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Teaching the Subject "Sets" with the 'Dissociation and Re-Association' (Jigsaw)

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ABSTRACT

In recent educational trends establishing learning environments in which students can express themselves is in the foreground. In this study, it is targeted to teach subject 'Sets' by using the 'jigsaw technique', one of the techniques of the cooperational teaching method. For this purpose, the subject 'Sets' is handled with nineteen 6th grade students of a primary school in Kocaeli in three lessons. The study is a qualitative status study. In this context, the obtained data is analyzed, interpreted and reported descriptively. At the end of the study, it is seen that the students noted enjoyed the cooperation, understood the subject better by listening to the subject repeatedly and that noticed that they needed to study harder and they enjoyed from cooperating with their friends. According to these results, several suggestions have been made to future researchers. It may be suggested that it might be useful to study in future whether the jigsaw technique has a meaningful effect on the logical thinking and critical thinking skills of the students or not, to study its effects on the problem solution processes of students and on their upper cognitive skills.

Keywords:
Cooperative learning, jigsaw technique, home groups, jigsaw groups, sets subject

Introduction

The idea of cooperation, which is as old as human history, draws attention as a teaching method since the beginning of 1900s. 19th century scientist Glonel was the first, who studied and used this method, having its roots till Plato.

Dewey was among the persons who recommended cooperative learning (Sönmez, 2008). The cooperative learning is a method in which concepts are learned at a high order level and students transmit their knowledge to their friends. The cooperative learning style, consisting of small groups which are working together for a common purpose, not only increases the students' sense for responsibility, but also improves their social skills (Gömleksiz, 1993; Mallinger, 1998; Slavin, 1990; Siegel, 2005). Cooperative learning is a teaching method depending on a system in which students are working in small groups for a common purpose by helping each other to learn (Açıkgöz, 2003; Ekinci, 2010). Cooperative learning practices create opportunities to students to learn sharing by supporting each other, to make decisions about their own learning by acting independently and to interact with their friends. With this teaching method, influencing the classroom atmosphere and friendship relations positively, success and learning motivation is increasing (Sampson & Clark, 2008).

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Specific definitions have been made by drawing attention to some features of cooperative learning by various researchers. According to Işık, Tarım and İflazoğlu (2007) is cooperative learning a learner centered method at which students take an active role. While Vaughan (2002) defines cooperative learning as the instructional use of small heterogeneous groups of students who work together, Bowen (2000) defined it as a teaching approach in which students are working for a common purpose to help each other to learn an academic subject by forming small mixed groups in classrooms and at which the achievement of the group is rewarded in various ways.

Condidering these definitions, cooperative learning can be expressed as a teaching approach at which students help each other to learn an academic subject for a common purpose by forming small mixed groups, students' self-confidence is increased, their communication skills are developed, students' problem solving and critical thinking abilities are improved and students actively participate to tasks (Doymuş, Şimşek & Bayrakçeken, 2004). Cooperative learning can briefly be illustrated as follows.

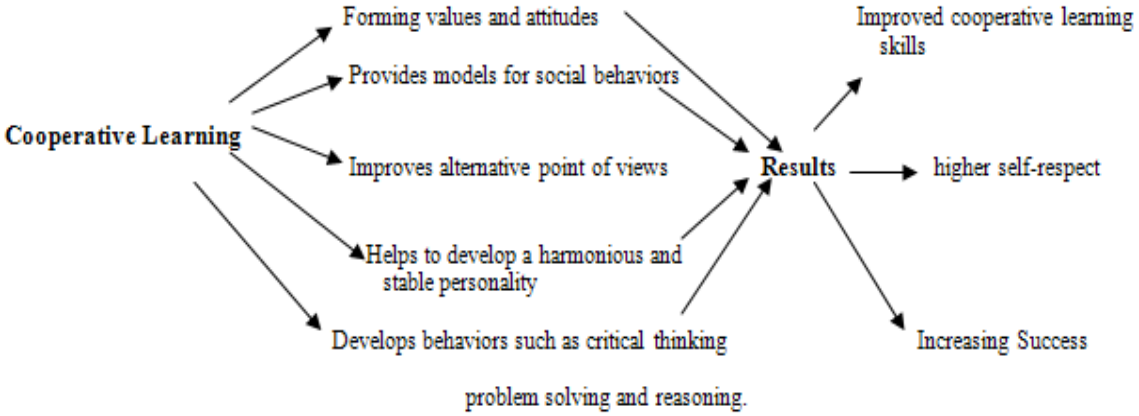


Figure 1. Cooperative learning (Borich, 2000, quoted Demirel, 2005: 95)

In order to achieve outputs of teaching and learning objectives of the Communicative learning method, one should know every steps of this method and these steps should be carried out accordingly. For this reason, it is useful to know about this method;

1. Together with the general information about the method, studies carried out in and outside the country and the ways of accessing these studies,
2. Things to do in order to use cooperative learning in classrooms,
3. Knowing the benefits of method for academic, social, psychology and assessments (Şimşek, Doymuş & Şimşek, 2008).

The principles which differentiate cooperative learning from traditional classroom studies are; group reward, positive dependence, individual assessability, face to face interaction, social skills, assessment of group process, equal opportunities for success. In cooperative learning environment, the success of the members of the groups depend on the success of groups itself. In order realize this, Slavin has asserted the idea that cooperative reward structure and cooperative work structure should be sustained. Cooperative reward structure is rewarding the group as a whole when the group members finish their final product in accordance with their common objectives. For the work structure, group members are responsible for different works and they make up the group score from points gathered from individual assessments (Açıkgöz, 2003). Positive dependence is the principle that a group member cannot be successful without the other group members since each group member is connected to others. Positive dependence creates an environment in which students share their materials, learning is increased and group success is celebrated. In order to sustain learning in cooperative environment, students are required to depend positively to other group members (Johnson & Johnson, 2005). The third principle of cooperative learning is the ability to assess individually and this can be achieved by the individual responsibilities of each group member. Within the scope of this principle the performance of each student is evaluated and the results of this evaluation are given to individuals and groups. That is, the evaluation is carried out by giving a test to each individual and by choosing a group member to present the group product randomly (Johnson & Johnson, 2005; Ekinci,

2010). Another principle of cooperative learning is face to face interaction and it means that students support and facilitate each others' effort to achieve the group objectives and to complete the group tasks (Ekinci, 2010). This principle both effects students' relations positively and strengthens psychological adaptation and social skills. The verbal and non-verbal answers of the group members provide important information about the performances of the students. In order to have a better face to face interaction, one should be careful about forming the group from 2 – 6 individuals. In social skills principle, if necessary social skills are not used and individuals or groups do not have these skills, they cannot cooperate effectively. According to this principle, social skills should be taught to individuals in order for them to work together at a high efficiency. In this scope, at the end of the studies group members decided that which activities help them to work together, which behaviors should be continued or which behaviors should be changed. This is called the evaluation principle of cooperative learning. During this process, each member contributes to the group work according to his or her ability and effort. Without thinking of the achievement levels of students, students performing equally and evaluating the contribution of each student separately comprise the principle of creating equal opportunities for success (Açıkgöz, 2003).

Thinking that cooperative learning is a single approach and has a single application form based on traditional learning is a frequent view that you can come across. However, there are several cooperative learning techniques that are different from each other (Namlu, 1999; Açıkgöz, 2003; Demirdağ; 2011). These are;

- ✓ Student Team Learning (STL)
- ✓ Student Teams – Achievement Sections (STAS)
- ✓ Team Games Tournaments (TGT)
- ✓ Team Based Personalization (TBP)
- ✓ Combined Cooperative Reading and Writing (CCRW)
- ✓ Jigsaw techniques.

In this study, among the techniques stated above 'jigsaw' technique was chosen and *Sets* subject was taught within the framework of the lesson plan which was prepared in accordance with this principle.

Jigsaw Technique

The Jigsaw was created in (1978) by Aronson et al. and it is used quite frequently both within face-to-face contexts and in online learning situations (Blocher, 2005). Jigsaw technique is realized when each student take the responsibility for learning in the group. In this structure, students are divided into two groups as the home groups and jigsaw groups. In the beginning, students are gathered in the home groups and every member of the group is selected to learn one part of the subject as a specialist (Doymuş, 2008). Home groups join to jigsaw groups by being dissociated and re-associated like the parts of jigsaw pieces. These jigsaw groups consist of individuals collected from home groups for studying the same subject. First of all in these groups students study specified subjects together. After the subjects are learned, students turn back to their home groups and transfer the knowledge that they have learnt (Clarke, 1999; Colosi & Zales, 1998; Pozzi, 2009). Jigsaw groups are illustrated schematically as in the following.

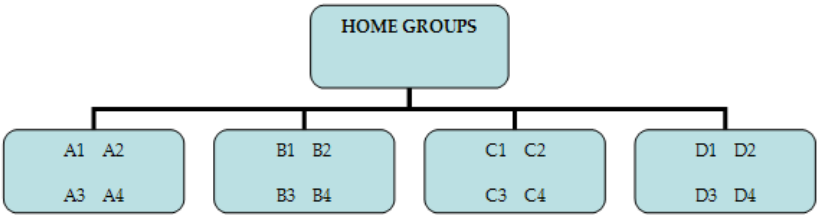


Figure 2. Home groups in jigsaw technique (Doymuş, 2008)

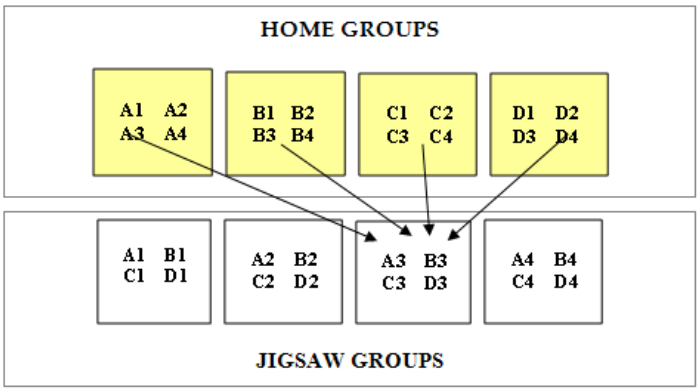


Figure 3. Jigsaw groups in jigsaw technique (Doymuş, 2008)

There are some differences during the application of jigsaw technique in traditional classroom environments. In a traditional classroom there are four main steps; subject, individual study, specialist group meeting, and jigsaw group meeting (Huang, Huang, & Hsieh, 2008). The subject is divided by the teacher into parts according to the number of jigsaw groups. Each jigsaw group studies the subject given to them. First of all, teachers should provide equal number of students to each jigsaw group. If the groups fail to have equal number of students, two groups may study the same subject (Huang, Huang, & Hsieh, 2008). Also in this study two groups studied the same subject (Operations of Intersection of Sets and Union of Sets). In the individual study section, group members study their own subjects and then they tell their friends what they have learnt. The purpose of a specialist group meeting is to transfer the knowledge that is obtained at individual studies. During this process there is a deeper understanding in the knowledge of individuals. When the specialist group meeting is over, specialists come back to their groups and share their knowledge.

In this study teaching 6th grade sets subjects (set and element of a set concept, introducing sets, universal, null and sub set concepts, intersection of sets and union of sets) by using one of the cooperative learning techniques which is called jigsaw technique was observed. The chapters of the study are given in details below.

Preparation stage. In the preparation stage of cooperative learning, the first thing you should do is to determine the teaching material. Later, dividing students into groups, organizing the classrooms, determining the roles and explaining the academic issues follow this process. Each lesson, at which the cooperative learning method is applied, contains first an academic subject, determining what the students will learn, and secondly the subjects, on which students will learn how to cooperate efficiently with each other (Şimşek, Doymuş & Şimşek, 2008).

In this teaching approach, one part of a teaching subject is distributed among members of the group or one part of a teaching subject is given to different groups. This limited resource given to each group is important for providing positive dependence. This also motivates students to study together in order to be successful (Johnson, Johnson & Holubec, 1994). In this study in the first place "Sets" subject was determined as the academic subject. The 'Sets' subject according to jigsaw technique was divided in three sub categories together with the mathematics teacher of the classroom by taking into consideration the academic levels of the students as in the following; *i) set and element concepts, introducing sets, ii) universal, null and sub-set concepts, iii) intersection and union of sets*. According to theory, when the groups are not equal or the academic levels are low, the same subject can be studied by two groups (Huang, Huang & Hsieh, 2008). For this reason, since the academic achievement levels of the students are low in this study, the subjects 'intersection and unions of sets" were given to two different jigsaw groups.

Distributing students to groups. When distributing students to groups, the size of the learning groups, how the students will be distributed to groups and how much time will be given to groups for studying are very important. The cooperative learning groups are generally required to consist of 2 to 6 individuals (Johnson & Johnson, 2005; Bacanlı, 2001). According to Yılmaz (2001), cooperative learning groups consist of

2 and 4 students. Having fewer students in the groups increases the success of the group. For this reason, groups with 4 students were preferred in this study.

Selecting students into groups. Although mostly homogenous groups are preferred for teaching a specific education subject or a special skill, in cooperative learning generally heterogeneous groups are preferred (Açıkgöz, 2003; Johnson et al., 1994). It should be forgotten that the Jigsaw is a very specific technique, which requires a particular orchestration as far as the social structure is concerned, because the home groups are homogenous in competences, while in the subsequent phase the jigsaw groups are heterogeneous (Pozzi, 2009). Heterogeneous groups are preferred, since the students in these groups have different backgrounds, skills, and different problem solving styles, and students in these groups have the ability to look from a different perspective and they are more prone to agree with arguments. In this research, the mathematics teacher of the classroom and the researchers divided students into heterogeneous groups. The academic achievement of the students was evaluated according to their mathematical achievements at the first stage of the primary. Since the students are in 6^{th} grades, they may have difficulties in finding group names. By taking this into consideration, in order not to lose time, they were asked to choose a group name among the names (Squares, Triangles, Circles, and Hexagons) determined before. The name badges for specifying the group members distributed and students wore their name badges.

Specifying time for group work. This teaching model requires asking students whether they have experienced cooperative learning before or not while specifying time for group work and if they have experienced before, the time will be specified accordingly (Ulmer & Cramer, 2005). For the groups who have not experienced cooperative learning before, it is ideal to plan one or two years for working time. For informal cooperative learning groups a few hours of course time can be arranged (Şimşek, Doymuş & Şimşek, 2008). Since informal cooperative groups were used in this research, it was decided that a few lessons as a working time would be sufficient and the working time was determined to be three lesson hours respectively.

Organizing the classroom. In this teaching strategy, the design of the classroom is very important to have a better communication among groups. There are a few important reasons for organizing the classroom. According to Katzenbach and Smith (1993);

i. The physical and spatial view of the classroom should be suitable for presentations. It is better to have a circular design with desks, which are arranged according to classical seating arrangement.
ii. The classroom design not only effects the audiovisual focus of the students, but also effects students' achievement and the way they use time properly.
iii. The shape of the classroom affects the students' work who have participated to educational activities, specifying the leaders of the groups, sustaining the communication among groups.

In literature, the seating arrangements in cooperative learning have been distinguished as T- seat design, face to face seat design, face to face L- seat design, laboratory seatsitting design, L-star seat design and traditional steat design (Ekinci, 2010). In this study, since working groups had four students, the classrooms where this study was carried out was established according to face to face seating design.

Things teachers should do at the application process. In cooperative learning method teachers' duties can be stated under four titles.

a. Planning before teaching and learning
b. Explaining cooperative structure and subject
c. Observations and interventions
d. Evaluation

In the planning stage prior to teaching and learning, researchers have prepared a lesson plan appropriate for the structure of cooperative learning and shared this lesson plan with the mathematics teacher of the classroom. The lesson plan had taken its final shape after mutual conversations between the researchers and the teacher. In every lesson the academic tasks and duties of the students, subsequent criteria needed for being successful, students' individual responsibilities and behaviors that teachers wish to see during a lesson were explained in details by the teacher (Şimşek, Doymuş & Şimşek, 2008). In this study, before the study started, the subject of the lesson, the expectations from the students and the criteria for being successful was explained in details. Later, students were observed while they were working both individually and as a group by using the semi-structured observation methodology. At the end of the study, a qualitative evaluation was made by using an *"Assessment Test"* with four questions, which was prepared by the researcher and a quantitative evaluation was made by using the forms, called as *'Individual Assessment'* and '*Your Thoughts About Cooperative Learning'*. The observations made in the classroom were taken into consideration while determining which group performed better at the end of the research. In addition to that, every student attending the research was awarded. The most successful was determined by combining the results of the tests and observations and this group was awarded with a *'3x3 Rubik's Cube'* and a *'Group Achievement Certificate'*. The most successful group was also awarded with the applause of the other students. The purpose here is to have students to gain the behavior of celebrating the others' success. According to Bourner, Hughes and Bourner (2001); Lejik and Wyvill (2001); Salend, Gordon and Lopez (2002) when cooperative learning is planned well, it gives the opportunity to evaluate students' performances both qualitatively and quantitatively. It is noted that in the process of evaluating students' performances as a whole, it plays a crucial role in the evaluation and their development in primary, secondary and higher education.

In this study, it has been tried to clarify that how 'Sets' subject was taught by using Jigsaw technique in cooperative learning environment and what affects students' performances during teaching process, what kind of difficulties the students have faced. With focus on this, the question '*How 6th grade primary students construct 'Sets' subject by using jigsaw technique in cooperative learning environments?*' was determined as the research question.

Method

Research Design

Case studies can be carried out both qualitatively and quantitatively. The purpose of each approach is to introduce some results related to a specific case (Yıldırım & Şimşek, 2008). The results of the qualitative research can provide important samples related to the practice and they can help practitioners to take more effective and efficient decisions by contributing to the development of their understanding and experiences. The descriptions, explanations, interpretations that are stated in these researches can enrich their professional specifications (Yıldırım & Şimşek, 2008). In this context, this study, instead of making generalizations, is supposed to enrich the professional specifications of practitioners that will use cooperative learning approach and it is thought that it could contribute to the field from this point of view. This study is established according to qualitative research designs. That, what had happened while teaching Sets subject in a cooperative teaching environment, was reported qualitatively. Qualitative research has the natural setting since the direct source of data and the researcher is the key instrument (Bogdan & Biklen, 1992). In qualitative researches, researchers are not only persons who have just observed the research subject as in quantitative researches but they also participate personally to understand and analyze the subject and participants well and they also had one to one interviews with the participants since they are a part of the process (Yıldırım & Şimşek, 2008). For this reason, researchers participate to the research as participant observers.

Study Group

The students participated this research had determined by using one of the purposive sampling methods which is called typical case sampling. The methods of purposive sampling are beneficial while explaining and discovering the issues and events. The purpose of typical case sampling is to have an idea about a field or to inform people who do not have enough information about this field, subject, application or innovation (Yıldırım & Şimşek, 2008). With regards to Sets subject the study was carried out with nineteen students who are attending a primary school in Kocaeli.

Photograph 1. One of the home groups, "Triangles"

Data Collection Instruments and Data Collection

Data collection instruments of the study are; worksheets by which the students studied the subjects and observations that are conducted during the research. Document analysis was used during data collection. Document analysis consists of analyzing written documents that have information about fact or facts that are aimed to be studied. Document analysis can be used alone for data collection, but it can also be used together with other instruments. In such researches, researchers can collect data without conducting any interviews or observations (Yıldırım & Şimşek, 2008). In qualitative research, the phrase personal documents are used broadly to refer to any first-person narrative that describes an individual's actions, experiences and beliefs (Taylor & Bogdan, 1984). The worksheets that were collected during the study and observations are data collection instruments.

Analysis of the Data

In qualitative researches data analysis means diversity, creativity and flexibility (Yıldırım & Şimşek, 2008). Kuş (2006) points out that qualitative research data analysis' aim is description, understanding, interpretation and explanation. Qualitative researchers are concerned with process rather than simply with outcomes of products and the researchers constantly asks questions as: How do people negotiate meaning?, How do certain terms and labels come to be applied?, What is the natural history of the activities or events under a study? (Bogdan & Biklen, 1992). Wolcott (1994) states that researchers add their own opinions while analyzing the data. Here, subjective and participatory aspects of the researcher come more into the prominence. While the data obtained in this study was analyzed descriptively, the researchers included their own interpretations since they were participant observers.

The Validity and Reliability of the Research

In qualitative studies, validity determines whether the research truly measures that what was intended to measure or how reliable the research results are (Golafshani, 2003). In order to have the whole picture of

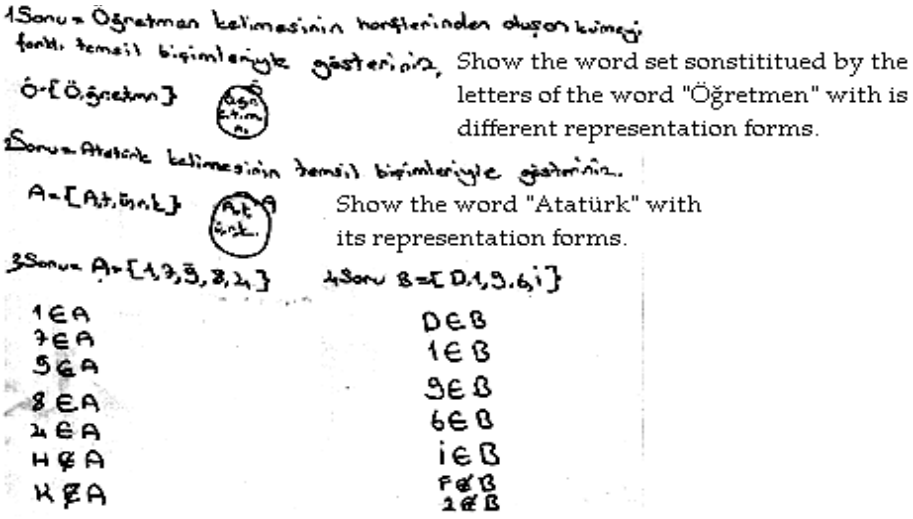
the fact or event being examined, researchers need to use extra methods such as variation, participant confirmation and peer confirmation. Peer confirmation was used to provide the validity of this study and it was seen that both researches achieved similar findings. Since the study is qualitative, it was preferred to use 'consistency' instead of 'internal reliability' and 'ability to be confirmed' instead of 'external reliability' (Yıldırım & Şimşek, 2008: 264). Roberts and Priest (2006) asserted that for ensuring that ability is confirmed, researchers first need to clarify their position during the study (like participant observer or preliminary experiences about research subject). It is emphasized that it is important for the researcher to explain the data collection instruments and data analysis methods in detail. Explaining how the data is recorded, how the documents are analyzed, how the results are combined are all helpful to researcher. Iin this study, in order to have the ability to be confirmed, the fact that researchers participate to study as participant observers, how the data is collected, what is done for data analysis, how the data and results are combined are explained in detail, too. Roberts and Priest (2006) stated that consistency is acquired by using another researcher while analyzing the data and by confirming the results obtained in the research. It can be confirmed that the results which are obtained in this way are based on the data instead of the researcher's opinions. For the consistency of this study, both researchers combined the results separately and then consistency is provided by comparing the studies.

Findings and Comments

This study is carried out in two parts, called as the jigsaw groups and the home groups, at which it is observed how students are learning Sets subject in a cooperative learning environment and the data obtained in this study is analyzed. For this reason the findings of this study is given under two titles.

Studying Sets Subjects in Jigsaw Groups

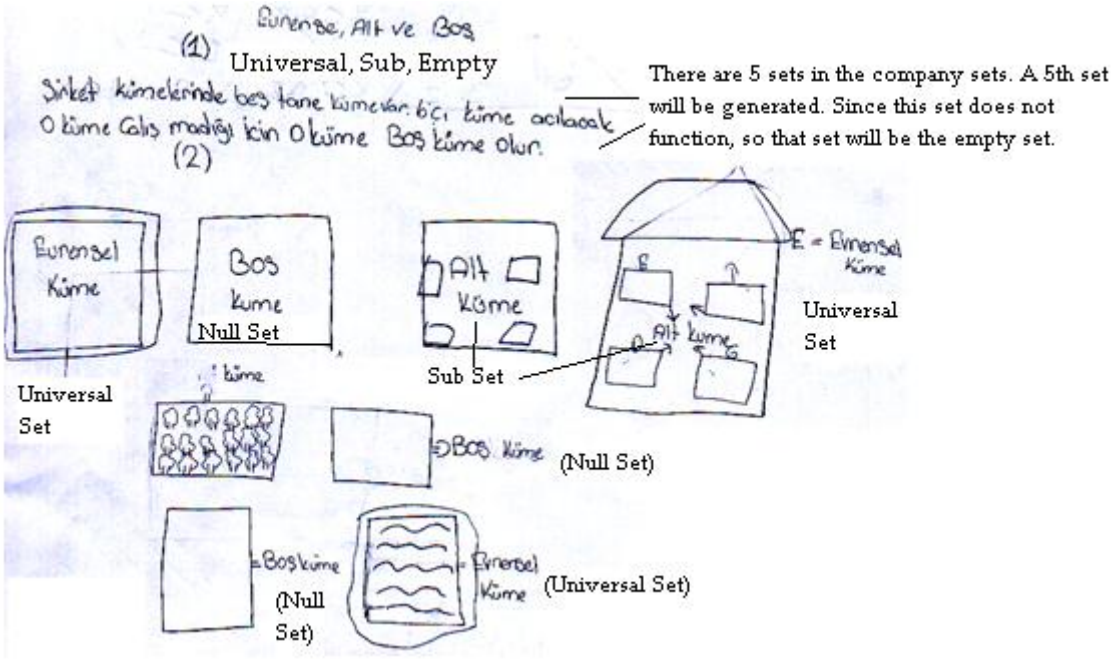
Jigsaw groups are formed by distributing 19 students, who are divided to four home groups (Squares, Triangles, Circles and Hexagons) initially, as in the following; the first members of each group to the first table, the second members to the second table, the third members to the third and the fourth members to the fourth table. The first group of jigsaw groups studied *'sets and element concepts, introducing sets'*, the second group studied *'universal sets, sub-set and null set'*, the third and fourth groups studied *"intersection and union of sets'*. The first study at the jigsaw groups was completed within a course time. Each jigsaw groups studied their subjects deeply. During the study, researchers guided the students at the points where they had difficulties and observed the studying of each group. The observations contributed not only to the results of this study, but also to the evaluation of the students at the end of the study. The data obtained from the jigsaw groups and findings and comments related to this data are given below.



Sample 1. Sets and element concepts, introducing sets, 1st jigsaw group

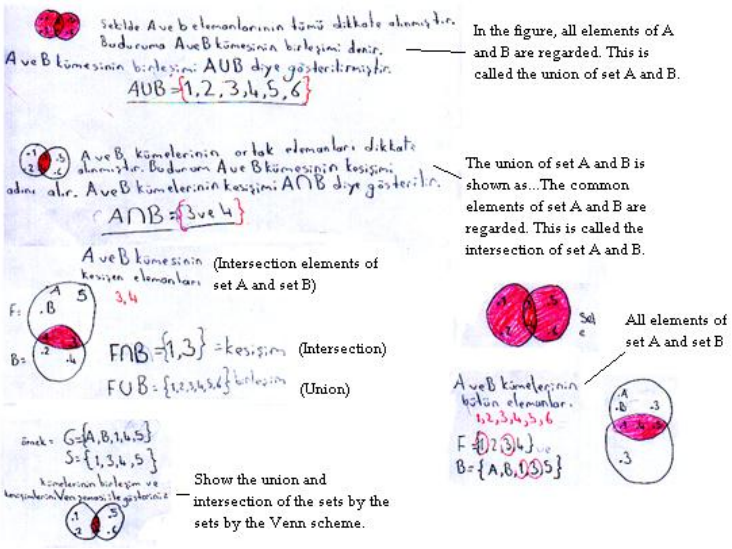
The first jigsaw group studied the sets and elements concepts and introducing sets subjects within a course time. As it is shown in sample 1, it is to be seen that students expressed introducing sets as 'different representations' within the framework of the new program. It is understood that students introduced the sets concept in two different representative forms as it is to be seen in sample 1. This was the same on the worksheets of the other members of the group. It is determined that students did not skip the knowledge that capital letters should be used in naming sets and each member of the group paid attention to this. With regards to the element concept, it is to be seen that students showed both the situation of being an element and not being an element, but one of the students wrote the name of the set to the left while he/she ought write it to the right. In order to correct this situation, the members are asked to tell each other once more, but it is seen that the problem still existed, therefore was intervened. Instead of teaching the point directly to the students, during this intervention students are asked to find the differences between their worksheets and those of the others, so that students can understand the point. It is seen that the first jigsaw group learned the subject properly and they cooperated with each other during the study time.

The second jigsaw group studied the universal, sub and null set concepts. The course book of the students started to introduce the subject by giving the example of a company and its sub-units. Since students do not know the concepts such as accounting, marketing, human resources, they had difficulties to understand this example. In this case, the understanding of the subject was tried to provide by giving examples from classroom and groups and by guiding students. It was observed that all the group members gave similar samples. It was seen that a student with a slightly higher level of success took the leadership of the group and took the responsibility of teaching the subject. It is understood that he or she taught the subject by drawing examples on his / her worksheet to the others and she or he enjoyed giving a course to the other members of the group. It is noticed both by the researchers and the members of the group that a student with a slightly lower level of success had difficulties to present the subject. It is seen that the student with a slightly higher level of success stood up and presented the subject excitedly and gave an example by using the library in the classroom to make his or her friends understand the subject. It is understood that in the second jigsaw group, while three students learned the subject sufficiently, one student had a partial understanding.



Sample 2. Universal, sub and null set concepts, 2nd jigsaw group

Since the success level of the students attending the study was not very high, the third and fourth jigsaw groups studied the intersection and union of the sets subjects. Each group studied the same subject at their own tables. Thus, slightly difficult operations in sets subject had the opportunity to be presented twice in the home groups. As a consequence it might be provided that this subject could be learned more easily.

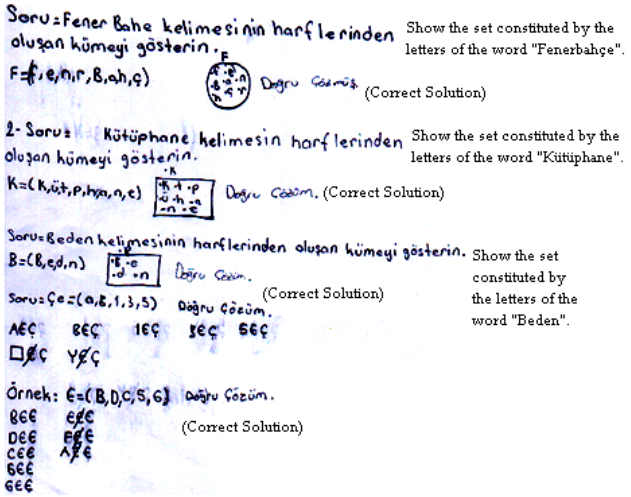


Sample 3. Intersection and union operations in sets, 3rd and 4th jigsaw groups

It is seen that all students in the 3rd and 4th jigsaw groups easily understood the slightly difficult intersection and union operations in sets subject. Although these groups studied this subject before studying the other parts of the sets subject, it is seen that they did not have any difficulty in illustrating sets and they even used different letters for showing sets. While showing intersection and union terms, they not only felt the necessity to color the shaded areas but also showed illustrations by using both Venn schema and listing method.

Studying Sets Subjects in Home Groups

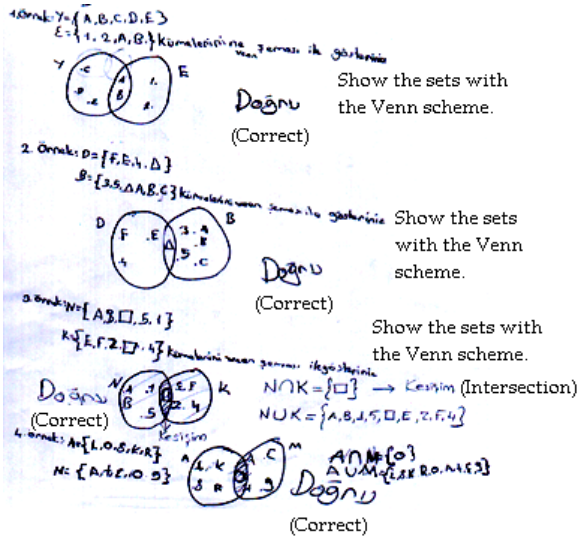
After a study lasted for one lesson in jigsaw groups, students came back to their home groups. In these home groups there was at least one student who knew the subject. The purpose of the study, which was conducted in the home groups, was to teach unknown subjects to the other group members. Since students did not know what to do in the home groups, first of all they were told about what they should do in the group. In the home groups, since students who had the badges number 1 learned the subjects such as set and element concept and introducing sets, the presentation began with them first. The study started with the presentation of students who had number 1 badges. The study in the home groups lasted one course time.



Sample 4. An example from the 1st home group

It is observed that students during their studies in the home group played the role of the teacher. This case can be seen clearly in Sample 4. During the studies of the home groups, students presented their own subjects, later they continued their presentations by letting their friends to solve sample questions for the friends who learned recently. They checked whether their friends solved the question correctly or not and

then they gave feedback in the form of 'Correct Solution' to indicate the question was solved correctly. This case was something that students performed by themselves and can be seen in all groups. It is understood that they tried to transfer everything that they learned in the jigsaw groups and they tried to generate their own questions while solving sample questions.



Sample 5. An example from the 3rd home group

Once more it is to be seen that they did not have any difficulty to name the sets and that they could name the sets by using different letters. It is observed that in every groups students paid attention to two sets for showing intersection and union operations. In addition to this, they did not pay attention to whether there were three or more sets or not. For this situation, there was an effort to make students realize this and a study was carried out for telling the students how they would show intersection and union operations with Venn schema, if there were three sets.

After the jigsaw groups, it is seen that students, working in the home groups, played the role of their teachers, checked what their friends did, tried to fix errors and evaluated the solved sample questions by stating whether this was a correct or wrong solution. The study in the home groups lasted for a lesson. In the third section of the study, in order to evaluate students individually, the students were given the 'Personal Evaluation Form' and "Assessment Test". The success level of the students in the study is determined by the researchers' observations. Beside this, students are asked to write their thoughts about the study. Below the personal evaluation form, the assessment test and the texts regarding their thoughts about the study of two students selected among the students are given.

Individual Assessment

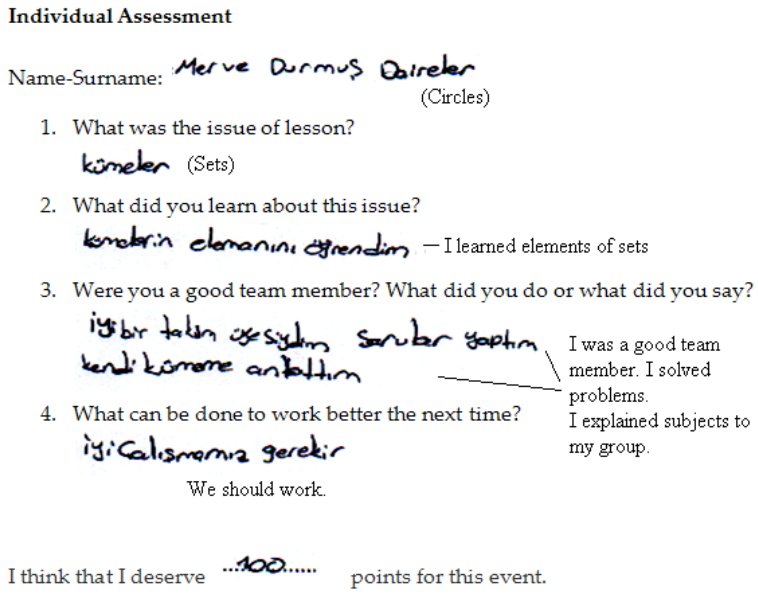
Name-Surname: FATİH UZMAN Üçgenler-gurubu — Triangles Group

1. What was the issue of lesson?
   Kümelerde işlemler — Processes of Sets
2. What did you learn about this issue?
   Kümelerin Alt küme olduğunu öğrendim / Evrensel kümeler — I learned that sets are subset / Universal sets
3. Were you a good team member? What did you do or what did you say?
   İyidim kümelerin hakkında çok şey öğrendik / Kümelerin Alt küme Boş kümeyi söyledik. — I was good at. We learned a lots of things about sets. We said that sets are subset, empty set.
4. What can be done to work better the next time?
   Çok çalışıp ve öğrenerek aklımıza datutarız. — We can keep in mind it with harkworking and learning.

I think that I deserve 10..... points for this event

Sample 6. Personal evaluation form, 1st example

One of the principles of cooperative learning is Personal Evaluation Form. All students filled out this form and evaluated their own performances. As it is to be seen in sample 6, for the first question students wrote the subject that they learned in the jigsaw group. It is seen that subjects studied after returning to home groups were not taken in consideration while filling out the Personal Evaluation Form. In the fourth question, it is to be seen that most of the students realized that they needed to work harder and that presenting the subjects one or two times helped them to have a better understanding.



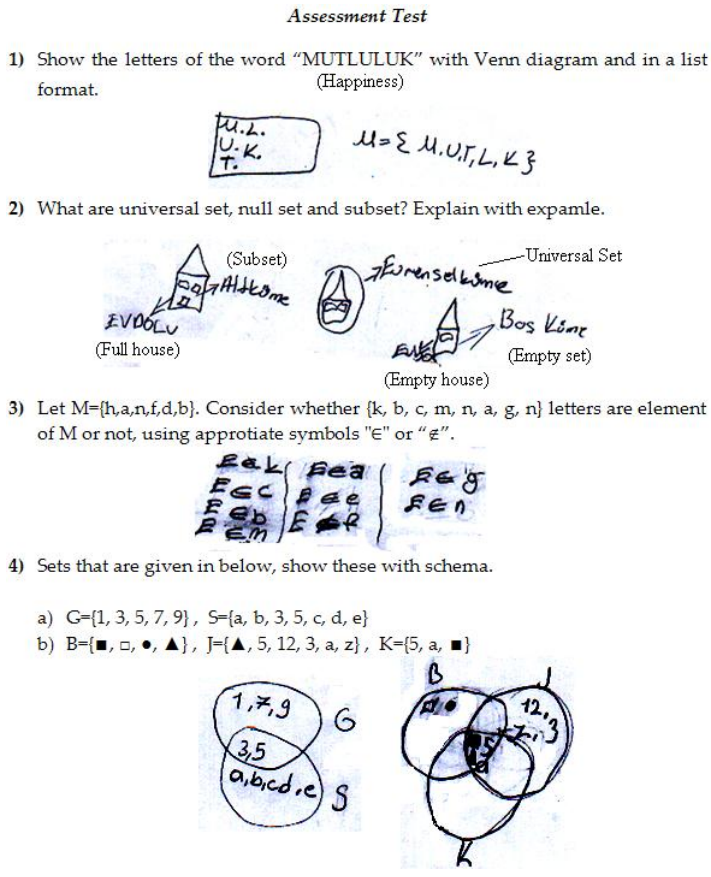
Individual Assessment

Name-Surname: Merve Durmuş Daireler
(Circles)

1. What was the issue of lesson?
   kümeler (Sets)
2. What did you learn about this issue?
   kümelerin elemanını öğrendim — I learned elements of sets
3. Were you a good team member? What did you do or what did you say?
   iyi bir takım üyesiydim sorular yaptım kendi kümeme anlattım
   I was a good team member. I solved problems. I explained subjects to my group.
4. What can be done to work better the next time?
   iyi çalışmamız gerekir
   We should work.

I think that I deserve ...100..... points for this event.

Sample 7. Personal evaluation form, 2nd example



Assessment Test

1) Show the letters of the word "MUTLULUK" with Venn diagram and in a list format. (Happiness)

M.L.
U.K.
T.

M={M,U,T,L,K}

2) What are universal set, null set and subset? Explain with expamle.

(Subset) Alt küme
Evdeolu
(Full house)
Evrensel küme — Universal Set
Boş Küme
(Empty set)
(Empty house)

3) Let M={h,a,n,f,d,b}. Consider whether {k, b, c, m, n, a, g, n} letters are element of M or not, using approtiate symbols "∈" or "∉".

k∉M | a∈M | g∉M
c∉M | e∈M | n∉M
b∈M | f∉M

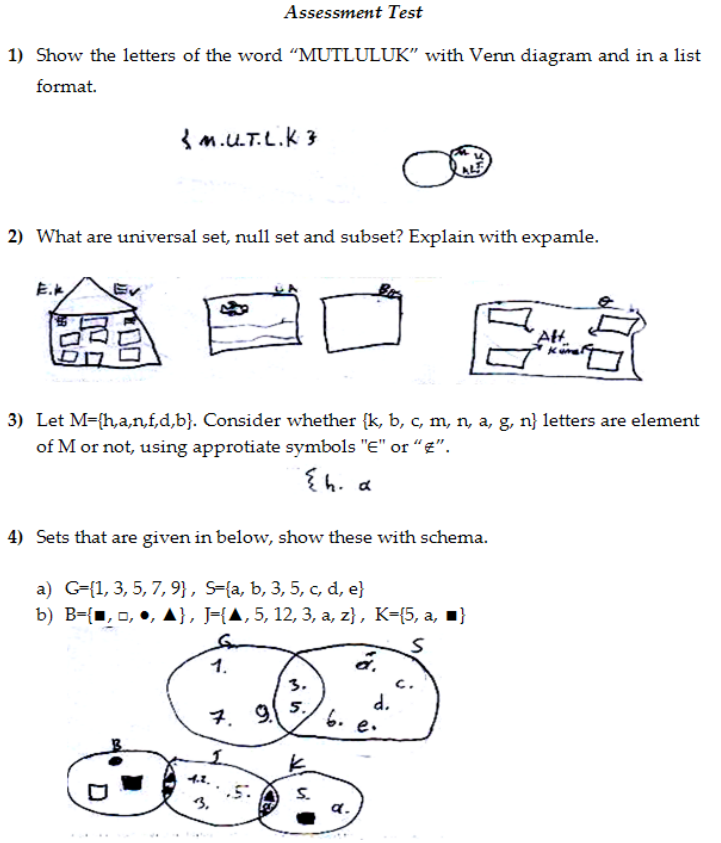
4) Sets that are given in below, show these with schema.

a) G={1, 3, 5, 7, 9}, S={a, b, 3, 5, c, d, e}
b) B={■, □, ●, ▲}, J={▲, 5, 12, 3, a, z}, K={5, a, ■}

1,7,9 G
3,5
a,b,c,d,e S

B
J
12,3
K

Sample 8. Assessment test, 1st example



Assessment Test

1) Show the letters of the word "MUTLULUK" with Venn diagram and in a list format.

{ M.U.T.L.K }

2) What are universal set, null set and subset? Explain with expamle.

3) Let M={h,a,n,f,d,b}. Consider whether {k, b, c, m, n, a, g, n} letters are element of M or not, using approtiate symbols "∈" or "∉".

{ h. a

4) Sets that are given in below, show these with schema.

a) G={1, 3, 5, 7, 9} , S={a, b, 3, 5, c, d, e}
b) B={■, □, ●, ▲} , J={▲, 5, 12, 3, a, z} , K={5, a, ■}

Sample 9. Assessment test, 2nd example

As it is seen in the 8th and 9th samples that students achieved better results on the subjects that they studied in the jigsaw groups. This is the same for all students attending the study. Generally students had difficulties in 3rd and 4th type questions. They had difficulties in expressing element concepts mathematically and they also had problems while making intersection and union operations if there were of three or more sets. They particularly had problems when they used the Venn schema for illustration.

The students are asked to write their opinions about the study. It is thought that they may have problems in expressing themselves, thus a brief explanation about what to write was given to students since they are 6th graders and this was the first time that they were attending such study. With regard to this, a few samples of the students' opinion are stated below.

"Group work was very beautiful. I think that everyone understood the issues better. I'm sure that everyone thinks like me. I understood the issues better in group work. More than one person told the subject, it becomes easier to understand. While I was describing the issues to my colleagues, I'm sure that they understood to them. Thank you very much for this work."

Sample 10. Opinions about cooperative learning, 1st example

"The work was very fun that was done by us and I loved it. This activity was done to learn better the issues. While I was doing the activity, I had difficulty to understand. I did the activity lovely. Communication and cooperation with my friends was very nice."

Sample 11. Opinions about cooperative learning, 2nd example

It is seen that most of the students had similar opinions about cooperative learning, they thanked for conducting such a study with them, they expressed that they did enjoyed the activities, that they had a good communication with their group friends, that they realized that listening to a subject more than once made their understanding easier.

Discussion and Conclusion

The main purpose of this study is to analyze how 6th grade primary students learn sets subject by using jigsaw technique in a cooperative learning environment. With regard to this in three lessons; in the first lesson students studied in jigsaw groups, in the second lesson they studied in home groups and the third lesson was for the evaluation, therefore it is found suitable to give the results also in three parts. Accordingly;

The Results of The Study in Jigsaw Groups and Discussion

In this part of the study, which lasted for one lesson, the students had adaptation problems at the first minutes of the study since they were attending such a study for the first time. In heterogeneously composed groups, students who spoke with each other for the first time caused some problems, too. But this situation was over after the 5th and 6th minute of the study. It is observed that as a result of the study, which was carried out in the jigsaw groups, students have had a better communication with each other. A while after the students had adapted themselves to the study, it is seen that students had difficulties in subjects such as introducing sets and intersection and union operations. For this reason researchers guided the jigsaw groups. Souvignier and Kronenberger (2007) stated that they did not provide any help in their researches. They cited that they did not provide help since the number of problematic groups were only one or two. In this study, the problems emerged as a result of the fact that students were attending such a study for the first time, so instead of solving problems directly, students had some help through the guidance of researchers and the problems were solved. The other problem experienced in the jigsaw groups was that students first focused on personal achievement instead of being successful as a group. It is obvious from the fact that they could not reach the conscious of being a group since they did not try to cover their lack of understandings by telling these subjects each other. It is referred in the researches conducted by Slavin (Slavin, 1980; Slavin & Cooper, 1999) and Moskowitz and others (1985) to similar results. They pointed out that students had focused on personal scores without thinking of the score of their groups. The other important point that attracted attention during the study was the age of the students. It is observed that students who have just completed the first phase of primary had difficulties in transferring information to the others and they had the fear of saying something wrong. This situation was clearly cited in Bratt's (2008) study. It was pointed out that the age of the participants affected the efficiency of the cooperative learning. It is stated that adolescents were more effective in cooperative learning than children in young ages.

The Results of the Study in Home Groups and Discussion

It is seen that after finishing the study in jigsaw groups, students who came back to their home groups were unaware of discovering what to do. So, a brief explanation was made to let students start studying. The study started when the number 1 student of each group started his / her presentation. It is seen that students in the groups took the role of a teacher and this situation is not intervened by the researchers. It is seen that after the subject was taught, students asked each other sample questions and checked the answers. When they came up with the wrong answers, they corrected them by solving these questions themselves. The communication problems that were seen in the jigsaw groups also existed in the home groups. This resulted in the fact that students were adapting themselves again to their new groups. A group work is called cooperative learning when all students in the group are expected to give an effort to increase not only their own understanding, but also the other students' understanding. That some students, due to the fact that they had learned the subjects in their jigsaw groups, thought that they were studying the same subjects in the main group resulted in interruptions of the group work. As Şarlıoğlu and Avcı stated, it is seen that they not only did not care on their own learning, but also did not care on the learning of other individuals in the group. It can be said that this was because of the fact that students were attending this kind of a study for the first time (Avşar & Alkış, 2007).

Evaluation

In this study, which aimed to teach sets subject by using jigsaw technique in cooperative learning environment, students are evaluated in three stages. The first evaluation is related to students' performances, both in jigsaw and home groups. This evaluation is based on the researchers' observations during this study. As a result of these observations, it is decided that the group "Squares" was the most successful group. The other evaluation is supplied by using a 'Personal Evaluation Form', which was prepared according to the structure of cooperative learning. According to this form, students have self-evaluated themselves during the study. The forms give us the fact that most of the students attending this study perceived themselves as successful. The final stage of the evaluation is the 'Assessment Test'. This test consists of four questions and revealed the fact that as a result of a test, which is carried out to test sets subject, being taught by using jigsaw technique in cooperative learning environment, most of the students learned the subjects that they had studied in the jigsaw groups better than the subjects that they had studied in home groups. This situation is due to the fact they thought they had learned the subjects that they had studied in the main groups before.

As a consequence, cooperative learning gives students an opportunity to communicate with their friends whom they have not communicated before with. Students, taking their teachers' role, experience the pleasure to give a lesson. They have the opportunity to evaluate themselves and to have a chance to decide about their own situation. At the end of the study, they realized the fact that they are not only responsible for their own learning, but also for the learning of others in the group; for this reason they have to communicate more with others. They also realized that they need to study hard and listen to same subject more than once in order to help them to gain a better understanding. According to the findings, obtained from this study, it can be statet that;

- ✓ Teachers can benefit from the cooperational learning method at the initiation of a communication among the students in order to generate a social learning environment,
- ✓ the students face difficulties in terms of adapting themselves to the process both at the group work and during the teaching of the issues they have learned to their friends as a result of the fact that they were rarely confronted with the jigsaw technique and thus the teacher spare more time for this technique during their lessons might be usefull,
- ✓ when the students return to the main groups after having learned the subjects in accordance with the jigsaw technique, they have structured the notions more meaningful by presenting these subjects to each other and considering that this will be effective in the developments of their skils in terms of establishing mutual empathy, that it it might be useful when teachers benefit from this technique.

Beside this, it may be suggested that it might be useful to focus on whether the jigsaw technique has a meaningfull influence on the logical thinking and critical thinking skils of students or not, on its influence on the problem solution processes and higher cognitive skils of the students.

References

Açıkgöz, K. Ü. (2003). *Etkili öğrenme ve öğretme* [Effective learning and teaching]. İzmir: Eğitim Dünyası Yayınları

Açıkgöz, K.Ü. (2003). *Aktif öğrenme* [Active learning]. İzmir: Kanyılmaz Matbaası.

Avşar, Z. & Alkış, S. (2007). The effect of cooperative learning "Jigsaw I" technique on student success in social studies course. *Elementary Education Online*, 6(2), 197-203.

Bacanlı, H. (2001). *Gelişim ve öğrenme* [Development and learning]. Nobel Yayınları: Ankara.

Blocher, J. M. (2005). Increasing learner interaction: using Jigsaw online. *Educational Media International*, 42(3), 269–278.

Bourner, J., Hughes M., Bourner, T. (2001). First-year undergraduate experiences of group project work. *Assessment and Evaluation in Higher Education*, 26, 19-39.

Bogdan, R. C., & Biklen, S. K. (1992). *Qualitative research for education: An introduction to theory and methods* (2nd ed). A division os Simon & Schuster, Inc.

Bowen, C.W. (2000). A quantitative literature review of cooperative learning effects on high school and college chemistry achievement. *Journal of Chemical Education*, 77(1), 116-119.

Bratt, C. (2008). The jigsaw classroom under test: No effect on intergroup relations evident. *Journal of Community & Applied Social Psychology*, 18: 403–419.

Clarke, J. (1999). *Pieces of the puzzle: the jigsaw method*. In Handbook of Cooperative Learning Methods, ed. S. Sharan. Westport, CT: Preager.

Colosi, J.C., & Zales, C. R. (1998). Jigsaw cooperative learning improves biology lab course. *Bioscience*, 48(2), 118–24.

Demirdağ, B. (2011). *Anorganik kimya dersinde web destekli işbirlikli öğrenme [web supported cooperative learning at ınorganic chemistry lesson*], Yayınlanmamış doktora tezi [Unpublished doctoral dissertion], Eğitim Bilimleri Enstitüsü [Institute of Educational Sciences], Dokuz Eylül Üniversitesi [Dokuz Eylül University], İzmir.

Demirel, Ö. (2005). *Eğitimde yeni yönelimler* [New trends in education]. Pegem Akademi, Ankara: Cantekin Matbaası.

Doymuş, K. (2008). Teaching chemical bonding through jigsaw cooperative learning, *Research in Science & Technological Education,* Vol. 26, No. 1, 47–57.

Doymuş, K., Şimşek, Ü., & Bayrakçeken, S. (2004). İşbirlikçi öğrenme yönteminin fen bilgisi dersinde akademik başarı ve tutuma etkisi [Effects of the cooperational learning method on the academic success and attitude in science lessons], *Türk Fen Eğitimi Dergisi*, 1(2), 103-115.

Ekinci, N. (2010). *İşbirliğine dayalı öğrenme*: *Eğitimde yeni yönelimler* [Cooperatiion Based Learning: New trends in education]. Geliştirilmiş 4. Baskı (Editör, Özcan Demirel), Pegem Akademi, Ankara: Cantekin Matbaası.

Golafshani, N. (2003). Understanding reliability and validity in qualitative research. *The Qualitative Report*, 8(4), 597-607.

Gömleksiz, M. (1993). *Kubaşık öğrenme yöntemi ile geleneksel yöntemin demokratik tutumlar ve erişiye etkisi* [Effect of the cooperative learning method and the traditional method on democratic attitudes and access], Doctoral dissertation, Çukurova Üniversitesi, Sosyal Bilimler Enstitüsü, Adana.

Huang, Y. M., Huang, T. C., & Hsieh, M. Y. (2008). Using annotation services in a ubiquitous Jigsaw cooperative learning environment. *Educational Technology & Society*, *11* (2), 3-15.

Işık, K., Tarım, K., & İflazoğlu, A. (2007). Çoklu zekâ kuramı destekli kubaşık öğrenme yönteminin ilköğretim 3. sınıf öğrencilerinin matematik dersindeki akademik başarılarına etkisi [The effects of the Multiple Intelligence Theory Supported Cooperative Learning Method on the academic success in mathematics classes of elementary school third grade students], *Ahi Evran Üniversitesi Kırşehir Eğitim Fakültesi Dergisi (KEFAD)*, 8(1), 63-77.

Johnson, D.W., & Johnson, R.T. (1992). Approaches to implementing cooperative learning in the social studies classroom, cooperative learning in the social studies classroom: An Invitation Social study, R.J., Stahl and R.L., Vansicle Editor : *Washington National Council for the Social Studies. Bulletin* No: 87, 44-51.

Johnson, D. W., & Johnson, R. T. (2005). *Co-operative Learning*, R. M. Gillies and A. F. Ashman (Ed.), Student Motivation in Co-operative Groups, Social Interdependence Theory (136-176), London and New York: Taylor and Francis e-Library.

Johnson, D.W., Johnson, R.T., & Holubec, E.J. (1994). *Cooperative learning in the classroom cooperation in the classroom*, Alexandria, VA: Association for Supervision and Curriculum Development, Minnesota.

Katzenbach, J., & Smith, D. (1993). *The wisdom of teams*. Cambridge, Mass: Harvard Business School Pres.

Kirk, J., & Miller, M. L. (1986). *Reliability and validity in qualitative research*. Beverly Hills, CA: Sage.

Kuş, E. (2006). *Sosyal bilimlerde bilgisayar destekli nitel veri analizi* [Computer aided qualitative data analysis in social sciences]. Anı Yayıncılık: Ankara.

Le Compte, M. D., & Goetz, J. P. (1982). Problems of reliability and validity in ethnographic research. *Review of Educational Research*, 52, 31-60.

Lejik, M., & Wyvill, M. (2001). Peer assessment of contributions to a group project: a Comparison of holistic and category–based approaches, *Assessment and Evaluation in Higher Education*, 26, 61-72.

Namlu, A. G. (1999). Bilgisayar destekli işbirliğine dayalı öğrenme [Computer supported cooperation based learning], *T.C. Anadolu Üniversitesi Yayınları No: 1145, Eğitim Fakültesi Yayınları No: 57*, p. 15, 50-84, Eskişehir.

Mallinger, M. (1998). Collaborative learning across borders: Dealing with student resistance, *Journal on Excellence in College Teaching*; 9(1), 53-68.

Moskowitz, J. M., Malvin, J. H., Schaeffer, G. A., & Schaps, E. (1985). Evaluation of jigsaw, a cooperative learning technique. *Contemporary Educational Psychology*, 10(2), 104–112.

Pozzi, F. (2009). Using jigsaw and case study for supporting online collaborative learning. *Computers & Education*, 55, 67–75.

Roberts, P., & Priest, H. (2006).Reliability and validity in research. *Nursing Standard*, 20, 41-45.

Salend, S.J., Gordon, J., Lopez, K. (2002). Evaluating cooperative teaching teams. *Intervention in School and Clinic*, 37, 195-201.

Sampson, V. & Clark, D. (2008). The impact of collaboration on the outcomes of scientific argumentation. Taken from http://onlinelibrary.wiley.com/doi/10.1002/sce.20306/pdf on January 31st 2012.

Slavin, R. E. (1980). Cooperative learning. *Review of Education Research*, 50(2), 315–342.

Slavin, R.E. (1990). Comprehensive cooperative learning methods: Embedding cooperative learning in the curriculum and school, cooperative learning. *Theory and Research Slavin,* R.E, 1990, (ed.: Shlomo Sahran), New York.

Slavin, R. E., & Cooper, R. (1999). Improving intergroup relations: Lessons learned from cooperative learning programs. *Journal of Social Issues*, 55(4), 647–663.

Siegel, C. (2005). Implementing a research-based model of cooperative learning, *The Journal of Educational Research;* Jul/Aug, 339.

Souvignier, E., & Kronenberger, J. (2007). Cooperative learning in third graders' jigsaw groups for mathematics and science with and without questioning training. *British Journal of Educational Psychology*, 77, 755–771.

Sönmez, V. (2008). *Öğretim ilke ve yöntemleri* [Teaching principles and methods], Ankara, Anı Yayıncılık.

Şimşek, Ü., Doymuş, K., & Şimşek, U. (2008). İşbirlikli öğrenme yöntemi üzerine derleme çalışması: II. İşbirlikli öğrenme yönteminin sınıf ortamında uygulanması [A compilation on the cooperative learning method: II. The application of the cooperative learning method in classroom environment**]**. *Erzincan Eğitim Fakültesi Dergisi*, Cilt-Sayı: 10-1.

Taylor, S. J., & Bogdan, R. C. (1984). *Introduction to qualitative research and methods: The search for meaning*. New York: Wiley.

Ulmer, J. D., & Cramer, M. C. (2005). "Why are those kids in groups?". *The Agricultural Education Magazine;* May/Jun, 77, 6, 14.

Vaughan, W. (2002). Effects of cooperative learning on achievement and attitude among students of color. *The Journal of Educational Research,* 95(6), 359–64.

Wolcott, H. F. (1994). *Transforming qualitative data: Description, analysis and interpretation.* Newbury Park, CA: Sage.

Yıldırım, A., & Şimşek, H. (2008). *Sosyal bilimlerde nitel araştırma yöntemleri* [Qualitative research methods in social sciences]. Ankara: Seçkin Yayıncılık.

Yılmaz, A. (2001). İşbirliğine dayalı öğrenme: etkili ancak ihmal edilen ya da yanlış kullanılan bir metot [Collaborative learning: an effective but neglected or wrong applied method]. *Millî Eğitim Dergisi*, Sayı 150 (Mart, Nisan, Mayıs), 46-50.