into heterogeneous groups in this technique. After the students teach the subject to each other, students compete with the students at the same level from other groups at the tournament table. The team points are calculated by summing the points of students. The groups with high points are rewarded (Slavin, 1995; Arends, 1998).

It is stated that individuals have benefited from Science and Technology instruction in using these scientific process and principles for decision-making and in participating in scientific discussions affecting the society and developing their skills to producing ideas on a subject (Akcay & Yager, 2010). According to another approach, Science and Technology instruction is an easy and tangible instruction that should be conducted with proper method and techniques by taking the interests, needs, level of development, desires and environmental facilities of students (Hancer, Sensoy & Yildirim, 2003). As can be understood from the explanations, for an effective Science and Technology instruction, students' sense of curiosity should be enhanced and an active environment in which students can discover and produce information should be created. The complicated structure of the Science and Technology course requires cooperation for students to learn the subjects (Yagcı, Kaptı & Beyaztas, 2012). Moreover, implementation of cooperative learning method in the Science and Technology classes is advised by the Ministry of National Education (Ministry of National Education, 2005).

It is thought that the use of a learning plan prepared in line with CL in the Science and Technology instruction provides students with more efficient thinking and problem-solving skills and cooperative working habit, develops students cooperation skills, enables them to present more extensive studies by making use of their shared experiences and supports long-lasting learning by supporting peer learning. For this reason, the efficiency of CL implementation in teaching "Systems in our Body" unit is evaluated in this study.

In this context, the purpose of the study is to determine the effects of teaching "Systems in Our Body" unit of Science and Technology course through CL method on students' achievement and their view regarding the course. The research questions are:

1- Is there a significant difference between the pre-test and post-test scores of students who studied the systems in our body unit of Science and Technology course based on cooperative learning method?
2- How do students' views on the systems in our body unit of Science and Technology course change through the cooperative learning method?

Method

Research Design

In this study, explanatory design, which is one of the mixed method designs, was used where qualitative and quantitative methods were gathered. The purpose of this two stage design is to support, explain, or exemplify data collected through quantitative and qualitative methods (Creswell, 2012). As for this study, in order to determine the effect of CL method on students' achievement, pre and post-tests before and after the implementation of cooperative learning in the course were applied. Then in order to support and explain the findings of the tests, focus group interviews were conducted so as to clarify the effect of CL method in this course from the students' points of view.

The following steps were followed for the study:

- Before the application of the learning plan, the researcher got demographical information about the students and made observations in the classroom. The researcher attempted to receive information related to the teaching practices of the instructor within the scope of Science and Technology course.
- The learning plan which was prepared by the researcher was examined by the instructor. Unclear parts were revised by taking the opinions of the instructor into consideration. This way, the plan was reconsidered and finalized by both the instructor of the course and the researcher.
- Students were informed about the practice.
- The achievement test prepared within the scope of the study was applied as a pre-test to the students.
- The practice took four weeks (16 class hours). The researcher evaluated the implemented program's suitability with the principles of teaching design by making observations during the implementation process. The lessons were not taught by the researcher, it was taught by the Science and Technology instructor of the school where the study was conducted. The instructor and the researcher held reflection meetings during the implementation process, in which the failing or unclear points were determined and the next class hour proceeded accordingly.
- At the end of the practice, the achievement test was applied as a post-test to the students and focus group interviews were carried out with 10 volunteers.

Participants

The research was carried out in a private school situated in Kartal district of İstanbul. The instructor of Science and Technology course applied CL method to the 6th grade students. The researcher took on the observer role in the study. The students were 20 in total, as 7 girls and 13 boys. The mean age of students was 12.

Data Collection Tools and Data Collection

In order to define the problem in detail and present possible solutions, quantitative data was collected from the achievement test and qualitative data was collected from the focus group interviews by taking the research question into consideration.

Achievement Test. The achievement test associated with the "Systems in our Body" unit was developed in order to collect quantitative data. The following method was followed while developing the achievement test: Firstly, a table of specifications was prepared and 50 test points was written in this context in order to determine the gains and topics that the achievement test measures. As the content validity of the test is mostly based on the expert opinions (Baykul, 2000), expert opinions were used to determine the extent and face validity of the assessment instrument. The table of specifications and the test were

given to the three Science and Technology instructors who were working at the secondary school and completed five years in their careers. Three Turkish instructors were consulted in order to determine whether the points were clear or not and whether there were any grammatical mistakes. Moreover, expert opinion was taken in terms of methodological suitability of the points. In this context, four academicians working at the department of Curriculum and Instruction, and Science Education of the Faculty of Education were consulted. In line with the expert opinions, a pilot form was prepared by excluding 10 points which were either not clear or did not have the capacity to test the expected competency. The pilot form consisting of 40 points was applied to 16 boys and 18 girls, a total of 34, 7th grade students studying at a secondary school at the Besiktas district of İstanbul province as part of the pilot study. The reason of practicing the pilot study on 7th grade was to have the students who had already learned the subject. Item and test analysis of the collected data were conducted, item discrimination index, item difficulty index and average difficulty of the test values were checked (Baykul, 2000). As a result of the analysis, 10 points whose item discrimination value was below 0.30 were removed from the test. By considering the allocation of points to the sub-learning fields, 5 points whose item discrimination index were between 0.30 and 0.58 were removed from the test. Thus, 25 item remained in the final form of the test. Average difficulty of the test was determined as 0.45 by the item difficulty test. As can be seen, the test has medium level of difficulty. Buyukozturk (2004) states that reliability is associated with how accurate the assessment instrument assesses the desired feature. The reliability of a test is determined by the correlation coefficient, which explains the degree of association between the real and observed points acquired from a scale. As a result of the analyses, KR-20 reliability coefficient of the scale consisting of 25 items was calculated to be 0.76. This value is at an acceptable level according to Linn and Gronlund (2005).

Focus group interview. Focus group interview was used in order to collect qualitative data for the study. Focus group interview is an unstructured meeting between a small group and a leader and using the effect of group dynamic in the planned discussion to collecting detailed information and produce ideas (Bowling, 2002). Interview questions were evaluated by one field expert and two experts from the Curriculum and Instruction department for validity and reliability. Validity of the interview questions were held in the following way: First, I determined the interview questions based on the cooperative learning principles asserted by Johnson and Johnson (1999). Then, these interview questions were examined by two experts in Curriculum and Instruction Department. The final version of the questions was constructed by taking the expert's opinions into account. Then, student volunteers were selected. As a result, 10 students were taken to the interview. For the reliability of the interviewing process, I interviewed the same focus group twice at different times. In both sessions, students were interviewed equally with the same questions. The main questions asked were: "What are the advantages of CL method?"; "What skills did you acquire through CL method?", "What are disadvantages of the method?" The first focus group interview took 90 minutes and the other one a week later took 60 minutes. The researcher and reporter took notes in the data collection process. Moreover, all the interviews were recorded. Later, all recordings were transcribed verbatim.

Process

Prior to the determination of the unit of research, both the researcher and the instructor of the course worked on the aforementioned principles of the CL method. Then, they both decided that the systems in our body unit would be appropriate to use CL method. Following, the general purpose of the learning plan was determined as " Students' comprehending the functions of support and movement, circulatory, respiratory,

lymphatic and immune systems in the body, the health of these systems and the effects of technological developments on treating the health problems related to these systems" by taking the National Curriculum for Science and Technology course.

Planning: While determining the content, the main concepts and rules related to the topics were determined in line with the teaching guidelines principle of CL. Jigsaw and tournament techniques of CL were used in teaching these main concepts and rules.

Warm-up: Students were divided into four heterogeneous (according to the gender and success levels) groups consisting of five students at this stage. In order to ensure group dynamics of students, the first two classes were dedicated to warm-up activities. Warm-up involves a problem which should be solved by the groups. Groups have to be in contact and develop strategies in order to solve the problem. At this stage, students' ways of communication, motivations, group dynamics and strategy development were noted by observer. When all groups finished working, self-evaluations of students were taken and the instructor gave feedback. In this process, the aim was to let students realize the important points related to the team awareness.

Teaching of the Lesson: The next stage is the teaching of the subject. Firstly, the jigsaw technique of the CL method was applied. Each member of the group was given one of the following subjects: "support and movement system", "circulatory system", "respiratory system", "lymphatic system" and "immune system". Firstly, each member of the group was given an individual worksheet during the class. Basic information, classifications, examples and tasks of the given system were included on the work sheet. Students worked individually for two classes. Later, the question based worksheet prepared by the researcher was filled by the students. At the next stage, students with the same subjects from different groups gathered and started expert group study. For example, all students who had the "circulatory system" subject gathered. Students shared the question based worksheet which they answered among each other and created a common answer sheet. Then, the instructor gave the expert group another worksheet with advanced information on the subject. The content of the mentioned worksheet consisted of relationship of the subject with other systems and its function in terms of body health. The mentioned stage lasted for two class hours. Then, students returned to their groups and each of them told what they learnt about their subjects to their friends. Then, groups came together and prepared poster and presentation work on all the subjects. This stage took four class hours. Then, groups made their presentations in order in two class hours. The instructor took self-evaluation from the group members and expressed his observations. Then, the instructor explained the "lymphatic and immune system" subject which was not completely understood by the students with the help of a computer presentation program. The tournament technique which was already explained to the students took place in the last two hours. In this process, 4 tables were formed in the classroom and one student from each group went to the tables to represent their groups. The instructor asked each student a different question related to the subject and the student who knew the answer earned the points for his/her group. Then, another student from his/her group came. The student from the other group had to stay at the table until he/she knows the answer. The team which completed the tournament first (the team all members of which came to the table and knew the answers) became the first. They were rewarded with pizza which was bought by the money collected from other groups.

Evaluation: Written or verbal reflection of the students on their own learning process and the teaching process at the end of each class were taken and evaluated for the evaluation aspect of the learning plan. The feedback of the students was evaluated, the next class plans were revised by the instructor and the researcher and necessary changes were made. At the same time, while students were working in their groups, they were

observed and directed by the instructor. The worksheets of students were collected by the instructor at the end of the class and given back to the students at the next class after the necessary revisions were conducted. In addition to the worksheets, the products produced by the students were evaluated in terms of whether they reached the expected goals. Throughout the process, as Johnson and Johnson (1999) and Johnson, Johnson and Smith (1998) recommend, each student evaluated himself and each other through verbal expressions and daily written reflections in the cooperative skill development, presentation, and tournament activities and the instructor evaluated the students, as well.

Data Analysis

T-test was conducted for the participant students to compare the points obtained from pre-test and post-test, and SPSS 16.00 program was utilized for the analysis of data.

The qualitative data acquired from the focus group discussions was interpreted through content analysis. The process of content analysis consists of the classification of data acquired from the interviews and determining main concepts and codes (Creswell, 2012). In this regard, transcripts of each of the student's answers to the relevant questions were read line by line by the researcher. The classification of the students' relevant answers was done by taking CL principles into consideration as Slavin (1987) and Johnson and Johnson (1999) recommended. Then, the themes were created by clustering the most repeated expressions together. Then, the codes representing the themes were determined. In the analysis process, one field expert and two experts from the Curriculum and Instruction department were asked to challenge the plausibility of the themes and the codes in regards to the data (see Table 2).

Results

Results Related to the First Question of Research

The first question of the research is "Is there a significant difference between the pre-test and post-test scores of students who studied the systems in our body unit of Science and Technology course based on cooperative learning method?" The results of t-test which was conducted in relevant groups to determine whether there is a significant difference between pre-test and post-test success grades are given in Table1.

Table 1. *T-test results of pre-test and post-test*

Gender	*N*	*M*	*sd*	*t*	*p*	*d*
Pre-test	20	52.40	14.38	7.50	.00**	1.68
Post-test	20	76.20	9.83			

** p<.01

When Table 1 is examined, the average pre-test achievement of is found to be 52.40 and the average post-test success is found to be 76.20. As the p value is lower than .01 which determine the significance level, the difference between the pre-test and post-test is statistically in favor of the post-test (t=7.50; p<.01). The effect value is determined with the Cohen d and it is found as 1.68. This value notes that the effect value is high as it is greater than 0.80 (Stevens, 1996: 174). Therefore, it can be said that CL had a favorable effect on students' achievement in the Science and Technology class.

Results Related to the Second Question of Research

The second question of the research is "How do students' views on the systems in our body unit of Science and Technology course change through the cooperative learning method? ". Six themes were established, namely "formation of cooperative environment", "creation of success opportunities", "supporting permanent learning", "developing a sense of responsibility ", "emergence of different skills", "necessity to be successful" as a result of the data content analysis acquired from the focus group interviews with students. The following code indicates which citation belongs to which student: The students are coded as first student (S1), second student (S2), third student (S3), fourth student (S4), fifth student (S5), sixth student (S6), seventh student (S7), eighth student (S8), ninth student (S9) and tenth student (S10). "Themes, codes and definition of codes" acquired from the student views are given in Table 2. The data is presented in detail.

Table 2. "Themes, codes and definition of codes" extracted from student views

Questions	Themes	Codes	Definition of Codes
What are the advantages of cooperative learning method in the teaching process?	*Formation of Cooperative Environment*	Interaction	Students have to work together in order to produce a product and be successful in the tournament
		Unity of Purpose	Everybody should work for a common purpose
		Peer contribution	All members of the group have to be successful for a group to be successful. Group members should help each other learn in order to make up for deficiencies

Table 2. (cont.) "Themes, codes and definition of codes" extracted from student views

Questions	Themes	Codes	Definition of Codes
What are the advantages of cooperative learning method in the teaching process?	*Creation of Success Opportunity*	Multitude of opportunities	There is no need to be successful only in the exams to be considered successful. Providing success opportunities in information transfer, presentation and tournament
		Favorable effect of the group on the individual	In order to be successful, the team is required to be successful. Even if an individual is not successful, the team members should support him for the team success
	Supporting Permanent Learning	Activeness	The student should be kept active in this process
		Repetition opportunity	Teams have the opportunity to repeat the same subjects in different forms and activities
		Peer learning	Students have the opportunity to learn from each other

Table 2. (cont.) "Themes, codes and definition of codes" extracted from student views

Questions	Themes	Codes	Definition of Codes
Which of your skills developed through the cooperative learning method in the teaching process?	*Developing a Sense of Responsibility*	Individual role	Giving each member a role from the beginning to the end and raising a sense of responsibility by expressing that if a member does not fulfill their role, the group will be affected unfavorably
		Team success	The student's inclination to fulfill his responsibility in a timely manner in order not to pose a problem to the team
	Presenting Different Skills	Leadership	Motivating team, use of expected skills at maximum level and coming to the front of the group leaders for crisis management
		Teaching	The emergence of students' teaching skills especially in the expert group studies and group sharing
		Presentation	Ensuring group success through effective presentation
What are the disadvantaged of the CL method?	*Necessity to be Successful*	Tournament	Because the team members do the teaching, the other team members' learning depends on the effectiveness of the teaching
		Expression	The questions in the tournament is directed to the individuals rather than the team. Thus, even if one of the team members is not good at answering the questions, the team can not win the tournament

The advantages of the cooperative learning method in the learning-teaching process:

Formation of Cooperative Environment: The students emphasized that the cooperation was very important in the cooperative learning environment during the lectures, presentations, and tournament. The students expressed that they had been in touch with the same students, but they had not even cooperated with their friends in previous classes. Hence, in this method, they had the opportunity to be in touch with different friends and learnt how to study cooperatively. In addition, students emphasized that in order to be more successful than other teams, they motivated their weak friends and corrected their deficiencies while getting ready for the tournament for the team success as all members were required to be successful. Moreover, students said that there was a common purpose in this process and the success of team members affected the team success. Therefore everybody had to work cooperatively to be successful. The student views in accordance with relevant codes are given below:

> "...In the past, I did not have any contact except saying hello to two members of my group. However, now I can say that I have had more opportunities with these two friends for

> cooperation than my close friends. Moreover, helping these two friends and asking for help from them made me feel happy." (S1, interaction)
>
> "…. I was not ready enough for the tournament. But, my group members helped me and I gained points for my group by answering the questions in the tournament. However, if I were alone in the tournament and my friends did not help me, I would not be successful." (S4, peer contribution and unity of purpose)
>
> "....In order to be successful in presentation and tournament, we always asked questions to each other. We even asked questions to each other on phone and Facebook." (S7, interaction and unity of purpose)

Creation of a Success Opportunity: Students stated that as they were expected to be successful in different fields in this process, everybody had the opportunity to present themselves in line with their own skills. In addition, students emphasized that they had the opportunity to express themselves in different fields according to their own interests and skills. Also, they stated that there was not just one criterion for success, where different criteria existed for success in this approach and this created a fairer environment. It thus helped students to feel better. Moreover, the students expressed they realized that it was not enough to know the information to be successful; conveying the information properly, motivating friends, and working cooperatively were also important. The views in accordance with relevant codes are given below:

> "...As there were different activities, all of us had the chance to be successful according to our skills. For example, S4 was excited in the presentation but he was very successful in the tournament." (S1, multitude of opportunities)
>
> "....I saw that my friends were successful in different fields. We saw that those who were generally better in the exams were less successful in the tournament and those who were worse in the exams were more successful in the tournament. It made me feel happy to see that everybody could be successful at any time." (S5, multitude of opportunities)
>
> "...I could not join the second class as I was ill. My group friends helped me study in order to be successful in the tournament." (S10, favorable effect of the team on individual).
>
> "....There were different activities to present ourselves in this class. For example, one of the group members was conveying information very well, another was preparing very good posters, another was snappy in the tournament, and all of them were successful." (S9, multitude of opportunities)

Supporting Permanent Learning: Students expressed that they had the opportunity to learn the subject from their friends in addition to the instructor and this situation had a favorable effect on learning the subject. Students emphasized that learning subjects from their friends were much easier. Moreover, they mentioned that they had the opportunity to recap the subject a few times in the same process. Hence, as the students had the opportunity to study the subject on their own, teach it to their friends, present it and use it in the tournament, permanent learning was ensured. The views in accordance with relevant codes are given below:

> " .... I studied this subject in the fifth grade but I did not learn it. My friend illustrated the subject so well that I understood it better. Moreover, I understood the related subjects better." (S3, peer learning)
>
> "...We had the opportunity to learn the subject more permanently as we recapped the subject over and over again in different activities." (S2, repetition)
>
> "...We were active at all stages of the class. We studied the subject, told it to our friends, prepared a presentation and competed. We learnt the subject because we were active." (S7, activeness)
>
> "...Learning from the instructor sometimes makes the subject more difficult. On the other hand learning from a friend is much easier." (S4, peer learning)

Information and skills adopted through the cooperative learning method in the learning-teaching process:

Developing a Sense of Responsibility: Students emphasized that their responsibilities were clearer compared to the previous classes. They expressed that responsibilities of each student was clear at all stages of the process, and as the success of members affected the team success, team members become a pressure point in fulfilling the individual responsibilities. Furthermore, students expressed that they were more careful in fulfilling their responsibilities in order not to be isolated from the group. The views in accordance with relevant codes are given below:

> "...We all had roles from beginning to the end. The instructor was always reminding us our responsibilities. We were required to fulfill our responsibilities in order to understand the subject, be successful in the presentation and the tournament." (S10, individual role and team success)
>
> "...Everybody had a role. I fulfilled my responsibility in order not to be ashamed as it was clear who did not fulfill his responsibility." (S9, individual role)
>
> "...Not only our teachers but also our friends got angry with us when we did not fulfill our responsibilities." (S1, team success)

Presenting Different Skills: Students explained that there were different activities in this process and different skills were required in order to be successful. They expressed that leadership skills were important in terms of managing the team, motivating friends, and solving problems. Students stated that different ones came to the frontline in this practice. While, certain students were at the front earlier, not only those who got higher grades but also others came to the front with this practice. Students mentioned that expressive skills, poster preparation skills, and presentation skills were very important in order to be successful in groups. The views in accordance with relevant codes are given below:

> "..The most important factor in becoming a successful group was our group leader. He motivated us, directed our friend who did not fulfill his responsibilities and most importantly he made us believe that we were going to be successful. The groups without a leader were not successful." (S3, leadership)

"...Earlier, the same persons always got the reward in the class. Those who got higher grades in the exams were favorites of the class. However, we saw in this practice that those who were leaders and motivated us had important skills and they were important for our success. The best thing was that these students were different." (S6, leadership)

" ...My ideas about Ö2 changed. I was thinking that he was very passive in the classroom. The illustrations and examples he used while telling about the subject impressed me. He was explained the subject very well." (S7, teaching)

"...I explain the subject to myself very well at home, but when the teacher asks me I get excited. In this practice, explaining the subject in the group did not make me excited. My friends like how I talk. This study increased my motivation." (S2, teaching)

"...We would not be successful if we could not present it well, no matter how well prepared we were. Everyone like the presentation of the second group because their presentation skills were very good. They talked just like anchorpeople. They did not get excited, they gave examples, let us speak and they were smiling." (S8, presentation)

The disadvantages of the cooperative learning method in the learning-teaching process:

Necessity to be Successful: Students expressed that in order for this practice to be productive, all students should be successful and the subject should not be very difficult. They stated that in order to be successful, students should master the subject and have good communication among them. It was found out that even one unsuccessful student affected the team success and this situation could create unfavorable pressure on the student. Additionally, students mentioned that no matter how well the students knew the subject, insufficient communication skills affected the team success. On the other hand, students emphasized that they worried a lot about being successful in order not to be isolated from the group and face others' negative attitude. The views in accordance with relevant codes are given below:

"…This practice is nice but we all have to be successful in the group. If one of us is not successful in the tournament, the team is not successful." (S4, tournament)

"...I would like successful students to be in my group in this practice. Even if I were successful, I would be considered unsuccessful if other students in my group were not successful." (S3, expression)

"...I saw that more relaxed groups were more successful in the presentation and tournament. Being relaxed and having good communication skills are as important as studying." (S6, expression)

"...I studied hard in order not to be unsuccessful in the tournament. But I could not answer the question, because I was excited. My group got angry with me. Yet, if I were unsuccessful in an exam, nobody would get angry with me." (S8, tournament)

"...I do not think that this is a good way to teach difficult subjects. Because, we cannot tell it as well as our instructor. We should use this practice in easy subjects." (S7, expression)

Conclusion

In this study in which CL method was used in the teaching of "Systems in our Body" unit of Science and Technology course, it was found out that CL method had a favorable effect on making the relevant gains. The cooperation based learning-teaching environment of the study provided cooperative learning environment, supported permanent learning, provided opportunities to be successful, contributed to the development of social and personal skills, but caused students to worry as it requires students to be successful at all stages.

Discussion

Based on the achievement test applied within the practice and the student views, it is seen that cooperative learning had a favorable effect on learning of students. The reasons behind this situation can be explained in two ways. First, CL strategies are based on repetition to support permanent learning. Students had the opportunity to recap the subject at different stages in the CL process. In the individual studying, they attempted to learn the subject themselves, then discussed the subject with their friends in depth and recapped the subject in order to present it. Finally, their studies to be successful in the tournament and their performances and learning process in the tournament could have contributed to their understanding of the subject. The second factor is Vygotsky's "Zone of Proximal Development" construct. Vygotsky's "ZPD" concept refers to the distance between the current development level of independent problem solving skills and the potential development level of problem solving skills with cooperation with a more skillful peer or under the supervision of an adult (Vygotsky, 1978). CL process supports peer learning. All individuals have to be successful in order for the group success. Therefore, students corrected other team members' deficiencies. The relevant studies support this finding (Hall, 1988; Slavin, 1995; Kolawole, 2007; Gok, Dogan, Doymus and Karacop, 2009; Ahmad and Mahmood, 2010, Parveen and Batool, 2012).

Another finding obtained from the participants is that CL environment creates a cooperative working environment. Cooperative learning involves working together for a common purpose and creates a rich teaching-learning environment in terms of student interaction (Arends, 1998). Students emphasized that "the difference of this practice from the teacher-centered processes is that studying together is more important to be successful rather than studying alone". Granier, Dyson and Yeaton (2005) stated in their relevant study that CL is the method which provides interaction among students at the maximum level. Studies of Rienties, Tempelaar, Bossche, Gijselaers and Segers, (2009) supports this finding.

Students mentioned that one of the most important advantages of the CL is that there are many opportunities to be successful. While the success indicator is grades in the traditional learning environment, there are many success indicators in the CL environment and this situation relaxed the students from an affective point of view. One of the students stated that "there were different activities to present ourselves in this class. For example, one of the group members was conveying the information very well, another was preparing very good posters, another was snappy in the tournament, and all of them were successful (S9)". It was observed that some students were successful in presentation, some were good at poster preparation and some were good at the tournament. Students have the opportunities to be successful according to their interests and skills in this environment. Senemoglu (2012) states that as CL requires contributions of each individual at different stages, it helps students to develop a sense of self-esteem and self-efficacy.

Another finding obtained from the participants is that CL environment contributes to the emergence and development of students' social and affective skills. Students stated

that "our friends who were passive before came to the front with leadership, teaching and presentation skills in this practice (S7, S9)". The root cause of this situation can be explained as follows: In order to be successful in the teacher-centered environments, students have to listen to the teacher carefully and study hard. However, in order to be successful in this practice, students have to study the subject, have good teaching skills in order to correct others' deficiencies and have good presentation skills to present the product of the group in a desirable way and think fast and control their excitement in order to be successful in the tournament. In other words, different skills come to the front. Statements from students such as "I learned different sides of my friends in this process (S7)" and "Generally my grades were high but I understood in this practice that I had to develop my problem-solving, presentation and communication skills (S8)" indicate that they both explored different sides of their friends and discovered their own deficiencies. In a relevant study, it was found out that CL is much more effective in eliminating the prejudices among students and increasing the student success than all traditional classroom teachings (Gage and Berliner, 1998).

In the study, the disadvantage of the practice was found out to be the requirement to be successful for all group members. This situation is stated in two ways. First one is the anxiety of less successful students due to the group pressure. "I studied hard in order not to be unsuccessful in the tournament. But I could not answer the question twice, because I was excited. My group got angry with me. Yet, if I were unsuccessful in an exam, nobody would get angry with me (S9). The other kind of anxiety is the anxiety of successful students to be unsuccessful because of the less successful members of the group. "I would like successful students to be in my group. Even if I were successful, I would become unsuccessful if they were not successful (S7)" Both of these reasons caused students to have unfavorable feelings. These results might be due to the characteristics of the study group. The mentioned group consists of students who got into the private school through scholarship exams with high academic success and their teachers and parents consider academic success among priorities. Therefore, students are inclined to eliminate the unfavorable factors affecting their success. Hence, the success of the students in this process was appreciated and in case of not being successful they stated that they were faced with isolation in the group and were scolded. Moreover, in order not to be isolated from the group and face with negative attitudes, they studied hard and saw these factors as favorable pressure items: "Not only our instructor but also our friends got angry with us" . This also created anxiety in case of not being successful: "I wanted to be successful in order not to be excluded from the group and being scolded. Especially, I studied hard in order not to be unsuccessful in the tournament but my anxiety was very high (S2)".

Recommendations

The field of education may benefit from the findings of the study in various ways. Although this study is limited by only using data from one 6th grade class, the results showed that CL method creates a favorable effect on achieving social and affective skills. This suggests that CL method can be used in Science and Technology classes. In particular, the effects of CL on different units of Science and Technology classes can be investigated, and the results of this study and following studies can be compared with the effects of CL in other disciplines., Also, in order to make instructors use the method effectively, it could be integrated into both pre-service education programs and professional development workshops for in-service teachers. In addition, teacher educators could model this method in such programs. In such an integration, one issue should be taken cautiously: Possible conflicts within and between groups, which are noted in the results of this study, could require the instructors make good observations and be a guide in preventing and solving intragroup conflicts.

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