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EFFECT OF STUDENT TEAMS-ACHIEVEMENT DIVISIONS TECHNIQUE USED IN SCIENCE AND TECHNOLOGY EDUCATION ON SELF-EFFICACY, TEST ANXIETY AND ACADEMIC ACHIEVEMENT

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Abstract. *The main purpose of this study was to determine the effect of teaching the "Force and Motion" unit of the Science and Technology class using the Student Teams-Achievement Divisions (STAD) technique on self efficacies, test anxiety and academic achievements of seventh grade students. The STAD technique was applied to the experiment group; the existing program based on constructivism to control-1 group, and traditional teaching methods to control-2 group. The analysis of the obtained data was achieved by using the one-way variance analysis (ANOVA). In conclusion, it was determined that the experiment group was more effective than the control groups in respect to self-efficacy and academic achievement. Moreover, significant improvements were obtained in the exam anxiety of the students in the experiment and control-1 groups compared to the group where traditional teaching methods were used.*

Key words: *academic achievement, self-efficacy, student teams, academic divisions techniques, test anxiety.*

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Introduction

For the individual to provide the best response to the issues faced with scientific and technological literacy is important in terms of finding a balance between the individual and the society, and meeting the requirements (Shin et al., 2003). Countries where the field of science and technology has thoroughly developed, attach great importance to Science and Technology in their education system. The first phase of science and technology in education is Science and Technology courses in elementary school, and thus, clearly reveals the importance of Science and Technology courses (Sorgo & Kocijancic, 2011).

A science-centered curriculum aims to encourage students to understand how science works and to become motivated learners who want to actively engage in science. At the same time, it directs the learners to mental based discoveries forcing them to think (Kelly, 2000). At the elementary school stage especially, the methods used in teaching should make science more meaningful for the students (Greene, 1991). In a classroom environment where the students start to discover the real world through scientific experiences, the ideas are organized and verified through oral and verbal communications (Avard, 2009). In such an environment, the students will start loving science, develop positive feelings, and improve their internal motivations. Moreover, this environment can contribute to these students building general scientific schemes, thus the continuity of belief and attitudes can be ensured for stability (Jalil, Abu Sbeih, Buojettif & Barkat, 2009)

In all education levels, there are factors impacting the success and attitude of the student (Komiya, Torii, Fujii & Hayashizaki, 2008). Many different scientific reports have recorded that students get negative messages regarding science all throughout their school lives. In fact, as far as this belief goes, most teachers responsible for science and technology classes at lower levels have the same belief: as "Understanding science requires certain ability and only some people have this ability." Thus, facing the reality of science creates anxiety for most students (Malow, 2006). It is well accepted that test anxiety especially, is the most serious obstacle when it comes to education. Test anxiety is the feeling of worry that the individual feels regarding his/her success in the test (Özan & Yüksel, 2003). Not having an evaluation process that is in line with the learning process, and having only one single chance to be successful despite a long-term learning process are factors that increase the test anxiety in the students (Stallworth-Clark, Cochran & Scott, 1998). The students in this state tend to perceive this as a threat against them. Thus, the anxiety of these students are high and their self-efficacy perceptions are low (Lee, Ng & Phang, 2002).

Self-efficacy perception is a concept that was first used in the Social Learning Theory of Bandura, and is about the personal judgments of individual regarding how well they can perform activities required to cope with possible situations (Bıkmaz, 2004). According to Pajares (2003), the individuals with high levels of self-efficacy are more comfortable and efficient when confronted with tasks at high difficulty levels, whereas people with low self-efficacy tend to believe that the tasks they need to perform are much more difficult than they really are. For this reason, self-efficacy belief affects the success and anxiety levels of the students significantly. The self-efficacy belief of a teacher affects the quality of teaching, methods and techniques used, and the participation of the student to the learning and understanding of what was taught. This feeling that causes students to experience learned helplessness may be the most significant reason behind their failure (Seijts, Latham & Whyte, 2000). Therefore, relieving the anxiety of the students can be achieved by encouraging them, which in turn means their self-efficacies are improved (Lee, Lim & Ng, 1997).

In Turkey, the Elementary School Science and Technology Academic Program have been developed based on the student oriented learning model, and all the activities are shaped in line with this (Şahin, 2011). The cooperative learning method, which is one of the active learning methods, used together with constructivism, is effective for students in regard to developing a positive attitude towards the school and the course, continuing this positive attitude and cooperating, and taking responsibility and participating in classroom activities. The general description of cooperative learning is the use of small groups for educative purposes in order for them to work together towards a common goal of improving both their personal learning and each other's learning (Johnson & Johnson, 1989). Various studies have proved that cooperative learning has a positive effect on various emotional and cognitive learning-teaching processes such as, remembering, transferring, high level cognitive strategies, participation in the lesson and self-respect (Lee, Lim & Ng, 1997; Keyser, 2000; Lee, Ng & Phang, 2002; Bilgin, 2006).

When the related literature was analyzed in Turkey, it was seen that the conducted studies focus on limited variables of the cooperative learning method affecting the academic achievements of students and their attitudes towards the course. In this study, a different dimension is aimed at by mostly focusing on the variables of test anxiety and the self-efficacy perception of students towards the Science and Technology course provided through the technique of the Student Teams-Achievement Divisions.

The main purpose of this study was to test whether there are significant differences between the experiment group where the STAD technique is used as one of the cooperative learning methods and the control groups where the traditional teaching and current academic program of Science and Technology were applied in teaching the "Force and Motion" unit of the 7th Grade Science and Technology course in terms of self-efficacy towards the Science and Technology course, test anxiety and academic achievement. In line with this aim, the main problem of the study was as follows:

"Is there a significant difference between the education processes organized and carried out according to traditional teaching methods, the current academic program of Science and Technology course, and the STAD techniques for the "Force and Motion" unit of the Science and Technology course in terms of 7th grade students' self-efficacy perception towards the Science and Technology course, test anxiety and academic achievement averages?"

Based on this, the present study addresses the following questions:

1. Is there a significant difference between the scores of the pre-test and post-test for self-efficacy towards Science and Technology according to the experiment and control groups?
2. Is there a significant difference between the scores of the pre-test and post-test for test anxiety according to the experiment and control groups?
3. Is there a significant difference between the scores of the post-test for academic achievement according to the experiment and control groups?

Methodology of Research

Study Model

In the study, experiment design with pre-test, post-test and control group was adopted. Within the three classrooms, one of them assigned as experiment and two as control groups with random selection. In order to determine the effects of the applied techniques and methods to the self-efficacies towards Science and Technology and the test anxiety of the students, the STSS and TAS were applied as pre-tests. After the pre-measurements, the experimental process was applied. The process was initiated at the same time for all three groups. At the end of the six week long experimental period conducted in the experiment and control groups; AAT, STSS, TAS post-tests were given.

Study Group

The study was conducted in a public primary school in Turkey. The three 7th grade classes in this school and a total of 91 students from these classes were chosen for the scope of the study. For establishing the equivalence of experiment and control groups, a one-way variance analysis (ANOVA) was applied based on the achievement scores of the students at the end of the previous academic year. The results of this analysis are given in Table 1 where it was determined that three groups are equivalent to each other ($F= 0.151$, $p< 0.05$). From the random selection, one class was determined as the experiment, two classes were determined as the control groups. Even though participation of all the students in these classes to the study was ensured, the data obtained from students who couldn't enter the pre- and/or post-measurements because of absence were not considered during data analysis. Thus, for this reason the number of students that data was collected for vary according to the data collection tools.

Table 1. The results of the One-Way variance analysis (ANOVA) regarding group equivalence.

	N	$\bar{X}$	d		SS	df	MS	F	p
Experiment	31	68.852	11.855	Between	48.704	2	24.352	0.151	0.860*
C-1	31	70.621	14.087	Within	14164.986	88	160.966		
C-2	29	69.632	11.946	Total	14213.690	90			

** p<0.05*

Data Collection Tools

The Science and Technology Self-Efficacy Scale (STSS)

The STSS was developed by Tatar et al. (2009) in order to determine the self-efficacies of elementary school second level students towards science and technology. The STSS has a three-factor structure composed of 27 items. These three factors were called "Trust towards science and technology", "Being able to cope with challenges regarding science and technology" and "Trust in science and technology performance" by benefiting from the literature. The coefficients of the internal consistence of these factors in the scale are respectively 0.93, 0.75 and 0.80. And the Cronbach Alpha coefficient for the whole

scale is 0.93. The scale items in the type of 5-point Likert scale are scored from 5 to 1 as "I strongly agree" to "I strongly disagree" (Tatar et al., 2009).

The Test Anxiety Scale (TAS)

The TAS is a scale composed of 34 items. Its validity-reliability tests and factor analyses were conducted. The scale has a 5-factor structure called "Opinions of others", "Your opinion", "Concerns about the future", "Concerns about being prepared and general test anxiety" and "Mental and physical reactions". Also, the Cronbach Alpha coefficient for the whole scale was calculated as 0.87. The scale items in the type of 5-point Likert are scored from 5 to 1 as "never" to "always" (Bahçeci, 2009).

The Science and Technology Academic Achievement Test (AAT)

The AAT was prepared by the researcher to determine the achievements of the 7th grade students in the unit of "Force and Motion". To develop this test, all gains regarding the 7th Grade "Force and Motion" unit was determined on the bases of the elementary school Science and Technology Academic Program (Ministry of National Education, 2006), the table of specifications was prepared and two items with four options were written for each gain. In order to ensure the scope validity of the measurement tool, the opinions of the experts working in the fields of measurement and assessment in education, and elementary school science education were noted and the required changes were made. The test form, with 49 multiple-choice questions covering all the targets, was applied to a total of 179 eighth grade students who had been studying this unit before, as well as in the experiment group. The difficulty indexes of the items and discriminative power indexes of the items were calculated with the help of Microsoft Excel and Statistics programs. While selecting the items, an attempt was made to select the items at a moderate difficulty level with discriminative values higher than 0.20 (Tekin, 1993). While examining accessibility in terms of gains, the percentages of correct answers given in the test and frequency values were compared with the critical value of 70% (Büyüköztürk, 2010). In order to examine if there was a pre-relationship between behaviors, tetrachoric correlation coefficients were used. Based on these criteria, the best item was selected among the two that measure the same behavior. And thus, the Academic Achievement Test composed of 27 items was obtained. The KR20 reliability coefficient of the test was found as 0.97. It was concluded that the academic achievement test measures the determined gains in the "Force and Motion" unit and has a high reliability.

Application

In the study, the "Force and Motion" unit was selected since it was suitable for the experimental process in terms of duration (to prevent the application process from being interrupted) and to obtain reliable results. Before starting to conduct the study; the gains, content, education materials and lecture plans of the unit were prepared. Including the application of the pre-test, the experimental process and the post-test, the study was completed in eight weeks.

In the experiment group, the unit "Force and Motion" was taught in line with the STAD technique of the Cooperative Learning method. Before the application, the students were informed about the technique and applications. In the application of the technique developed by Slavin (1978), the lecture sheets and personal tests prepared by the researcher before the study were used as teaching material. The five basic application phases of "teams", "presentation", "tests", "personal improvement points" and "team award" were adapted from Slavin (1998).

Forming the teams: Hile forming the teams for the first time, the students' averages of the written exam scores for the Science and Technology course of the previous year were taken as the success criteria, and they were ordered on a scale from large to small according to their success scores. Since the teams would be composed of four people and the classroom population was divided into groups of four, there were seven teams formed in total. In the assignment of students to the teams, the first seven letters of the alphabet (A-B-C-D-E-F-G) were given to the first seven students. The following students

were labeled starting from the last letter and the same process was repeated upwards starting from the end of the list. The students that got the same letter were assigned to the same team and the students that were in the middle of the list and not lettered were distributed into the groups as the fifth person. It was also decided the groups would be heterogeneous in terms of gender.

Presentation: Lecture presentations were made by using plain narration, question-answer, discussion, representation techniques, and by using assisted visual-audit teaching technologies. The first two or three hours of each subject of the unit were presented by the researcher, team work was done in the following two hours and personal tests were given to the students in the last hour.

Team Work: After the presentation was made on the subject, the worksheets composed of activities in line with the purpose and subject of the unit such as problems, questions, fill-in items, multiple choice items, map fill-in questions, puzzles, experimental studies were distributed to the students as two copies. The teamwork was in the form of students working face to face on worksheets until they were sure that each member in the team had learned the subject fully. The researcher only intervened in cases where none of the team members could reach a solution.

Personal Test: At the end of each subject, personal tests prepared in line with the worksheets were given. By being seated the regular order during the tests, the students were not allowed to interact with them. The tests were marked by the next lecture and the results announced in the following lecture.

Determining Personal Improvement Points: Personal improvement points were determined by subtracting the last base score from the subject test score. The personal improvement point is between 0 and 10; and the "Improvement Point Determination Criteria" are given in Table 2. Moreover, the students who had very high grades received bonus points.

Table 2. Improvement point determination criteria.

Test Score	Personal Improvement Point
More than 10 points lower than the initial score	0
0-10 points lower than the initial score	10
1-10 points higher than the initial score	20
More than 10 points higher than the initial score	30
Error-free exam	30
BONUS (the one that increased the initial score by at least 20 points)	10

Team Award: The team score was defined as the average of the personal improvement points of all the team members. In line with the criteria defined before (Table 3), team awards were defined according to the team score and the successful teams of the week were announced in bulletins. And at the end of the unit, the successful teams and successful students were awarded with certificates of achievement.

Table 3. Score criteria for team award.

Criterion	Award
15 – 19	Good Team
20 – 24	Very Good Team
25 and higher	Perfect Team

In the control-1 group, the unit "Force and Motion" was discussed in line with the current Science and Technology academic program based on the constructive approach. The lecture plans, prepared according to the process steps of the 5E model with the of the teacher's guideline, were used as teaching material.

And the control-2 group, the unit of "Force and Motion" was discussed in line with traditional teaching methods. When preparing the lecture plans, the process steps of teaching through presentation

used in traditional teaching methods were used. In the lectures where basic principles and concepts were taught, the narration, question-answer and discussion methods were used.

Analysis of Data

In this study, parametric tests that using in cases where the size of each unit of the sub-groups is 15 and higher (Büyüköztürk, 2010) were used in order to test whether there was a significant difference in terms of self-efficacy, test anxiety and academic achievement between the experimental group and the control groups.

In line with this, One-way variance analysis (ANOVA) was conducted to determine whether the pre-test and post-test averages differentiate based on the groups or not. In order to determine among which groups this difference could be seen, the Dunnet C multiple comparisons test used in cases where variances are not homogenous (Xu, 2005) and the LSD multiple comparison test used in cases where sample groups are not equivalent (Büyüköztürk, Bökeoğlu & Köklü, 2009) was used. On the other hand, to determine the effect size of the independent variable, the eta-square (η^2) value was checked. The obtained eta square values were "0.01", "0.06" and "0.14", and these were interpreted as "small", "medium" and "large" effect sizes (Büyüköztürk, 2009).

The 0.05 significance level was accepted in the interpretation of the results.

Results of Research

For determining whether there is a statistically significant difference between the pre-test score averages of groups in self-efficacy scale, one-way variance analysis (ANOVA) was conducted. The results of this variance analysis (ANOVA) are given in Table 4.

Table 4. ANOVA results based on self-efficacy scale pre-test scores of experiment and control groups.

	N	$\bar{X}$	d		SS	df	MS	F	p
Experiment	29	3.15	0.32	Between	0.04	2	0.02	0.204	0.816*
C-1	26	3.10	0.38	Within	8.64	81	0.11		
C-2	29	3.15	0.27	Total	8.69	83			

** p<0.05*

When the results on Table 4 were examined, it was seen that the classes did not display any significant difference in the self-efficacy scale pre-test according to the groups of students in the experiment and control groups (F = 0.204, p>0.05). The score averages of the experiment and control groups are close in the self-efficacy scale.

The results of ANOVA was conducted for determining whether there is a statistically significant difference between the post-test score averages of the groups in the self-efficacy scale, are given in Table 5.

Table 5. ANOVA results based on self-efficacy scale post-test scores of experiment and control groups.

	N	$\bar{X}$	d		SS	df	MS	F	P	Difference
Experiment	29	3.56	0.50	Between	3.90	2	1.95	10.369	0.000*	Experiment/C-1
C-1	26	3.03	0.49	Within	15.24	81	0.189			Experiment/C-2
C-2	29	3.27	0.27	Total	19.14	83				

**p<0.05*

In the examination of Table 5, a significant difference was observed in the self-efficacy scale post-test according to the groups of students in the experiment and control groups (F = 10.369, $p<0.05$, $\eta^2= 0.203$). According to the Dunnet C multiple comparisons test results; it was concluded that the self-efficacy perceptions of the groups differentiate significantly in favor of the experiment group where the STAD technique was used compared to the control groups where traditional teaching methods and the current academic program were used. There was no significant difference between control-1 group where the current academic program based on constructivism was applied and control-2 group where traditional learning methods were applied. Further, when the eta-square value was considered, the applied techniques had a large effect on the self-efficacies of the students.

For determining whether there is a statistically significant difference between the pre-test score averages of groups in test anxiety scale, the one-way variance analysis (ANOVA) was conducted and the results are given in Table 6.

Table 6. ANOVA results based on test anxiety scale pre-test scores of experiment and control groups.

	N	$\bar{X}$	d		SS	df	MS	F	p	Difference
Experiment	29	2.89	0.53	Between	2.07	2	1.035	2.251	0.112*	NO
C-1	26	2.91	0.76	Within	37.24	81	0.460			
C-2	29	3.23	0.73	Total	39.31	83				

** p<0.05*

When the results on Table 6 were examined, it was seen that the classes did not display any significant difference in the test anxiety scale pre-test, according to the cluster of students in the experiment and control groups (F = 2,251, $p>0.05$). The score averages of the experiment and control groups are close in the test anxiety scale.

For determining whether there was a statistically significant difference between the post-test score averages of the groups in test anxiety scale, the one-way variance analysis (ANOVA) was conducted, and the results are given in Table 7.

Table 7. ANOVA results based on test anxiety scale post-test scores of experiment and control groups.

	N	$\bar{X}$	d		SS	df	MS	F	p	Difference
Experiment	29	2.53	0.47	Between	7.31	2	3.66	10.79	0.000*	Experiment/C-2
C-1	26	2.83	0.52	Within	27.46	81	0.34			C-1/C-2
C-2	29	3.24	0.72	Total	34.77	83				

** p<0.05*

In the examination of Table 7, a significant difference was observed in the test anxiety scale post-test according to the cluster of students in the experiment and control groups (F = 10.790, $p<0.05$, $\eta^2= 0.210$). According to the LSD multiple comparison test results, it was concluded that the test anxiety of the groups differentiate significantly in favor of control-1 group where traditional teaching methods were applied, compared to experiment group where the STAD technique was applied, and control-2 group where t the current academic program was applied. Moreover, no

significant difference was found between control-1 group where the current academic program based on constructivism was applied and the experiment group where the STAB technique was applied. Further, when the eta-square value was considered besides these, it was seen that the applied teaching methods had e a considerable influence on the test anxiety of the students.

For determining whether there was a statistically significant difference between the academic achievement test scores of the groups, the one-way variance analysis (ANOVA) was conducted, and the results are given in Table 8.

Table 8. ANOVA results based on academic achievement post-test scores of experiment and control groups.

	N	$\bar{X}$	d		SS	df	MS	F	P	Difference
Experiment	21	17.62	4.88	Between	222.69	2	111.35	3.530	0.035*	Experiment/ C-2
C-1	24	16.37	6.61	Within	2081.91	66	31.55			
C-2	24	13.33	5.10	Total	2304.61	68				

** p<0.05*

When Table 8 was examined, it was seen that there was a significant difference only between the experiment and control-2 groups in respect of the academic achievement scores ($F=3.530$, $p<0.05$, $\eta^2= 0.097$). According to the LSD multiple comparison test results, it was concluded that the academic achievements of the groups differentiate significantly in favor of the experiment group where the STAD technique was used, compared to the control group where traditional teaching methods were used. Also, no significant difference was found between control-1 group, and the experiment group and control-2 group where traditional teaching methods were used. Alternatively, when the eta-square value was considered besides these, it was seen that the applied teaching methods had a moderate level effect size on the academic achievements of the students.

As a result, it can be said that the education method based on STAD increases the academic achievements of the students, compared to the education based on traditional teaching methods.

Discussion

The purpose of study was to investigate the effect of STAD technique used in Science and Technology education on self-efficacy, test anxiety and academic achievement. According to results of analysis, it was seen that education based on STAD techniques has a higher effect on the self-efficacy perceptions of these students compared to education provided with the current academic program based on constructivism and the education provided with traditional teaching methods. The STAD technique positively increases the self-efficacy perceptions of the students.

The influence of cooperative education on performance experience, which is the most important determinant of self-efficacy, is fairly high (Johnson & Johnson, 1999). In cooperative teamwork, each student has an important contribution in the sense of both supporting the teamwork, and also winning points for its team because team scores are calculated based on the personal improvement points of the team members. Therefore, the individuals feel proud of themselves because of their contribution to the success of the team and their contributions are supported and rewarded by their teammates and the teacher. Thus, the students' belief in their own ability in the point of taking responsibility in the thing they learn, in other words their self-efficacy perceptions increase (Lee, Lim & Ng, 1997; Nora & Zhang, 2010). Nichols (1996) and Vaughan (2002) also stated that the education provided with STAD technique also positively affects the psychological elements such as motivation and attitude and also the self-efficacy perceptions of the students.

So, it solves the problem of affective education that has been neglected since it is hard or even impossible to provide with other methods (Hänze & Berger, 2007).

It was seen that education with the STAD technique is more effective in reducing test anxiety of students compared to traditional teaching methods, and that there is no significant difference between this technique and the education provided with the current academic program based on constructivism. Bunun yanında yapılandırmacılığa dayalı mevcut programa göre verilen eğitim, geleneksel öğretim yöntemine göre sınav kaygısını azaltıcı etkiye sahiptir.

The fact that the cooperating learning method decreases the anxiety levels of students compared to traditional teaching method was supported by studies from (Açıkgöz, 2008; Johnson & Johnson, 2002; Slavin, 1982). According to the findings obtained in the study, test anxiety and pre-exam study behaviors of the students affected by taking personal exams after each subject, and working constantly on worksheets was an expected outcome for the students of the experiment group where the STAD technique was used. Oludipe and Awokoya (2010) explained this outcome as follows: "Achievement anxiety is explained by the relationship between study behaviors and academic achievement. In traditional classes, when a student is called upon to answer a question by the teacher, the entire class focuses on that student. A mistake made or a wrong answer will attract the attention of the entire class. Consequently, such experiences create shame and anxiety in the student. However, when students work with groups in the cooperative learning method, the attention is distributed between the group members. A mistake or misunderstanding of a student is the responsibility of the entire group. Thus, the student cannot be criticized personally and his/her anxiety level decreases." In one study, Yamarik (2010) states that the students who work in cooperative groups learn more in a shorter time period compared to the times when they work individually, develop positive attitudes towards the method and the course as their academic achievements increase, and thus their anxiety levels decrease.

It has been observed that the researchers focus on two main ideas regarding the source of test anxiety. The first is that students with inadequate learning and study skills have high test anxiety levels. The students with poor learning and study skills don't have the organizational skills required to remember the information; thus, this causes them to feel greater anxiety in a test environment. In fact, the problem was not the tests per se for this group of students, but the revision time allocated prior to this test. Secondly, the negative thoughts the students have during the test. Negative experiences cause some students to think negatively about themselves and create a prejudice and a learned helplessness in the form that the students who have concerns not related to the test during the test will fail (Schaffner & Schiefele, 2007). The fact that the current academic program, which uses a learning method based on constructivism and the STAD technique (based on placing great attention on active learning, enabling the individual to form connections between existing information and new information, and focusing on how to obtain relevant information) emphasizes that learning is possible with unique learning tasks (Ergin, 2007) supports the findings that teaching methods applied to experiment and control-1 groups decrease the test anxiety levels of the students.

The effect of the STAD technique on the academic achievements of the students is greater than with traditional teaching methods. However, there is no difference when compared to the education provided based on the current academic program in line with the idea of constructivism. The STAD technique enhanced the academic achievements of the students compared to the traditional method.

It is well documented that cooperative learning improves academic achievement at all academic levels more than traditional teaching methods (Ascher, 1986; Balfakih, 2003; Johnson & Johnson, 1989; Slavin, 1982). Yamarik (2010) determined that students who work in groups are more successful in tests when compared to students working individually; Yamarik gave three reasons for this. The first reason is not hesitating to ask questions and correcting mistakes since student-student and student-teacher interaction is higher than in the traditional classes. Secondly, students working in cooperative groups are able to complete their gaps in their knowledge by correcting the mistakes of each other while preparing for tests. Finally, students working in groups

believe working with other group members while preparing for tests is more fun and educative and develops a positive attitude towards both the course and the method. These three factors explain the effectiveness of this technique in improving academic achievement.

There was no statistically significant difference between the academic achievement levels of the experiment and control-1 groups. The cooperative learning method being one of the active learning techniques based on the constructive approach could be the reason why there is no significant difference between the experiment and control-1 groups (Yoder & Hochevar, 2005). No statistically significant difference was found between control-1 and control-2 groups. When the findings from this study were analyzed, it was observed that even though the academic achievement average for the constructivism based current program is high, the difference was not that significant when compared with traditional teaching methods. These findings are in line with the findings from the study conducted by Liang and Gabel (2005).

Conclusions

According the results of study, it was seen that education based on STAD techniques has a higher effect on the self-efficacy perceptions, academic achievement and reducing test anxiety of students. The brief and subject-oriented presentation by the teacher before the team work enables the students to listen carefully to this information that they will benefit from in tests and team work carefully, and prevents them from getting bored by the lecture quickly. It was observed that this practice is effective: re students' attitude towards the course. Moreover it was observed that personally announcing improved students and successful teams issuing them with weekly bulletins and rewarding them created a positive increase in the study performances, thus motivating students until the next personal test. The cooperative learning method not only improves academic achievement in high level complex learning activities, but also increases the trust that students feel towards each other, and students' attitudes and interest towards the subject. Therefore, science teachers should be aware of the importance of improving the students' science process skills and positive attitudes toward science, because they are strong predictors of the students' achievement in science.

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