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The Effects of Science Teaching Through Team Game Tournament Technique on Success Level and Affective Characteristics of Students

Mansur HARMANDAR[1], Emine ÇİL[2]

[1]Prof. Dr., Muğla University, Science Literature of Faculty, Departmant of Chemistry, Muğla, TURKEY
[2]Postgraduate Student, Karadeniz Technical Univ., Fatih Edu. of Fac., Dept. of Primary Sci. Edu., Trabzon.

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ABSTRACT

The purpose of this study is to investigate the effects of teaching a unit "Reproduction and Growth in Living Things" from the science curriculum of 8th graders by using Team Game Tournament (TGT) technique on the achievement and affective characteristics of the students. In order to determine the effects of TOT technique on achievement, quantitative research approach was used and to determine its effects on the affective characteristics, qualitative research approach was used. In the quantitative part of the study, quasi-experimental design was used. Teaching was performed through TOT technique in the experimental group and through lecturing in the control group. In the collection of the quantitative data, a test consisting of 25 multiple-choice questions concerning the unit cited above was used as pre-test and post-test. The data obtained were analyzed through SPSS 11.0 statistical package program. In the qualitative part of the study, documentation method was used. The data required to determine the effects of TOT technique on the affective characteristics of the students were collected by means of students' compositions. In the analysis of the quantitative data, content analysis and descriptive analysis were used. As a result of the data analyses, it was concluded that TOT technique is more effective on increasing the students' achievement than the lecture type of teaching. Moreover, when the students' opinions about supportive learning, peer relations, satisfaction in the classroom, effective learning, and preference for the current teaching method over others were examined, it was found that the students in the experimental group expressed more positive opinions about the effects of the teaching method used in their group on their affective characteristics than the control students.

Keywords: Co-operative Learning Method, Team Game Tournament Technique, Science Teaching, Reproduction and Growth in Living Things, Learning, Affective Characteristics.

INTRODUCTION

It is known that the innovations and inventions in applied sciences both have important contributions to the development of countries and lay the basis for scientific and technological advancements. This results in countries' attaching more importance to applied sciences and their teaching at schools. For this purpose, countries attempt to improve science-teaching programs, enhance the qualifications of teachers, and equip the

classrooms with required tools and instruments (Ayas, Çepni & Akdeniz, 1993; Özmen, 2004).

In today's information age, one of the main objectives of the educational systems should be to equip students with the means of having access to information rather than transferring already existing information to students. If the person who is the subject of teaching can process the information gained from external sources via observation, experience, and synthesize it, this information becomes meaningful (Yeşilyurt, 2004). If science is taught through scientific processes, students gain processing skills and use these skills in their daily lives. Moreover, students develop more positive attitudes towards science and their creative skills improve. Science courses are of great importance in educating individuals who have the skills of thinking, evaluating, creating, and opportunities to have access to information (Kaptan & Korkmaz, 2001). Besides teaching subjects to students and helping them to retrain what they have been taught, it is of great importance to develop students' social skills such as working in teams, improving positive relations with peers, sharing, taking responsibility, creating common products. On of the approaches to do this is Cooperative Learning Method.

According to Demirel (1999), Cooperative learning method is a kind of approach where students form small groups for the purpose of solving a problem or achieving a task by working in cooperation. The feature that makes the group works a type of cooperative learning is students' trying to stretch both their own capacities and their friends' capacities to the highest limit. This is something different from each student's completely learning what is taught. During group work, students find opportunities to live very important learning experiences such as asking questions, making explanations, criticizing, giving examples that cannot be done individually (Açıkgöz, 2003). One of the techniques where Cooperative Learning Method is most frequently applied is Team Game Tournament (TGT) technique. In TGT technique developed by De Vires ve Slavin (1980), students are divided into heterogenic groups in a balanced way according to their abilities and genders. The purpose of establishing heterogenic group is to form groups with students of varying levels of success, interest, ability and so on. Forming heterogenic groups makes it possible for the groups established in the classroom to be heterogenic in general. In this way, in tournament games, the groups with similar capacities can compete with each others. The target of each group is to be successful in the tournament. The target is presented to the group members by the teacher and the teacher provides them with the suitable materials according to their status in the group. The students come together after collecting all the available books and resources concerning the topic to be learned. By working together and assessing each other they get ready for the tournament (Demirel, 1999). Cooperative learning was especially came under focus in 1970s. This method has been investigated in different field and at different stages of education. The studies looking at cooperative learning make comparisons between cooperative learning method and other learning methods or comparisons among different cooperative learning techniques. Majority of the studies have dealt with the effects of this method on student achievement and retention level. In a study that Stevens, Slavin & Famish (1991) carried out to determine the effects of cooperative learning and direct teaching on reading, internalizing, detection of the main idea, supporting students' learning, it was found that the experimental group where cooperative learning was used was more successful in finding the main idea of the text than the control group.

Bilgin & Akbayır (2002) investigated the effects of cooperative learning method and traditional learning methods on academic achievement and retention concerning "Sets and Series" unit in mathematics course. When they analyzed the data, they found that the students in the control group were more successful than those in the experimental group in

the achievement test. Yet, similar positive results can not be obtained for the retention level.

Students may develop negative attitudes towards science courses due to some reasons as of primary school. These negative attitudes may affect the future potential educational perceptions adversely. Therefore, it is very important to endear the science courses in primary school. Students need to believe that they will be successful in science courses. The effects of cooperative learning method and technique on students' attitudes and sense of self-efficacy has become the subject of some studies. İflazoğlu (1999) reported that group-supported individualization technique has positive impacts on mathematical achievement of the primary school fifth graders. However, this study could not come up with significant differences between the attitudes of the experimental and control groups.

Altıparmak & Nakipoğlu (2002) investigated the effects of Cooperative Learning method on the attitude and achievement in high school biology laboratories. At the end of the study, they found no significant difference with regards to students attitudes towards laboratory works; however, a significant difference favoring the experimental group was found for student achievement.

Kaptan & Korkmaz (2000) looked at the effects of the science education based on cooperation on the sense of self-efficacy of the student teachers. When they analyzed the data, they found results favoring the experimental group with regards to both student achievement and sense of self-efficacy.

It is necessary to establish educational settings where, through the cooperation of students in group works, students social skills are enhanced and to use various methods and techniques which render learning attractive for students. Köroğlu & Yeşildere (2002) designed mathematical games and scenarios to teach mathematical subjects to primary school second graders. At the end of this study, it was found that there is a significant improvement in student achievement. Moreover, the relationship between student success and gender was investigated but no significant difference was found. It was stated by the researchers that the students are very attentively listening to their teacher, voluntarily participating in the activities and they are cognitively active during the study. Kurtuluş (2001), in his article, where he reviewed the findings of the studies carried out to examine the effects of cooperative learning in the field of art education, found that cooperative learning method contributes to the development of the students in cognitive, affective and kinesthetic dimensions, and improves their motivation levels, self-confidence, attitudes and communication skills.

As a result of the literature review in this field, it was found that the effects of Cooperative Learning method and its various techniques in the field of science and other fields have been adequately researched, but there is a paucity of research on the use of TGT technique in the literature. Therefore, we believe that more research should be conducted on the effects of TGT technique on learning where teaching activities can be performed in a cooperative and game-like setting.

The purpose of this study is to investigate the effects of TGT technique and lecturing type of teaching on the achievement and affective characteristics of the students. While being taught through TGT, the students are active participants and they learn in a cooperative and game-like atmosphere. On the other hand, when they are subjected to lecturing type of teaching, they are passive listeners and study individually.

METHODOLOGY

The study used the mixed method (Creswell, 1994; Aktaran Alev, 2003: s: 105). In order to determine the effects of TGT technique and Lecturing type of teaching on student achivement, quasi-experimental method, one of the quantitative research methods, was

used. What is different in quasi-experimental method from the experimental method is that the control and experimental groups are not established through random distribution. Though there are different applications of quasi-experimental method, in this study, "pre- and post-test model of not equalized group" was used (Robson, 1998). At the school where the study was carried out, out of two classrooms, one of them was assigned as a control group and the other as the experimental group through drawing of lots. Before the unit was taught, both of the groups were administered a test. While TGT technique was used in teaching of the unit in the experimental group, lecturing type of teaching was drawn on in the control group. At the end of the teachings, both groups were administered the same test as a post-test. In order to determine the effects of different teachings on affective characteristics, documentation method, a qualitative research method, was used. Documentation method means analysis of the written documents including information about the researched phenomena or events. One of the strengths of this method is its making it possible to reach a wide sampling (Yıldırım & Şimşek, 2005). In the present study, it is aimed to get the opinions of all the students participating in the study by using documentation method.

1- Study Group

All of the 56 eight graders studying in two separate classrooms of Menteşe Primary School, Kavaklıdere, Muğla, in 2003-2004 school year make up the sampling of the study.

2- Data Collection Tools

In this study, as a data collection tool, achievement test and students' compositions are used.

a- Achievement test: By examining the target behaviors determined by the Ministry of National Education for the unit "Reproduction and Growth in Living Things", emblem table was formed (App.1). In line with the targets of the given unit, an achievement test consisting of 25 multiple-choice questions prepared by using different test books and questions previously asked in high school entrance examinations was designed (App. 2). While selecting the questions to be included in the achievement test, a special care was taken for them to be answerable within a class period by the students. Moreover, the sequences of the options given for the questions taken from the test books were changed. By doing so, it was made impossible for the correct choices of the two consecutive questions to be in the same option (for example, correct option is **a-** for question 1, and again the correct option is **a-** for question 2), and for each option, the possibility of being correct was equalized. The researchers got two lecturers from the department of Primary School Science Teaching, at the Faculty of Education, Muğla University and three science teachers working for the Ministry of National Education to analyze the designed test in the written form for its power to test the target behaviors, its compliance with the levels of the students and to determine whether it includes scientific errors or not. In light of the expert opinions (e.g., increasing the number of the questions concerning the meiosis and mitosis divisions, using the term of dizygous twin instead of false twin, increasing the number of living creatures in asexual reproduction) some changes were made to increase the scope and content validities. Then, the test got reevaluated by the same people, so that it had applicable content. Reliability of the test was tested by administering it to 31 high school first grade students. The reliability coefficient calculated by dividing the test into two was found to be r=.71 and KR reliability coefficient was found to be .76. In this achievement test, 1 point is assigned for every correct answer and 0 point was assigned for every false answer. The possible highest score to be obtained from the test was determined to be 25

and the lowest as 0. The total scores of the students vary from 25 to 0. This test was administered as a pre-test at the beginning of the study and as a post-test at the end of the study.

b- Students' compositions: By adapting the way followed by Açıkgöz (1990) to determine the affective characteristics of the students, students compositions were used to obtain data in the present study. After the study of the unit was completed, students were reminded what materials were used, what kind of activities were performed and what kind of assignments were given to be done outside the school to teach the unit. The participants of the both groups were asked to write their positive and negative opinions about all these activities. This composition writing was adopted to let the students express themselves freely, and form their own perspectives, touch upon all the possible points. By doing so, students' freedom of expression was not limited by the pre-structured questions.

3- Procedure

1. In the school, where the present study was done, class 8/A was appointed as experimental group and class 8/B as control by drawing lots. Both of the groups were administered pre-test.
2. Before starting the study, for the students to get accustomed to the teaching method to be used in the study, a pilot study was conducted about directing molecules in the cell (DNA and RNA)
3. In the control group, lecturing method was used to teach the unit. Throughout the teaching of the unit OHP materials, TV and video cassettes were used.
4. On the other hand, in the experimental group, teaching was performed through TGT technique. By considering pre-test results, teacher opinions and the number of the students in the classes, four teams consisting of seven students were formed. In this way, in the tournament games organized for one class hour per week, it was made possible to set up a seven tables of tournament each of which has four students.
5. After the required information about Mitosis division was presented to the students for two class hours within the first week of the study, another class hour was reserved to provide the students with available resources and time to study. And the last class hour of the week was saved for the execution of the game of tournament. The games of tournament consist of presentation and subject-related questions designed to evaluate the students' learning during team works. The teacher prepared 24 subject-related questions and then wrote each individual question on a card (App.3). The questions were duplicated through photocopying and then placed into envelopes. And they were organized in such a way as to be distributed to the seven tournament tables. The best student from each team was appointed to Table 1; the students following them at success level were appointed to Table 2; the followings to Table 3; and the students from the tables with the lowest success level were appointed to Table 7. While performing the grouping, the numbers of the tables were randomly assigned. In this way, students were prevented from knowing which table is for better students and which one is for worse students. In seven tournament tables, where one representative from each of the four teams was present, students played the tournament game simultaneously. Students were given some responsibility in the distribution of the envelopes and scoring. After the students were reminded the rules, first reader was determined through drawing of lots to start the game. First reader selected one of the envelopes on the table, and tried to answer to the question in the envelope. When he gave the correct answer, the card remained in front of the student. When the first reader could not come up with the correct answer, another change was given to him to make a guess, and even he made a mistake, he was not punished. After the first reader gave his

answer, a right was bestowed to the student on his left to object to the given answer or provide a different answer. Other players, in turn, were given to present their own answers. The game continued for the second lap by appointing the student on the left of the first reader as the second reader and so on. While the students coming up with the correct answers gained cards, they had to leave one card they had previously gained back onto the table when they came up with a wrong answer. When none of the student could nor provide the correct answer, the card was left on the table. When five minutes left for the lesson to be over, the teacher announced that they game was over and asked the students to count the cards in their hands. Each card gained was considered to be 1 point, and score of each student was written on first-week status summary page (App.4). In this way, weekly performance of each student could be evaluated. In the first week, the score of each team was calculated and the results were announced in the classroom.

6. In the second week, two class hours were spared for the teaching of Meiosis Division. Students were provided with time to be with their team members and get ready for the tournament until the last class hour of the course. For second week game of tournament, the teacher prepared 24 questions about meiosis division and the questions were arranged in such a way as to be distributed to seven tables of tournament. In the arrangement of the tournament tables, first-week status summary page was capitalized on. The students who were successful in the tournament table where he participated in the first game were promoted to the table of higher achievement level and those who were not successful to the table of lower achievement level, and the other students remained at the same tables. In this way, it was aimed that in each tournament table, the students with similar achievement level could come together and contribute to their teams proportionate to their capacities. At the end of the lesson, by assigning one point for each card gained one point, the scores of the second week were calculated and recorded on second week status summary page. Both separately and together, the scores of the four teams for the first and second weeks were announced in the classroom.
7. In the third week, Asexual Reproduction topic was taught in the classroom. Again, students came together with the same team mates, and got ready for the game of tournament. The teacher prepared 24 questions for the studied subject and arranged them in such a way as to be used in the game. In the assignment of the students to the tournament tables, second week status summary page was used. The scores gained by the students were recorded on the third week status summary page. The scores gained by the students for the third week and the total scores for the three weeks were announced to the students.
8. In the fourth week, Biological Characteristics of Reproduction in Human Beings were studied. The teacher designed and duplicated 24 questions to be used in the game of tournament. In the formation of the tournament tables, the results for the third week were drawn on. At the end of the game, the scores gained by the students and total scores of the teams obtained at the end of the fourth week were announced. At the end of the fourth week, the champion team of the tournament was determined. In order to reward the champion team, the name of the team members were written on a piece of carton and displayed in the classroom.
9. The teaching activities in both of the groups were performed by the same teacher.
10. The study was completed in both groups at the same time period (4 weeks).
11. Three weeks after the study was completed, achievement test was administered. In order to prevent the students from studying before the exam, it was not announced that they would take a test.

12. At the end of the study, all the activities performed throughout the study were reminded to the students. The students were asked to write their all positive and negative opinions about the activities that they liked and did not like, the things they learned and difficulties in learning, the reasons behind these difficulties throughout the study.

4-Data Analysis

The quantitative data obtained from the study were analyzed through SPSS 11.0 statistical package program. As the data consisted of two-choice situation and they did not have normal distribution, they were analyzed with non-parametric tests (Çepni, 2007). According to pre-test results of the experimental and control groups, Mann Whitney U-Test was conducted to determine whether there were statistically significant differences between the prior-knowledge of the students about the units to be taught throughout the study. In the same token, in order to compare the effects of different teaching methods on the achievement level, the post-test scores of the both groups were compared by using Mann Whitney U-Test. In order to see the intra*group improvements, the analyses of the pre- and post-test scores of the control and pre- and post-test results of the experimental group were performed by means of Wilcoxon Marked Sequences Test.

In order to determine the differences between the affective characteristics of the control and experimental students, the students' compositions were examined sentence by sentence; and by conducting content analysis, it was found that the students expressed positive and negative opinions about supportive learning, peer relations, satisfaction, effective learning, and preference for the other methods. As statements expressing sense of responsibility, social skills, research, and questioning abilities in the students' compositions are important in contributing to students' entire development; they are conceptualized as "supportive learning." The statements of the students about sharing, helping and integration can be subsumed under the title of "peer relationships". Students' statements about having fun, finding the course enjoyable can be regarded as the signs of satisfaction, so they are conceptualized as "satisfaction." Completion of the missing knowledge, providing opportunities for the reinforcement of the gained knowledge and internalization of as much information as possible and long lasting retention show that the knowledge gained are influential on students. The sentences in students' compositions are determined to make up "effective learning". Desire on the part of the students for the teaching methods applied to be applied in the teaching of future subjects, students' comparisons of these methods with the methods used in other courses, and opinions stemming from the comparisons of the different methods used to teach different subjects in different science lessons are considered "preference for other methods". Moreover, in order for students' opinions to be understood better, descriptive analyses supported with the samples from the compositions are conducted.

FINDINGS

In this section, the results of the analyzes data obtained from the experimental group where TGT technique was used are compared with the results of the analyses of the data obtained from the control group where lecturing was used.

The Effects of Teaching Through TGT Technique and Lecturing Technique on Student Achievement

Before starting the teaching of the subjects, both the experimental group and the control group were administered pre-test for the purpose of seeing how equal they were. The data obtained from this pre-test were analyzed via Mann Whitney U-Test and the results of this analysis are presented in Table 1.

Table 1. *Mann Whitney Test Results for the pre-test scores of the experimental and control groups*

Groups	N	Sequence mean	Sequence total	U	p
Experimental	28	29.09	814.50	375.50	.78
Control	28	27.91	781.50		

As it can be seen in Table 1, there is no difference between the control and experimental groups in terms of their prior knowledge about the unit "Reproduction and Growth in Living Things" ($U=375.50$, $p>.05$).

Three weeks after the teaching activities were completed; achievement test was administered to control group and experimental group students. The data obtained were analyzed with Mann Whitney U-Test and the results are presented in Table 2.

Table 2. *The Mann Whitney Test results for the post-test scores of the control and experimental groups*

Groups	N	Sequence mean	Sequence total	U	p
Experimental	28	37.59	1052.50	138	.000
Control	28	19.41	543.50		

After the study, it was observed that there was a significant difference favoring the experimental group when the post-test scores of the groups were compared ($U=138$, $p<.000$). The students of the experimental group, where TGT technique was used, were found to be much more successful than the students of the control group.

In order to see the effects of TGT technique on student achievement, intra-group progress was examined for the experimental group. The Wilcoxon Marked Sequences test results for the pre- and post-test scores of the experimental group students are presented in Table3.

Table 3. *Wilcoxon Marked Sequences results for the pre- and post-test scores of the experimental group*

Post-test – pre-test	N	Sequence mean	Sequence total	z	p
Negative sequence	0	.00	.00	9.19*	.000
Positive sequence	56	56.50	6272.01		
Equal					

*On the basis of negative sequences

When we look at Table 3, we see that there is a significant difference between the pre-test and post-test scores of the experimental group students (z=9.19, p<.000). When the sequence total of the difference scores is considered, it is seen that this difference favor the negative sequences, that is, the post-test.

In order to determine the effects of lecturing technique on student achivement, pre-test and post-test scores of the control group students were compared with Wilcoxon Marked Sequences test and the results are presented in Table 4.

Table 4. *Wilcoxon Marked Sequences test results for pre- and post-test scores of the control group.*

Post-test – Pre-test	N	Sequence mean	Sequence total	z	p
Negative sequence	0	.00	.00	6.52*	.000
Positive sequence	56	28.50	1596.00		
Equal					

*On the basis of negative sequences

The results of the analysis show a significant difference between pre-test scores and post-test scores of the control group where lecturing type of teaching was performed (z=6.52, p<.000). When the Sequences total is considered, it is seen that this difference favors the post-test scores.

In both of the control group and experimental group, significant differences for student achievement were found after teaching activities were performed. However, while sequence total is 56.50 in the experimental group, in the control group, it is 28.50.

Effects of Teaching Through TGT Technique and Lecturing Technique on the Affective Characteristics of the Students.

The data required to determine the effects of Team Game Tournament technique and Lecturing type of teaching on the affective characteristics were collected through students' compositions. Findings obtained from the analysis of students' compositions are presented in Table 5.

Table 5. *Comparison of the affective characteristics of the control group students with the experimental group students*

Opinions	Experimental group				Control group			
	Positive		Negative		Positive		Negative	
	Number of students	%	Number of students	%	Number of students	%	Number of students	%
Supportive learning	5	19	_	_	_	_	_	_
Peer relations	15	55	5	19	_	_	_	_
Satisfaction	19	70	_	_	8	33	3	13
Effective learning	23	85	_	_	9	38	2	8
Preference over other methods	21	78	_	_	_	_	_	_

In table 5, it is seen that the experimental group students expressed positive opinions about every dimension, particularly about the effective learning and preference over the

other teaching methods. In the experimental group, only about peer-relations, negative opinions were expressed. On the other hand, both positive and negative opinions were expressed in students' compositions about two dimensions; namely, satisfaction and effective learning.

When we look at Table 5, we see that while 19% of the experimental group students expressed positive opinions about supportive learning, none of the students expressed negative opinions about this dimension. None of the students in the control group expressed either positive or negative opinions about this dimension. "When I have gained points in the tournaments, attitudes of my friends towards me have changed, and I started to trust myself" (experimental group-Supportive learning/positive).

While 55% of the experimental group students expressed positive opinions about the dimension of peer relations, only 19% of them expressed negative opinions. On the other hand, in the control group, it should be noted that none of the students expressed either positive or negative opinions about peer relations. It is understood from the students' compositions that the experimental group students' negative opinions about the dimension of peer relations result from their loss of points in the tournament.

"Before this technique was implemented in the classroom, I did not have good relations with my class mates. They did not ask me such questions like Hakan! How did you do this, Can you help me? But after this technique started to be used in the class, both our interactions and friendship were enhanced" (The experimental group-Peer relations/Positive).

"When we could not answer the questions we said to each other not to feel sorry, but, we are losing points and we feel resentment against each other" (experimental group-peer relations/negative).

As it can be seen from Table 5, while 70% of the experimental group students expressed positive opinions about satisfaction in the lesson, only 38% of the control group students expressed positive opinions. While none of the students in the experimental group expressed negative opinions, 13% of the control group students expressed negative opinions.

"Our science lessons were already enjoyable, the incorporation of this game into the science course made it more enjoyable and we started to wish we had six class hours for the science course per week instead of three; moreover, we could all participate in the lessons" (experimental group – satisfaction/positive).

"This unit was enjoyable" (control group – satisfaction/positive)"

"We do not have enough time to understand the topic" (control group – satisfaction/negative).

The students' opinions about realizing effective learning can be interpreted as follows according to Table 5; 85% of the experimental group students have positive opinions. On the other hand, only 38% of the control group students expressed positive opinions. While none of the experimental group students expressed negative opinions, 8% of the control group students expressed negative opinions.

"While playing team games, I thought that I only had pleasure, but then I realized that I deeply internalized the topics. Even if we are now asked about these topics, we can answer" (experimental – effective learning/positive).

"I have more easily learned the things reflected on OHP" (control group – effective learning/positive).

"Usually the topics are easy to learn but they can easily be forgotten"(control group – effective learning/negative).

When Table 5 is examined, it is seen that 78% of the control group students prefer the method they are exposed to to other methods. In the experimental group, none of the

students expressed preference for other methods over the method they are exposed to. Interestingly, in the control group, there is no student expressing either negative or positive opinions.

"In my opinion, team work was wonderful, I would like it to be used for the next unit" (experimental – preference over other methods/positive).

DISCUSSION

In this study, the effects of teaching through TGT technique and lecturing technique on student achivement in primary school science course were investigated. Moreover, in order to determine the effects of these techniques on the affective characteristics of the students, the students' opinions about the dimensions of supportive learning, peer relations, satisfaction, effective learning and preference over other methods were examined.

According to the analyses of the pre-test scores of the control group where lecturing type of teaching technique was used and of the experimental group where TGT technique was applied, there was no significant difference between students' prior knowledge about the topics to be taught before the study. At the end of the analyses, it was found that teaching through TGT technique in the experimental group and teaching through lecturing in the control group resulted in improvement in student achivement. However, when evaluated over mean differences, the degree of change in the experimental group was found to be higher than that of the control group. These results prove that TGT technique makes more contribution to student achievement than lecturing type of teaching technique. The experimental group students' coming together to work to be the first team in the tournament, and their attempting to answer the questions asked in an atmosphere of game during the tournaments may have contributed to student achievement. This finding is in compliance with the findings obtained by Kasap (1996), Delen (1998), Ertekin (2001), Nakiboğlu (2001), Lazarowitz & Natan (2002), Özsoy and Yıldız (2004).

This positive influence on the achievement is also observed on the affective characteristics. For instance, while there is no student expressing either positive or negative opinions on the dimensions of supportive learning and peer relations in the control group, 19% of the students expressed positive opinions on the dimension of supportive learning and 55% of them expressed positive opinions on the dimension of peer relations in the experimental group. In the experimental group, 19% of the students expressed negative opinions about peer relations. TGT technique may have resulted in positive effects on supportive learning by helping students to establish social relationships among themselves and between teachers, to take responsibility, to contribute to team success in the tournaments, to improve self-confidence. On the other hand, as for the dimension of peer relations, positive opinions may result from the fact that the team members come together while getting ready for the tournaments, so that they help each other and cooperate with each other to study the subject. In students' compositions, it is apparent that most of the negative opinions are the result of point losses in the tournaments. These findings are in line with those of Açıkgöz (1990), Tonbul (2001). With regards to the dimension of having satisfaction in the lesson, while 33% of the control group students expressed positive opinions, 70% of the experimental group students expressed positive opinions. While none of the students in the experimental group expressed negative opinions, 13% of the control group students expressed negative opinions. And this proves that the experimental group students have fun in the lesson, they learn while enjoying and they participate more in the lessons. Negative opinions in the control group were expressed in the students' compositions in the form of statements expressing lack of class participation. These findings also comply with the findings of Açıkgöz (1990). The proof of the occurrence of

more effective learning in the experimental group is that while only 38% of the control group students expressed positive opinions on this dimension, this percentage reached 85% in the experimental group. 8% of the control group students stated that they could not gained effective knowledge through the teaching method applied. This situation was expressed in students' compositions in the form of statements saying that some parts of the topic could not be understood well enough, and most of the things learned are forgotten after a short time. The students' opinions about their own learning are similar to those found in a study by Tonbul (2001). When the students' compositions were examined, it was found that 78% of the students in the experimental group were pleased with the teaching method applied, and there were no students expressing negative opinions about the teaching method used. In their compositions, the students stated that they would like similar technique in other courses, as well, and if they became teachers, they would use such techniques in their own classes. On the other hand, in the control group, there is no student expressing either positive or negative opinions. This may be because of the fact that the students paid attention to the games, different tools-instruments and scenarios presented to themselves. This finding is in accordance with that of Açıkgöz (1990), Tonbul (2001), Aycan, Türkoğuz, Arı & Kaynar (2002).

RESULTS and SUGGESTIONS

According to the findings obtained from the study, TGT technique is more effective on students' success than lecturing technique. When TGT technique is used, the students actively participate in learning process and take responsibility. Here, a team objective and team success can be achieved with the cooperation of the whole team members. For the success of team, all the team members are responsible for each other's learning. Through the tournament game, all the students' participation in the lesson is made possible. As each student gains point for their team, students come together to get ready for the tournament. By working in cooperation, they complement each other. During the tournament game, they both enjoy and consolidate the knowledge they gained. Through the information gained in the context of team work and game atmosphere, students may have long lasting information and thus their academic success can be improved.

Findings obtained from the students' compositions prove that TGT technique produces more positive results with regards to the affective characteristics of the students than lecturing type of teaching technique. In order for their team to be champion, each member of the team should gain points for their team. Therefore, students are responsible towards their team members. In order to be able to gain more points in the tournament games, the students may need to collect information from different sources and do more research. Students' interacting both with their team members and the members of the other teams may contribute to improving their social skills. Sense of being a member of a team, and gaining points by giving true answers in team games may increase students' self-confidence. In this way, besides the academic success of the students, other characteristics can be promoted.

Today, individuals' conducting group works, and generating group products are gaining more importance. Peer relations in group works are also of great importance. In TGT technique, students have to work together because here the important thing is not the personal success but the success of the team. And team success depends on the points gained by the individual members of the team. Students' working in cooperation with their team members requires them to help each other. This technique may contribute to the improvement of peer relations in the classroom.

Students' participation in the lessons may be a factor influencing the love towards the course and student success. In particular, creating settings for primary school students where they learn while having fun may have positive influences on students. As every student competes as the representative of their teams in the tournament games held for one class hour per week within the context of TGT technique, they actively participate in the lesson. Moreover, students have active roles in handing out and handing in the question envelopes, and in calculation of the scores. In this way, the students may have more satisfaction in the lesson.

In TGT technique, the team members come together to get ready for the tournament games. During cooperative work, students may complement each other, and correct the others' mistakes. During the tournament games, previously gained knowledge can be reinforced. Asking and answering questions in a game atmosphere may contribute to better retention of the information. On the other hand, using visual materials in lecturing type of teaching may also be conducive to effective learning.

The students want TGT technique to be used for the teaching of the other units of the science course and they also prefer it to other methods used in the other courses. Opportunities provided by this technique for students to participate more in the lessons, entertaining class environment, learning through games, contributing to the success of the team, being a team member, sharing within the team may render this technique more attractive compared to lecturing technique. In light of the study findings, following suggestions are made:

According to the findings obtained from the study, it can be argued that TGT technique produces more positive effects on students' achievement than lecturing technique, so this technique should be used more in teaching and learning processes

In order to promote peer relations in the classroom, TGT technique can be conceptualized on.

In cooperative learning methods, teaching and using social skills are important. Pilot studies with longer time span of application can be conducted to find more positive results concerning the effects of TGT technique on the dimension of peer relations

When it is considered that the knowledge gained with pleasure and fun is more lasting, it seems to be appropriate to conduct teaching activities both in cooperation and in a game-like atmosphere.

For students to take responsibility within the team, to improve their sense of their responsibility and their self-confidence, TGT technique can be drawn on.

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Appendix-1 Emblem Table							
Evaluation							
Synthesis							
Analysis	They realize that through meiosis division pair chromosomes are separated and so cells with n chromosomes can be formed			X			
Application	By drawing attention to the problems experienced in the puberty, solutions to these problems are discussed with examples. .						X
Internalize	They explain the importance of sexual health and requirements for remaining healthy.						X
	They give examples for physical and psychological problems of the boys and girls who are in the period of puberty.						X
	They talk about the negative factors affecting growth and development in human beings and give examples.						X
	They talk about the factors affecting growth and development in human beings and gives examples.						X
	They explain what the prospective mother need to pay attention for the healthy development of embryo .					X	
	They realize the role of placenta in the development of embryo.					X	
	They show the stages of developments from zygote to the baby on a table.					X	
	They explain the insemination of sexual cells in human beings.					X	
	They explain the features of sexual cells by drawing.					X	
	They explain sexual reproduction and gives examples for the living things sexually reproducing.					X	
	They explain asexual reproduction and gives examples for living things asexually reproducing.				X		
	They determine the differences between mitosis and meiosis divisions.		X	X			
	They explain the importance of meiosis division.			X			
	They explain the reasons why the number and content of the chromosomes are different in different living things	X					
	They explain the cells formed as a result of the mitosis division and the connections among the stages of mitosis division		X				
	They explain that the mitosis division is a division of cells resulting in cells in the same nature.		X				
	They realize that during cell division, the cell is drawn into the flow of events of cell division.	X					
	They first explain the cell division before explaining the reproduction in living things	X					
Knowledge	They explain diseases spread though sexual intercourse and the means of protection form these diseases.						X
	They sequence the stages of human growth and development.						X
	They explain the types of asexual reproduction and its importance.				X		
	They tell that there are different ways of reproduction in living things.				X		
	They explain that "2n" symbol means chromosomes in living things exists in pairs.	X					
	They know that the number of the chromosomes in living things is indicated through the symbol of "2n".	X					
	They explain that DNA both serves the function of guiding the life of cell and reproduces cells carrying similar characteristics to it.	X					
	They explain that reproduction is the ability of a living thing to reproduce creatures similar to itself.	X					
Objectives	Behaviors / Unit titles	Repro-duction	Mito-sis divi-sion	Meiosis division	Asexual reproduction	Reproduction in human beings	What are growth and development affected by?

Appendix -2 Achievement test for the Unit "Reproduction and Growth in Living Things"

1. Which one of the following or followings is true?

I .As a result of the mitosis division, body cells are formed.

II. As a result of the meiosis division, sexual cells are formed.

A . Only I B . Only II

C . Both are true D . Both are false

2. How many chromosomes are present in liver and ovary cells of a living thing consisting of a zygote with 52 chromosomes?

	Liver	Ovary
A .	104	52
B .	52	26
C .	26	52
D .	52	104

3 . What can be told about the following information?

I . Asexual reproduction increases variety among the members of s species.

II. Sexual reproduction increases variety among the members of a species.

A . Only II is true B . Only I is true

C . Both are true D . Both are false

4 . As there are 46 chromosomes in human beings, which combination of reproduction cells results in male infant ?

A . (23 + X) + (23 + X) B . (22 + X) + (22 + Y)

C . (22 + Y) + (YY + Y) D . (46 + X) + (46 + Y)

5 . Which of the following situations are peculiar to meiosis division and not seen in mitosis division?

A . DNA's fertilizing itself C . Homolog chromosomes' forming synapses

B . Formation of spindle threads D .Lining of chromosomes in equatorial region

6 . Which one of the followings is not one of the problems encountered in the children who are in the period puberty ?

A . Being anxious about gaining identity C . Being indecisive in job selection

B . Having frequent hesitations in making decisions D . Improving sports and hand skills

7 . In which one of the following options chromosome teams resulting from mitosis and meiosis divisions are given?

	Mitosis	Meiosis
A .	2n	n
B .	2n	2n
C .	n	2n
D .	n	n

8. A cell having 2n=12 chromosomes undergoes mitosis division twice and then meiosis division. What is the chromosome number of this cell ?

A . 4 B . 6

C . 12 D . 24

9 . Which of the followings is the type of reproduction seen in Sea star and planarian?

A. Regeneration B. Sexual reproduction

C. Division D. Spore

10 . I. Monozygotic twins are very similar to each other.

II. In dizygous twins, those with the same gender are similar to each other.

III. In dizygous twins, the gender can be same or different.

Which one or ones of the given above are true?

A. Only I B. I and III C. II and III D. I, II , III

11 . Which one of the following types of reproduction <u>is false</u> for the given animal?
A . Beer yeast – budding C . Planarian – Regeneration
B . Bacteria – division D . Sea star – Spore

12 . In a human body completed its growth, which one of the following is <u>not observed</u>?
A . Meiosis cell division C . Change in body weight
B . Mitosis cell division D . Formation of new tissue with cell differentiation

13 . Where does zygote complete its development in mammals?
A . Ovary B . Ovary channel
C . Stomach D . Sperm bed

14 . From which of the following cells, a living thing is formed?
A . Ova B . Sperm
C . Zygote D . Pollen

15 . How many chromosomes are present in each of the cells of a cell with 2n = 38 chromosomes after it is undergone one mitosis division and one meiosis division?
A . 19 B . 38
C . 76 D . 95

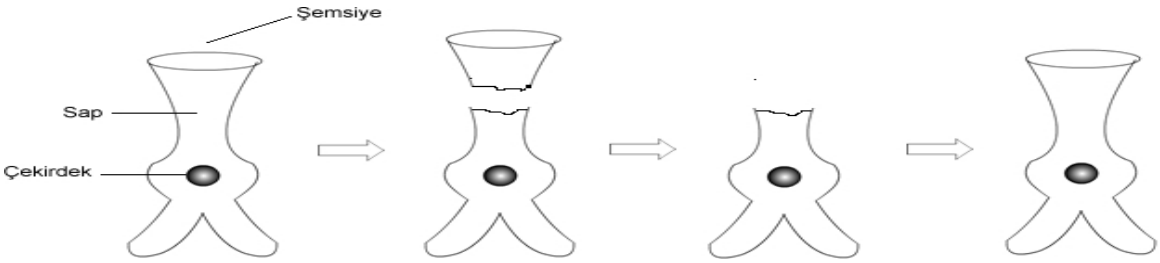
16 . Which of the following results in more variety in a living thing?
A . Asexual reproduction B . Sexual reproduction
C . Regeneration D . Mitosis division

17 . I . Healing of wounds
II . Growth of organs
III . formation of reproduction cells
Which of the above mentioned event or events occur as a result of <u>meiosis</u> division?
A . Only III B . I – III C . II – III D . I , II ve III

18 . In which of the following options chromosomes distribution in female cells in human beings is correctly given?
A . 22 + XX B . 23 + Y
C . 22 + X D . 23XY

19 . Which one of the followings <u>is not the feature of meiosis</u> division?
A . Decreases the number of chromosomes by half
B . Forms sexual cells
C . Results in increase in the number of chromosomes
D . Seen in reproduction cells.

20 .



A scientist cuts marine kelp as seen in the above picture. Although the umbrella part dies after a short while, the bottom part completes itself . Which of the following conclusions <u>can not be reached</u> by the scientist?
A . Marine kelp can not grow without the nucleus
B . In some living things removed part can be regenerated
C . For some cells to stay alive, nucleus is necessary
D . Some living things reproduce through division

21 . If a cell consecutively undergoes two mitosis divisions and then one meiosis division, how many cells are formed?

A . 2 B . 4
C . 8 D . 16

22 . According to the table below, which conclusions can not be reached?

Animal species	Reproduction frequency (annually)	The number of the babies per birth(maximum)	Approximate pregnancy period(day)
House mouse	7 - 8	13	21
Rabbit	6 - 7	6	42
Dog	2	10	60
Elephant	Each two years	1	660

A . The time of pregnancy is longer in animals with bigger body size
B . Population frequency is connected with the environmental conditions
C . Reproduction frequency is connected with the environmental conditions
D . The number of the babies per birth is the least in the animal with the biggest body size.

23 . Which of the following matching related to structures used in the growth and reproduction of human beings and their functions is false?

A . Placenta ---------- Feeding the baby
B . Navel ----------Carrying blood vessels
C . Ovary---------Promoting the development of the baby
D . Embryo----------Promoting the formation of the baby

24 . Which of the following is the shared effect of smoking, alcohol consumption, drug use on the growth?

A . Causing diseases
B . Encouraging committing crime
C . Destroying the balance of the movement
D . Destroying the functioning of the respiratory system

25 . I . Spindle threads disappear
II . Chromosome takes the form of chromatic thread
III . Chromosomes gather in the middle of the cell
IV . Nucleolus disappear through melting

Which of the above mentioned are observed in the telophase stage of mitosis cell division?

A . II and III
B . I and II
C . I and III
D . III and IV

Appendix – 3 Sample questions used in tournament games

1. What is diploid?
2. What is haploid?
3. What is the importance of mitosis division in unicellular animals?
4. What is the importance of mitosis division for the human beings?
5. How many chromosomes are present in the liver cell of a living thing whose stomach cell has 16 chromosomes.
6. What are the events taking place in inter-phase?
7. Tell the stages a cell undergoes during nucleus division in sequence.
8. A cell with 2n=38 chromosomes undergoes two consecutive mitosis division . What is the chromosome number of the cells formed at the end of these divisions?
9. In which stage, mitosis divisions that a leaf cell and skin cell undergo differentiate from each other?
10. What are the events taking place in the prophase stage of mitosis division?
11. What is centromere?
12. In which stage of mitosis division, sister chromatists line on the equatorial line?
13. Which events are observed in the stage of anaphase?
14. What is the stage where spindle threads disappear?
15. Explain the reason why Cytoplasm division is different in animal and plants cells
16. What is the importance of inter-phase?
17. How many chromosomes are present in the body cells of a living thing whose sexual cells have 32 chromosomes?
18. In which stage of mitosis division, do nucleus membrane and nucleolus melt?
19. I. First nucleus coupling occurs.
    II. The number of chromosomes decreases by half.
    III. After nucleus coupling, cytoplasm is divided.

Which one or ones of the given above are not related to mitosis division?

20. Which one or ones of the followings can be different among the baby cells formed as a result of mitosis?

I. The number of chromosomes
II. Cell size
III. Variety in the organs of cells

21. If a cell with 2n=16 chromosomes is consecutively undergoes mitosis division three times, totally how many cells are formed at the end of these divisions?
22. Give examples for the occurrences taking place in association with mitosis division in the body (At least three examples)
23. Which cells are monoploide in eukaryote animals?
24. Which occurrences take place in a cell after it has completed its mitosis division?

Appendix -4 1st Weekly Status Summary Page

1st table	Sultan TINAS Selim YILDIZ Servet KÜÇÜK (-) Ebru ŞANLI	7 6 4 7
2nd table	Murat EVRAN Kezban DELLAL(-) MuhammedKAHRAMAN(+) Nilüfer BARBAROSOĞLU	6 4 8 6
3rd table	Hafize ÜSTÜN(-) Remzi DAĞ Gonca gül GENÇ(+) Serpil KARAMAN	3 8 9 4
4th table	Fatma KAHRAMAN(+) Özlem ÇİN Seval GÜLERGİN Çiğdem ÇALIŞKAN	7 6 5 5
5th table	İsmail USTAOĞLU Eyüp YEŞİLKAYA Gökhan BARBAROSOĞLU Fatma YILMAZ	5 8 6 4
6th table	Neşe ŞEN Taşkın ÇALIŞMAZ Filiz BIÇAK Hakan SÜVE	3 7 6 5
7th table	Yunus Emre ŞEMSİ Tanju TAŞ Pembe AKDAĞ Bayram ŞANLI	5 7 3 5

Note: (+) indicates the students who advanced to higher status tournament table in the next tournament game

(-) indicates the students who went to a lower status tournament table in the next tournament game