

Full Length Research Paper

Use of jigsaw technique to teach the unit "science within time" in secondary 7th grade social sciences course and students' views on this technique

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The aim of this study is to apply the jigsaw technique in Social Sciences teaching and to unroll the effects of this technique on learning. The unit "Science within Time" in the secondary 7th grade Social Sciences text book was chosen for the research. It is aimed to compare the jigsaw technique with the traditional teaching method in teaching of the unit. The sampling of the research was conducted with total of 53 students, in two different classes, studying in 7th grade of a secondary school located in the Erzurum province of Turkey during 2014 to 2015 academic years. Pre-test/Post-test control group design was used as a method in the research (Karasar, 2006). A control group was formed with students randomly picked from both classes, and the rest of the students were the experimental group. While the lessons were taught to the control group using the traditional teaching method, cooperative learning technique (jigsaw technique) was used on the experimental group. The lessons were taught to the control and experimental group by the researcher. To determine prior knowledge of students' in both groups, Prior Knowledge Test (PKT) was given, and Science within Time Achievement Test (swtAT) was administered to identify their conceptual understanding in the unit "Science within Time". Later, Jigsaw Opinion Scale (JOS) was given to the students in the experimental group and their opinions on the implementation of jigsaw technique were identified. At the end of the research, to determine students' achievement, swtAT was administered to all of the students (control and experimental group) again as the post-test and the same test was applied again as the retention test to examine the retention of knowledge after eleven weeks. The achievement level of students obtained from both the traditional teaching method and cooperative learning using jigsaw technique was compared with this research. When the statistical analysis of the research is examined, the achievement level of students in the unit "Science within Time", which was taught with the jigsaw technique, has a significant difference in favor of the experimental group.

Key words: Cooperative learning, Jigsaw technique, time and science, Social Sciences.

INTRODUCTION

"Social Sciences teaching sheds light on people's lives. It is acknowledged that the need to reorganize this course

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emerges; because students' skills should be developed so that they can have access to information, solve their problems, and develop their decision making skills. In line with all these needs, new approaches in teaching programs have become more intriguing in parallel with the developments in the world. Progress is being made in enabling students' active participation in life, to make right decisions, to solve their own problems by keeping their existing experiences and the value of information in mind. Thus, it is attempted to accomplish a student – centered new understanding balancing knowledge and skill, enabling environmental interaction by considering individual differences and own experiences (MEB 2006).

This method is known as “cooperative learning, work group, collaborative learning, peer learning, peer teaching, team learning, team work, collective learning, learning communities, reciprocal learning, study circles and study group” abroad; but in the country of Turkey it is mainly known as Collaborative learning method (Kardaş, 2015). Academic Controversy technique is one of the important techniques used in “Collaborative Learning” (Kardaş, 2015). The most important feature of the Collaborative learning method is that students work and discuss together, they maximize their own learning and their friends' learning by helping each other (Şahin et al., 2011). Collaborative learning is a learning and teaching approach in a learning environment and activities fit for purpose in which students form small heterogeneous groups and work together on a topic or problem determined (Kardaş, 2014). Collaborative learning is a learning and teaching approach in a learning environment and activities fit for purpose in which students form small heterogeneous groups and work together on a topic or problem determined (Kardaş, 2013b).

Cooperative learning technique provides students with positive feelings to one another, and increases motivation (Saban, 2004), teaches students to respect thoughts of one another, how to be tolerant and establish empathy and help them learn how to discuss (Senemoğlu, 2001). It also reveals a different opinion (Davidson and O'Leary, 1990), besides it is a learning method that makes teaching-learning environment fun and leaves permanent mark in the learning process (Tan et al., 2002). Cooperative learning is a type of learning that a subject is learnt with small heterogeneous groups (4 or 7 members) and meanwhile in which group members attempt to teach each other. The methods and techniques of cooperative learning enhance students' self-confidence and in this view, students actively join the learning actions (Maden, 2010).

In cooperative learning method, teacher is only a guide whereas active participant is student. Cooperative learning method allows teachers to respond quickly to students who have a hard time understanding the subject; in this way problems concerning students who do not listen or make trouble can be avoided (Karaca, 2005).

Process steps of collaborative learning technique can

be summed as:

“Determining educational targets, forming the groups, dividing students into the groups, preparing the educational environment, giving roles to the group members, determining materials about the subject, distributing group topics, reporting the academic work, informing about the evaluation of the individual and group success rate, the groups' preparing for the topics, termination of the studies and evaluation” (Kardaş, 2013a).

The features that distinguish collaborative learning from other learning methods are:

- a. Positive dependency
- b. Face to face interaction
- c. Individual responsibility
- d. Social skills and
- e. Evaluation of the group process.

These features of collaborative learning approach are regarded as five basic principles that ensure comprehension of the learning based on collaboration and that enable collaboration among the group members (Maden and Durukan, 2011). Cooperative learning is not just a group of students sitting together and studying separately or a student's doing the whole work unaided. It is clear that splitting students into groups and expecting them to study together will not improve learning or collaboration. It is necessary for the sake of effective implication of the technique that students are motivated to study together (Gelici and Bilgin, 2011). Cooperative learning method not only enables students to effectively convey their thoughts in group debates with features such as clarity, awareness, rationality, naturalness, expression and style but also teaches some methods such as free debate, question and answer method, large and small group debates, fish bowl debate strategy, seminar, and brain storming (Bolling 1994; Gardener and Korth, 1996; Gömleksiz, 1993; Keig and Waggoner, 1995; Mills, 1991; Schaible and Robinson, 1995). In addition to cooperative learning, it is an umbrella term for a variety of educational approaches involving joint intellectual effort by students, or students and teachers together (Maden, 2011).

The studies carried out show that cooperative learning method has fundamental effects on cognitive and affective learning outputs, and processes such as retention, transfer, high-level perception, friend relationships, standard education for the disabled, self-esteem, attitude, anxiety and control but mainly on success (Açıkgöz, 1992; Avşar and Alkış, 2007). While numerous studies have been conducted in the world on cooperative learning method, it has gained importance as a teaching method in Turkey recently (Baykara, 1999). It has been proven that at the bottom of active learning

methods, there is listening, writing and speaking skills and that it has positive effects on cognitive and affective learning products. In another words, it has been defined as a teaching method that brings collaboration forward, highlights social interaction, answers students' needs, and enables students to use their cognitive skills and to take decisions on their learning processes (Yıldız, 1999).

A lot of studies were made in the fields of Turkish, Science, Mathematics, Geography and Music which examines the effects of cooperative learning methods especially on approaches related to subject area. Because these studies are related with research subject, it is dealt in terms of demonstrating activity of cooperative learning method (Carpenter, 1982; Klein, 2000; Mattingly and Vansickle, 1991).

METHODOLOGY

This section presents detailed information on this study's research model, data collection techniques and analysis of collected data.

Model

Pre-test, post-test and control group design were taken as a model to compare the effects of two different teaching methods on the achievement level of 7th Secondary grade students at Social Sciences course in the unit "Science within Time" and also to identify students' views on cooperative learning using jigsaw technique introduced to teach (McMillan and Schumacher, 2001).

Sampling

Sampling of the research consists of 53 7th Secondary grade students studying in two different classes at a school in the Erzurum province in 2014 to 2015 academic years. One of the classes was randomly selected as the experimental group (n=25), in which cooperative learning method was employed while the other was the control group (n=28) in which the traditional teaching method was applied.

Problem sentence

With this research, the study aimed to seek answers for the following problems.

1. What kind of technique is cooperative learning technique (jigsaw technique) which is a different learning technique?
2. What are the differences of cooperative learning method compared with other teaching methods?
3. What are the attitudes of students towards cooperative learning method (jigsaw technique)?

Data acquisition tools

Initially, Prior Knowledge Test (PKT) was used to identify students' knowledge of Social Sciences course. Later, Science within Time Achievement Test (swtAT) was applied to measure students' knowledge of the unit "Science within Time". Jigsaw Opinion Scale (JOS) was given after teaching to the students in the experimental group to specify their views on the method applied. In addition, to

make a comparison between prior knowledge of the students in the control group and the experimental group, Social Sciences grades on school report cards were used.

Prior knowledge test (PKT)

PKT consists of 25 multiple choice questions formed from various sources such as questions from previous examinations held by the Ministry of National Education, preparation books for high school, Social Sciences course books with the aim of identifying students' prior knowledge of science, discovery, renaissance, reform, exploration, change, civilization, and other main terms used in Social Sciences course which help students learn the unit "Science within Time". For the sake of reliability and validity degree of the test, opinions of academic members in Department of Social Studies Education, of senior and experienced teachers were received. In order to measure reliability and validity degree of the test, the test was administered to 50 students studying in 8th grade of a secondary school located in the Erzurum province and it was decided to remove 5 questions as they decreased reliability of the test. The internal consistency coefficient (Cronbach Alpha) of the 20-question test prepared for PKT was calculated as 0.74. Prior Knowledge Test was applied to the control and experimental group at the same time. While each correct answer in PKT was scored as 1 point, incorrect or unanswered questions were scored as 0 point. PKT scoring was calculated as such.

Science within time achievement test (swtAT)

The data for academic achievement of the students participated in the research was collected by the swtAT prepared by the researcher. The content of the test is created by using secondary 7th grade Social Sciences course books, preparation books for high school, test questions in TEOG (Transition to Basic Secondary Education) and DPY (State Public Boarding and Scholarship Examination) examinations held by the Ministry of National Education. After a meticulous study, zBT consisted of 25 multiple choice questions, was prepared. For the sake of reliability and validity degree of the test, opinions of academic members in Department of Social Studies Education, of senior and experienced teachers from various schools were received.

Experts stated that questions in swtAT would be appropriate to be used to measure students' knowledge of the unit "Science within Time". To identify reliability of the achievement test prepared, it was applied to 58 8th grade students at Şair Nef'i Secondary School in Yakutiye district of Erzurum Province. 5 questions were removed as they decreased reliability of the test. The internal consistency coefficient of the 20-question swtAT was calculated as 0.85. While each correct answer in swtAT was scored as 1 point, incorrect or unanswered questions were scored as 0 point. The achievement level of students was assessed with the scores obtained from the test.

Jigsaw opinion scale (JOS)

JOS was used with the aim of determining views of students in the experimental group on jigsaw technique that was applied throughout the learning process of the unit. This scale was taken from Uğur (2009) and the internal consistency coefficient of the scale was calculated as 0,74. JOS was applied as the post-test to the experimental group studying with the jigsaw technique. The scale was composed of fifteen items, fourteen of which included multiple choice answers (Very Effective, Quite Effective, Equally Effective, Less Effective, Much Less Effective) according to Likert scale, and one open ended question for students' further views.

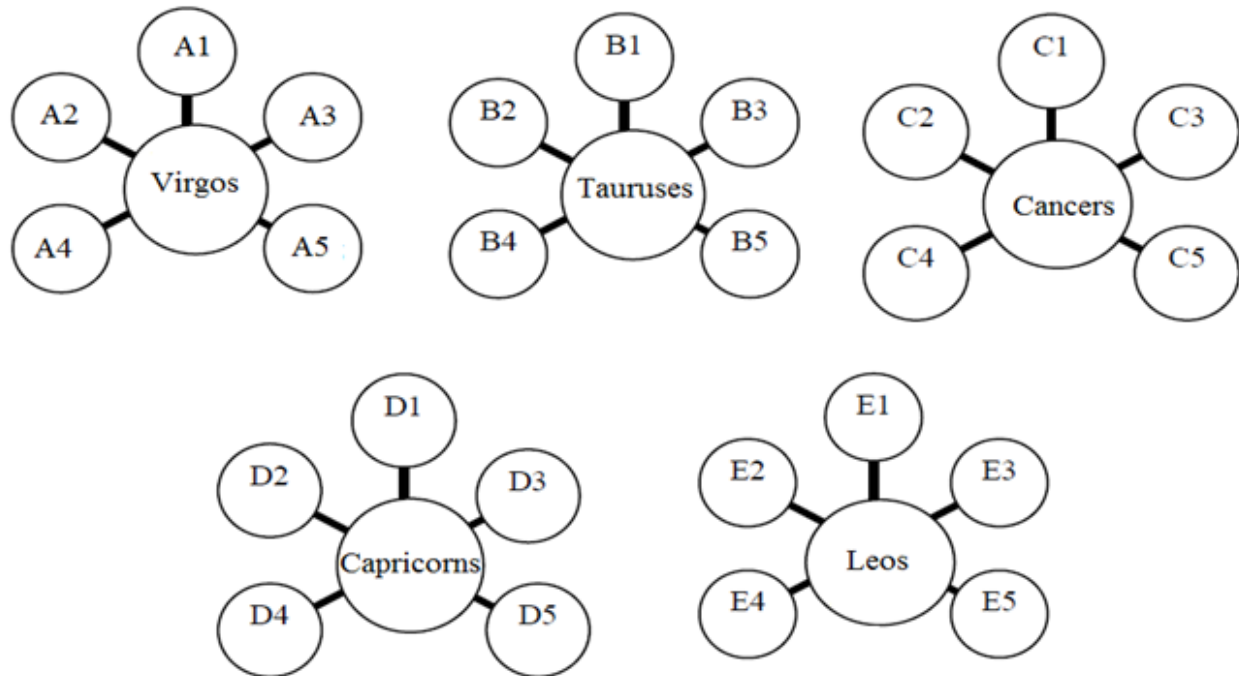


Figure 1. The home groups sharing the main subjects in the science within time unit.

Data analysis

In the research, descriptive statistics obtained from PKT, the pre-test, post-test, and retention test of swtAT were calculated and analyzed by using an independent t-test. In addition, independent samples t-test was performed to compare Social Sciences grades, at the end of 6th grade, on school report cards of the students in the control group and the experimental group. Data obtained from JSO was assessed based on qualitative and quantitative analyses.

Implementation

In this section, the implementations of jigsaw technique that is used in cooperative learning method and traditional teaching method are given. In addition, how these methods were used during teaching of the unit "Science within Time" is discussed. To determine achievement levels of students who participated in the research in "Science within Time" unit of the Social Sciences course, swtAT was administered to all of the students, and to determine prior knowledge of students' in both groups, Prior Knowledge Test (PKT) was applied as pre-test to both groups before the research.

In the experimental and control group, the unit "Science within Time" was taught by the researcher three hours a week to cover five weeks. The unit "Science within Time" in the secondary 7th grade Social Sciences text book is composed of the following subjects: Geographical Discoveries, Renaissance, Reform, Age of Enlightenment, and Industrial Revolution. Lesson plan was organized in detail after breaking five main subjects forming the unit into minor groups.

As can be seen in Figure 1, the class, to which jigsaw technique was applied was, was divided into five groups. Each group was formed by five students. Each group was asked to choose a group title and president. Groups chose their titles as 'Virgos', 'Tauruses', 'Cancers', 'Capricorns', and 'Leos'. Afterwards, the following subjects were given to the five home groups:

1. Geographical Discoveries
2. Renaissance
3. Reform
4. Age of Enlightenment and
5. Industrial Revolution.

Each group member was given a subtopic by the group president to research, learn and can teach to other own group members.

As can be seen in Figure 2, the jigsaw groups were formed from the students given the same subtopic in each home group. In the home groups, students in A1, B1, C1, D1 and E1 groups researched on the causes of geographical discoveries, the development of exploration, lands discovered and the results; students in A2, B2, C2, D2 and E2 groups researched on the birth of Renaissance, its spread and effects on Europe; students in A3, B3, C3, D3 and E3 researched on the third subject titled the cause and results of the Reformation; students in A4, B4, C4, D4 and E4 groups researched on the fourth subject titled echoes of Enlightenment Era to Europe; and students in A5, B5, C5, D5 and E5 groups researched on the fifth subject titled Industrial Revolution and developments in Europe.

After completing exploratory studies of subjects, students completed the three-hour lesson by discussing, exchanging opinions, teaching their subject to one another, and preparing subject report to teach their specific subjects to other group members. After completing their studies in the jigsaw groups, students returned to their home groups and taught their subtopics to their own group members in the third week during three-hour lessons. After group members in the home groups completed teaching their subtopics to one another, the first main topic was completed. The whole unit was taught in this way by finishing other subtopics as well.

The lessons in the control group were carried out with the traditional learning method, that is, teacher-centered. The teacher

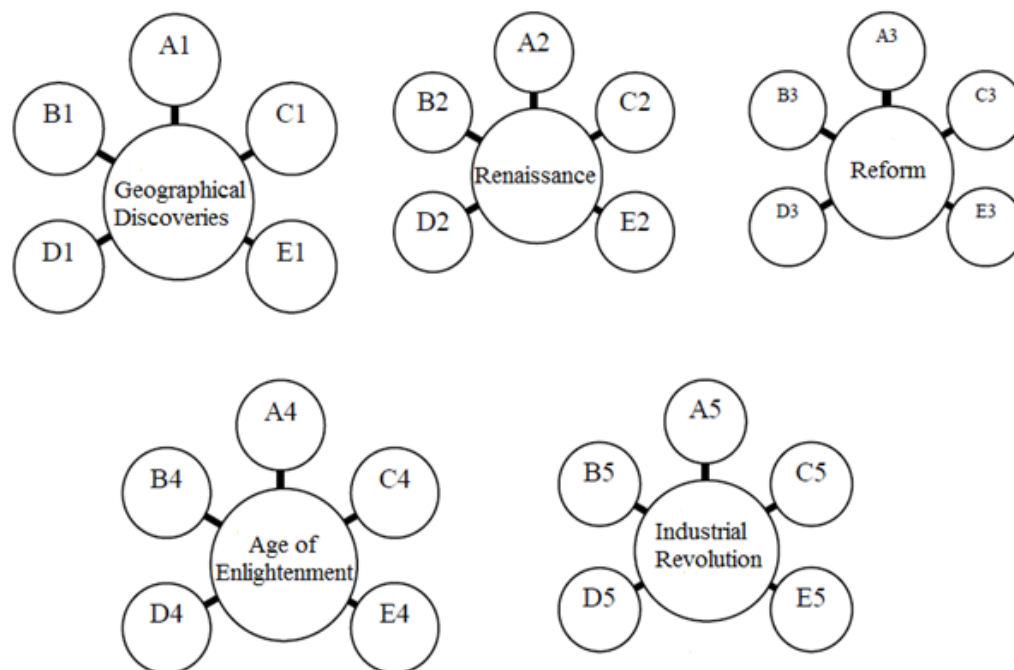


Figure 2. Jigsaw groups forming the main topics in the unit science within time.

Table 1. Descriptive statistics for scores of pkt and swtat pre-test and the results of independent t-test.

Tests	Groups	N	\bar{X}	SD	DF	t	p
PKT	Experimental	25	46.24	11.493	51	0.712	0.480
	Control	28	44.14	9.946			
swtAT	Experimental	25	47.36	11.70	51	0.637	0.527
	Control	28	45.57	8.66			

Maximum scores for PKT and swtAT: 15 and 25 respectively.

prepared a three-hour lesson plan by using the textbook, workbook, teacher guidebook, and other resources. There were also some parts in the lesson plan related to what would be taught in the lesson, examples that would be given, and the method that would be used. During the lesson, question and answer method and lecturing were preferred. Activities about some topics were carried out by the teacher by demonstrating. After completing the explanation on the topic, the teacher asked questions to determine whether the topic was comprehended or not.

After teaching of the unit, swtAT was administered to all of the groups as post-test. swtAT was applied as retention test after 11 weeks to determine the effects of cooperative learning jigsaw technique and of traditional teaching method on retention of knowledge.

FINDINGS

To determine prior knowledge of students' in both groups, Prior Knowledge Test (PKT) was administered, and

before teaching the unit "Science within Time", swtAT was given as pre-test to identify their knowledge level on these topics. Descriptive statistics obtained from these tests were calculated and independent samples t-test was performed to see whether there existed a significant difference among the mean scores. The results obtained are given in Table 1.

Based on the scores in Table 1, there is not a statistically significant difference between scores of PKT and of swtAT. (For PKT $t(51) = 0,712$; $p > 0,05$ and for swtAT $t(51) = 0,637$; $p > 0,05$). In conclusion, it can be seen that prior knowledge of students and their knowledge level in the unit Science within time are equal in both groups. As given in Table 2, this similarity is supported by the results of independent t-test: $t(0,077)$; $p > 0,05$.

After teaching of the unit Science within Time, swtAT was administered to all of the groups as post-test, and

Table 2. Descriptive statistics and the results of independent t-test according to social sciences grades on school report cards of 6th grade.

Groups	N	\bar{X}	SD	DF	t	p
Experimental	25	63.56	7.78	51	0.077	0.939
Control	28	63.39	7.92			

Table 3. Descriptive statistics and the results of independent t-test relevant to scores of swtat post-test and retention test.

Tests	Groups	N	\bar{X}	SD	DF	t	p
Post-test	Experimental	25	73.60	9.59	51	9.76	0.001
	Control	28	51.28	6.97			
Retention Test	Experimental	25	67.68	7.47	51	9.74	0.001
	Control	28	49.85	5.81			

Table 4. Students' opinions obtained from JOS.

Categories	Students' opinions
85-100%	A highly effective method; Student-centered; Builds a bond of friendship in the group; Gives self-confidence prominence; A democratic environment between student and teacher; Attracts students' attention to the lesson
75-85%	A sense of comfort brought by the use of a different teaching method, b) Increases academic achievement; Dialogue, understanding and being understood; Mutual love, respect and tolerance; Increases student motivation towards lessons
Less than 75%	Regular and strong communication with friends; Develops a sense of responsibility

the same test was applied again as retention test after 11 weeks. Descriptive statistics of scores obtained were calculated, and T-test was applied to see whether there was a significant difference among the mean values. The results obtained are given in Table 3.

Based on the data in Table 3, there is a significant difference in the mean scores of the control and experimental group's swtat post-test. $t(51) = 9,76$; $p < 0,05$). The results thus show that the experimental group to which cooperative learning jigsaw technique was applied is more successful than the control group which was taught with the traditional teaching method according to scores of swtat post-test ($X_{\text{Experimental}} = 73,60$; $X_{\text{Control}} = 51,28$). Looking at scores of the retention test in Table 3, there is a significant difference between the experimental and control groups in terms of retention of knowledge after 11 weeks ($t(51) = 9,74$; $p < 0,05$). Based on the results, it can be said that cooperative learning jigsaw technique is more effective than the traditional teaching method in terms of making knowledge last longer.

The results obtained from JOS given to the students in the experimental group to identify their opinions on the implementation of jigsaw technique are given in the next

table. Students' opinions and feelings on jigsaw technique were combined into three categories. According to positive replies, the first category was assessed as 85-100 %, the second category as 75 to 85%, and the third one as 65 to 75%. Based on this assessment, students' opinions are given in Table 4.

According to students' opinions given in Table 4, the implementation of the jigsaw technique in the class is effective, lasting and beneficial with regard to academic achievement.

DISCUSSION AND CONCLUSION

Cooperative learning jigsaw technique not only increases academic achievement in especially high-level perception, but also builds trust among students, and contributes positively to students' attention and attitudes towards lessons. Compared to other methods, it has been proven by researches that cooperative learning method has more positive effects on cognitive and affective learning products. Thanks to the jigsaw technique, every member in the group knows that without the achievement of other members, he/she will be unable to succeed; for this

reason he/she helps other members learn. It thus increases solidarity and cooperation.

It can be seen that there is not a significant difference between the experimental group to which cooperative learning jigsaw technique was applied and the traditionally taught control group in terms of scores of PKT and of swtAT pre-test; that is to say, before the implementation both groups were equal (Table 1). Students' Social Sciences grades on school report cards of 6th grade (Table 2) were examined and no significant difference was determined, which reveals that knowledge level of students in the groups before the implementation was equal.

At the end of the implementation that lasted 11 weeks, swtAT scores of the experimental group were higher than scores of the control group. It was proven by the research that the academic achievement level of the experimental group, to which the jigsaw technique was applied, was higher than achievement level of the control group. The results obtained from our research show parallelism with the studies conducted by using cooperative learning method such as the studies of Bilgin (2005), Demirel (2007), Doğan (2010), Gök (2006), Kincal (2007), Kırbas (2014) and Yıldız (1999). There are many factors affecting students' success rate in the experimental group such as group communication and interaction, enthusiasm to work together, high motivation, a sense of responsibility, dialogue, and a desire to reach a common goal.

Academic achievement test was applied to the experimental and control group after 11 weeks as retention test. Retention of knowledge was found to be higher in the experimental group (Table 3). When the achievement and retention tests were analyzed, it was determined that permanent change was higher in the experimental group to which cooperative jigsaw technique was applied. In the cooperative learning environment, students interact; and experience cognitive and social learning environment with intense mental activities; they also possess positive feelings for one another, realize that they have individual differences in the class. They stop feeling themselves isolated and alone during the learning-teaching process; they thus learn by experiencing and performing.

After the implementation of the technique, JSO was administered to the experimental group to determine their opinions on the jigsaw technique; and it was understood from the results obtained from the research that students had positive thoughts about the method (Table 4). A similar study was conducted by Doğan (2010), as well. According to the research, it was identified that the jigsaw technique in teaching was more effective, efficient, lasting, and enjoyable than the traditional teacher-centered approach.

SUGGESTIONS

The following suggestions can be made in the light of the

findings and results obtained from the research:

1. First of all, teachers should have adequate information on the method by doing research on cooperative jigsaw learning method and by examining the studies conducted.
2. Teacher need to be prepared beforehand for the activities that involve cooperative learning method. Before the implementation of cooperative learning method, the content of the subject that will be taught should be appropriate for this method.
3. Students should definitely be informed of cooperative learning jigsaw method and techniques beforehand. Each student should be given adequate information on the technique and the activities to be performed.
4. Teachers should set the right targets. As the jigsaw technique is a group study, the teacher should observe students' studies and intervene whenever necessary, in the right place at the right time.
5. Cooperative learning method should be used at secondary schools in Social Sciences lessons if there are enough resources and time.

Conflict of interests

The author has not declared any conflict of interests.

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