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THE EFFECTS OF TEACHING FRACTIONS BY USING CONCEPT MAP ON THE ACHIEVEMENT OF SIXTH GRADE STUDENTS

KESİRLERİN ÖĞRETİMİNDE KAVRAM HARİTASI KULLANIMININ 6. SINIF ÖĞRENCİLERİNİN BAŞARILARINA ETKİSİ

Atilla Özdemir*

Mine Aktaş**

Elizabeth Jakubowski***

* Milli Eğitim Bakanlığı, atimaths06@gmail.com.

**Yrd. Doç. Dr., Gazi Üniversitesi, Eğitim Fakültesi, mineaktas@gazi.edu.tr.

*** Doç. Dr., Florida State University, College of Education, emjakubowski@admin.fsu.edu.

Abstract: The aim of this study is to investigate the effects of using concept maps on the mathematics classes achievement of students. The sample consists of 71 students, who are in two sixth grade classes at a Secondary School in Turkey. One of the sixth grade classes was used as the experimental group and the other one as the control group. The equality of the groups was determined by t-test analysis on a pre-test. The research was carried out over four weeks. The control group studied with conventional teaching methods and the experimental group studied with a teaching method including the use of concept map. Achievement Test was used as a data source and t-test was used to evaluate the hypothesis. Results showed there was a significant difference between the control and experimental group based on results of the achievement post test. The experimental group was more successful than the control group, $p=.000$ ($p<.05$). Based on this results we concluded the teaching the subject "fractions" through the use of concept map increase the knowledge of fractions.

Keywords: Fraction, concept map, mathematics achievement.

Özet: Bu araştırma; Kavram haritaları destekli eğitiminin öğrencilerin matematik dersindeki başarıları üzerindeki etkilerini incelemek amacıyla yapılmıştır. Araştırmanın örneklemini, Ankara ilindeki bir Ortaokulun 6. sınıfında okuyan 71 öğrenci oluşturmaktadır. Çalışmada Ortaokul 6. sınıf şubelerinden bir sınıf deney, bir sınıf kontrol grubu olarak belirlenmiştir. Oluşturulan kontrol ve deney gruplarının denk olduğu yapılan başarı ön testi sonuçlarından görülmüştür. Çalışma 4 hafta süresince devam etmiş olup kontrol grubuna geleneksel öğretim yöntemi ile deney grubuna ise kavram haritası destekli öğretim yöntemi ile ders yapılmıştır. Araştırmada veri toplama aracı olarak, başarı testi kullanılmıştır. Hipotezlerin değerlendirilmesi için t-testi kullanılmıştır. Yapılan istatistiksel analizlerde deney ve kontrol gruplarının başarı son testi puanları arasında deney grubu lehine anlamlı bir farkın ortaya çıktığı görülmüştür. Araştırma sonucunda; "Kesirler" konusunu kavram haritası destekli öğretimle işlemenin öğrenci başarısını olumlu yönde etkilediği görülmüştür, $p=.000$ ($p<.05$).

Anahtar Kelimeler: Kesir, kavram haritası, matematik başarısı.

Introduction

One of the factors that play an important role in mathematics teaching is the concept of education. Because one of the most important goals of mathematics teaching students learn the relationships between concepts and concepts that they interpret them with the background information. Given that the majority of the mathematics course is a course consisting of intangible concepts in the minds of the concept arises the importance of perception. All concepts in mathematics are interrelated, each new concept is self-other relationship built on previous concepts. Today, an appropriate effective learning the structure of mathematics, "associative learning" and is considered to be realized. Associative learning, concepts and processes consist of the bond between them with information. Students, after winning concepts and processes information, failed to establish a link between the concepts of information by processing information is not capable of learning mathematics (Baykul, 2003). One of the most important methods applied in the concept is the concept maps in education.

Concept maps have been proposed the first time by Novak and his students in 1974 (Novak and Gowin, 1984). Ausubel (1968) has given an assimilation theory of cognitive learning the idea of concept maps to Novak (1990). "Cognitive structure," Ausubel (1960) contends, "is hierarchically organized in terms of highly inclusive concepts under which are subsumed less inclusive subconcepts and informational data" (p. 267)

Novak and Cañas (2008) explains concept maps:

Concept maps are graphical tools for organizing and representing knowledge. They include concepts, usually enclosed in circles or boxes of some type, and relationships between concepts indicated by a connecting line linking two concepts. Words on the line, referred to as linking words or linking phrases, specify the relationship between the two concepts (Novak and Cañas, 2008, p.1).

Concept maps can facilitate effective when used in mathematics education. May allow students to enjoy more with mathematics. Some studies on the use of concept maps in education emerges in the literature:

Erdoğan (2007), "Calculus Using the Teaching of Concept Maps" in his work, the front and the data obtained from the post-test were analyzed with statistical methods, compared to the experimental group and the control group, the results of the experimental group was determined to be statistically significant difference in favor of the t-test.

Bayındır (2006), in his work with 6th grade students formed the experimental and control groups; the concept maps to the experimental group and with traditional methods, while the control group received only traditional methods. As a result of the experimental group, the degree of significance has determined that it is more successful than the control group.

Kabaca (2002), in their study of mathematics courses with a total of 149 high school freshman, concept maps have determined that the method is more successful than traditional methods of statistically significant differences in the degree.

Duru(2001), in his study of seventh graders, concept maps scratching course of students' academic achievement in processing was found to be higher than the traditional method course success of students in the class processed.

Persall, Skipper ve Mintzess (1996), concept map their research related to the students' working class with concept maps for a period, they observed that a significant increase in the restructuring of existing information, the observed 75% of these structural changes, "development" shows that were put forward.

By Horton (1991), concept map has been determined that the students conducted on the effect of the attitude towards the course and concept maps of concept study results based on the analysis of experimental studies on the map student behaviors that positively affect and concept maps with a greater success in education in the classroom.

Wallace and Mintzes (1990), they make concept maps in research in discovering useful conceptual change in biology and have determined that it is a valid technique.

“As a result, educational technology and to enhance the learning environment by creating concept maps based on course activities, providing better quality than the traditional teaching learning” (Erdoğan, 2007 p.49). For these reasons, in the 6th grade students on this research "fractions" concept in teaching the topic map is used as a teaching method.

Method

This study was conducted with a class of 71 students attending 6th grade in Turkey and answer the following questions were sought.

1. Is there any difference at the pre-test scores between in the experimental and control groups?
2. Is there any difference between in the experimental and control groups at the post-test scores?
3. Is there any difference between the pre-test and the post-test scores in the experimental group?
4. Is there any difference between the pre-test and the post-test scores in the control group?
5. Is there any difference between the average of the difference between the pre-test and post-test scores of the experimental group and the average of the difference between the pre-test and post-test scores of the control group?

Procedure

The experimental method of research models controlled pre-test and post-test model was applied. This model, as grouped by classes and school conditions and methods in schools is carried out on the group, which was formed earlier in accordance with specific purposes (Kaptan,1998). An experimental study of this study, one chance to try one of the groups formed by previously assigned in the control group and the other group the experimental group at once with pre-test before the start of the experiment was measured by the post-test once. Total studying at a secondary school in Ankara 71 (seventyone) 6th grade students; they are chosen as the experiment and the control groups. In this situation is shown in Table 1.

Table 1. Number of Students in the experimental and control groups

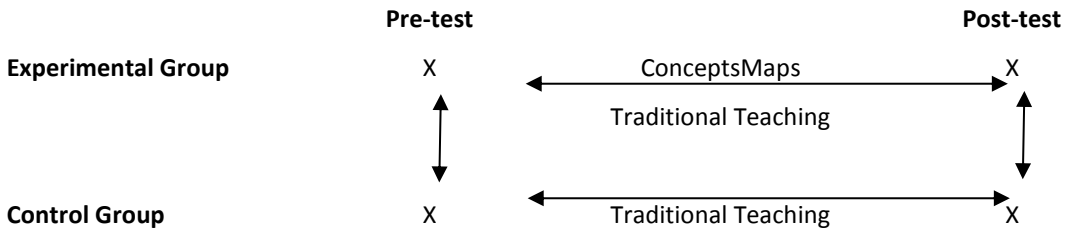
Groups	Sample	Total
Experimental	38	71
Control	33	

The distribution by gender of the variables are shown in Table 2.

Table 2. The distribution by gender of the variables

Gender	Experimental Group	Control Group	Total
Females	21	17	38
Males	17	16	33
Total	38	33	71

Experimental design used in the study are shown in Figure 1.

**Figure 1.** Experimental Design of Study

After the pre testing, classroom teacher as researcher is already past the stage of implementation for the experimental group prepared in accordance with lesson plans. Given information about concept maps before application to the experimental group and a simple concept map application was built.

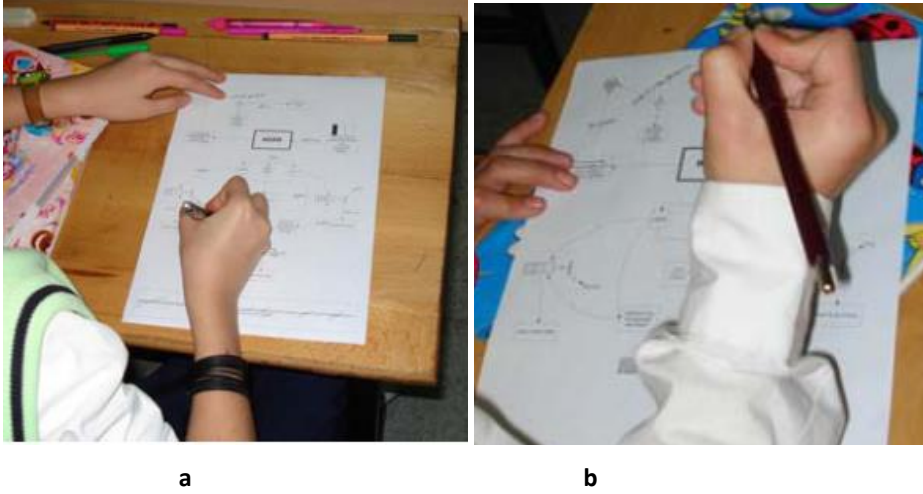
The concept maps technique and the traditional method have been applied to the experimental group and the traditional method has been applied to the control group during the application.

The students in the experimental group, Concept Mapping Technique applying concept maps related issues has been prepared with the computer program Microsoft Visio. During four week of each fraction about the topics covered final course the desired concept maps created by teachers of students in the experimental group about the issue time, but was given to the students incomplete. Missing parts of the map of the students were asked to fill. Before the next course concept maps evaluated made by the students errors have been reported as feedback by teachers in their students' after concept maps as an interactive classroom with the students was carried out again on paper in 90x60 size.

Concept maps are teaching tools developed by Novak and his team. Has been developed in accordance with the rules of English language. Therefore, the use of concept maps should be given to the rules of Turkish language.

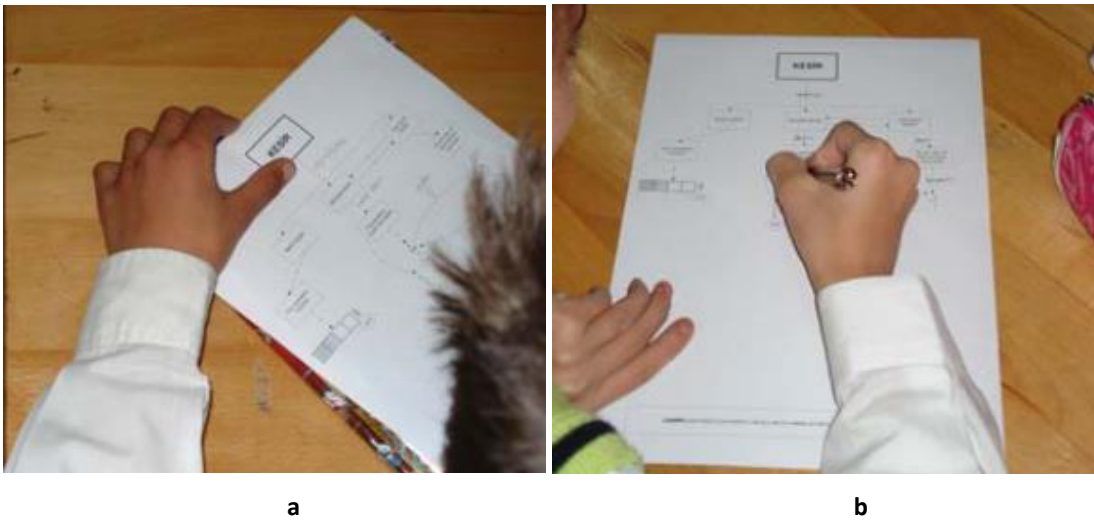
Features of concept maps given to the students in the experimental group are as follows;

- 1) What is a fraction? related concept map; generated concept map structure is placed on the map concepts and relationships given list, placement on the list of the students were asked to map the relationships.



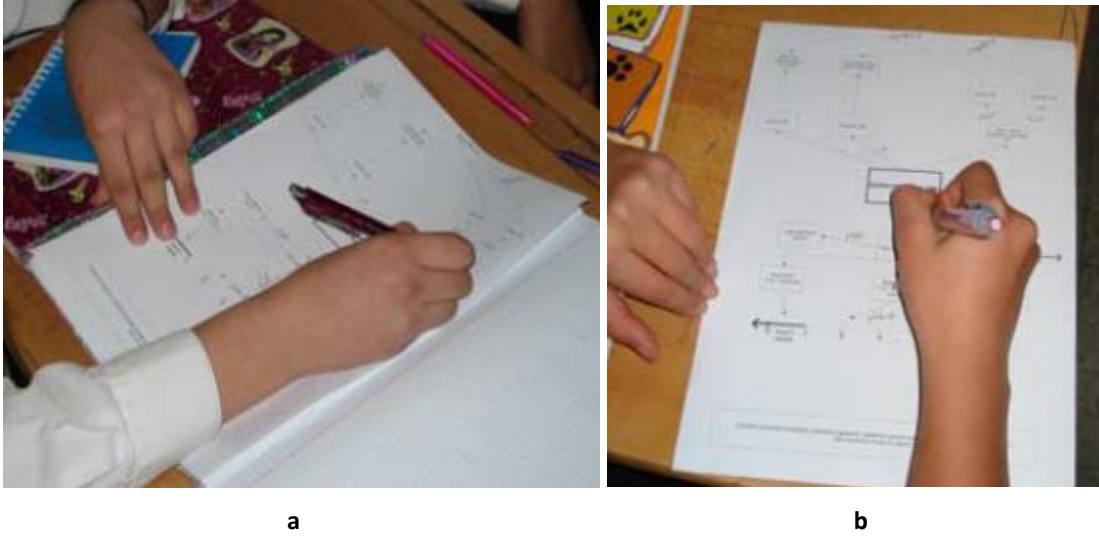
Picture 1 a-b: What is a fraction? Students fill the map with the related concepts.

- 2) What are the types of fractions? related concept map; generated concept map structure is placed on the map concepts and relationships given list, placement on the list of the students were asked to map the relationships.



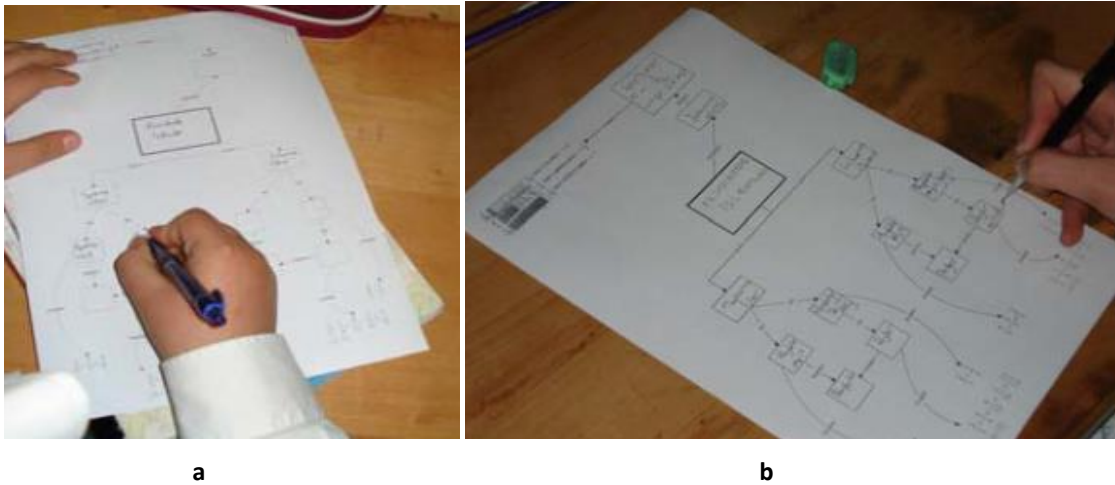
Picture 2 a-b: What are the types of fractions? be completed by the students about the concept map.

- 3) How to sort in fractions? related concept map; generated concept map structure is placed on the map concepts and relationships given list, placement on the list of the students were asked to map the relationships.



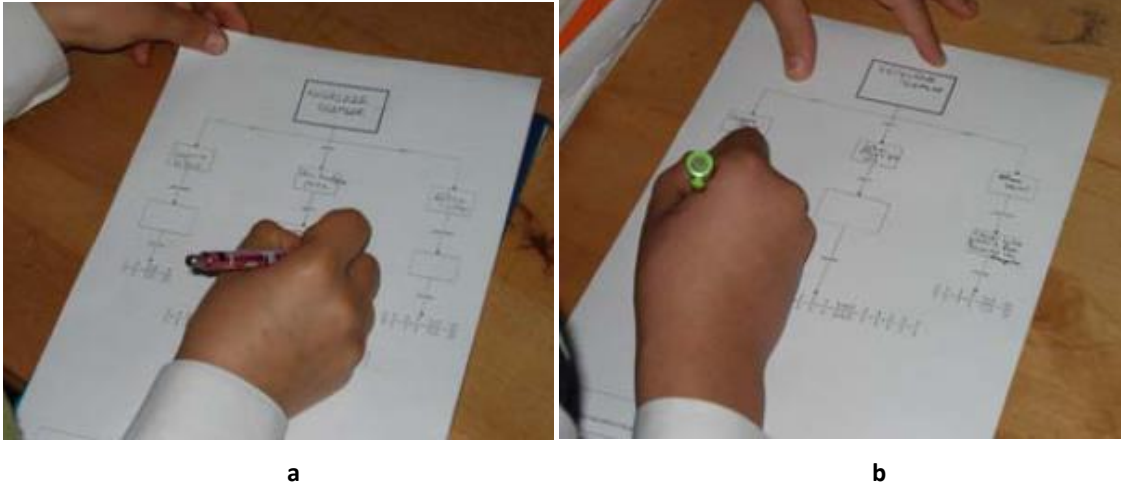
Picture 3 a-b: How to sort in fractions? be completed by the students about the concept map.

4) How in the addition and subtraction of fractions? and how the strategy is estimated using the results of operations with fractions? related concept map; generated concept map structure, relationships and concepts in the map list placed and concepts given in the list of the students were asked to place on the map.



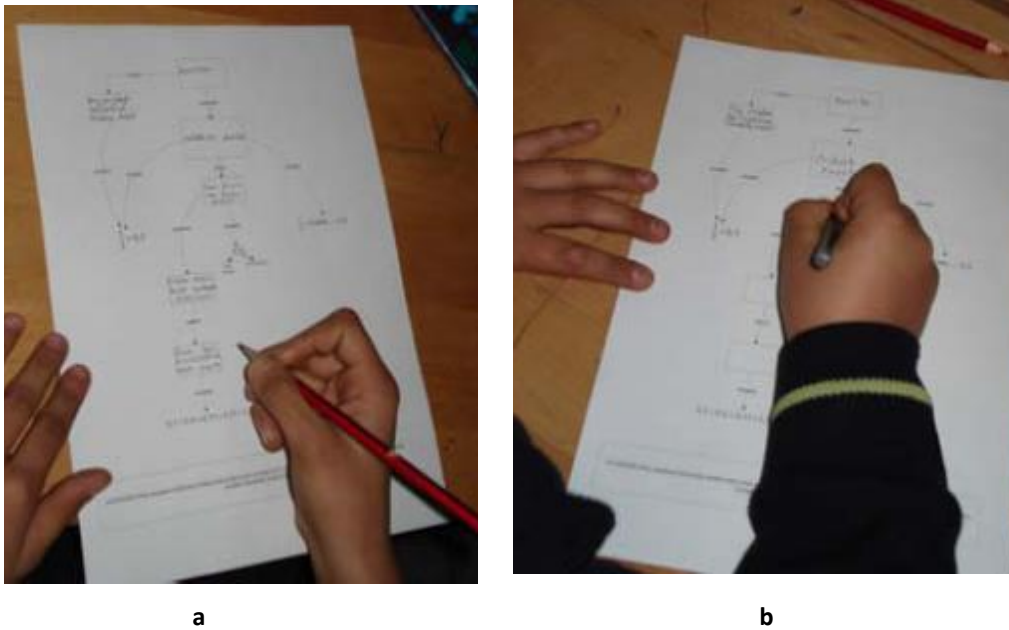
Picture 4 a-b: How in the addition and subtraction of fractions? and how the strategy is estimated using the results of operations with fractions? be completed by the students about the concept map.

5) How to multiply and divide operations with fractions? related concept map; generated concept map structure, relationships and concepts in the map list placed and concepts given in the list of the students were asked to place on the map.



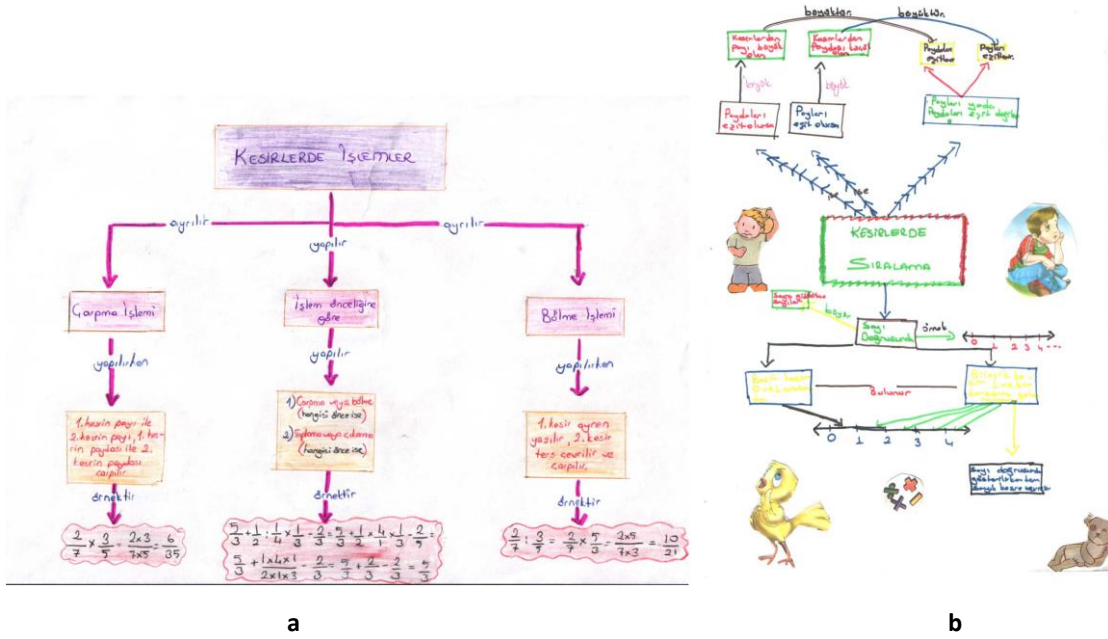
Picture 5 a-b: How to multiply and divide operations with fractions? be completed by the students about the concept map.

6) Regarding the comparison of the decimal expansion of fractions and decimals concept map; generated concept map structure, relationships and concepts in the map list placed and concepts given in the list of the students were asked to place on the map.



Picture 6 a-b: Filled in by the students of the respective concept map with the comparison of the decimal expansion of fractions and decimals.

7) Map concepts with fractions; Students of the "fractions" using the concepts of the lower areas of learning were asked to make their own concept maps.



Picture 7 a-b: Concept Maps prepared by students

Three hours of application on the experimental and control groups lasted approximately four weeks. At the end of the study achievement test of prepared for applications about fractions is given to students in experimental and control groups to the final test.

Data analysis was done using SPSS 15.0 computer program. So in this context, frequency, independent t-test was used. Pre-test and post-test evaluation of subjects administered achievement tests;

- How many students gave the correct answer to each question,
- How many students gave the wrong answer to every question
- Group of pre-test and post-test scores and the mean of the differences between them have been found

Results

This section is devoted to the findings related to the research questions sought answers

- Is there a significant difference at the pre-test scores between the experimental and control groups?

Is there a significant difference between the experimental and the control group pre-test scores were analyzed using t test for independent samples and the results are shown in Table 3.

Table 3: Comparison of the experimental and control group pre-test results

Test Type	Group	N	Median	Std. Deviation	t	Sd	p
Pre-test	Experimental	38	8.89	2.86	0.733	69	0.466
	Control	33	8.36	3.24			

The pre test results of the experimental group ($\bar{X} = 8.89$) was found to be higher than the pre-test results of the control group ($\bar{X} = 8.36$). However, a statistically significant difference was not found between the pre-test results of the experimental group and control group ($p > 0.05$). In other words, the measured outcomes related to sub-fractions of the control group and the experimental group learning areas are similar, there is no difference. These findings shows before the application of students in the experimental and control groups that they are close to each other in the level of readiness levels related to the previous topic. No significant difference between the experimental and control groups, in order to measure the effectiveness of the test, a significant difference between the post-test were analyzed whether applied.

- Is there a significant difference at the post-test scores between the experimental and control groups?

Is there a significant difference between the experimental and the control group post-test scores were analyzed using t test for independent samples and the results are shown in Table 4.

Table 4: Comparison of the experimental and control group post-test results

Test Type	Group	N	Median	Std. Deviation	t	Sd	p
Post-test	Experimental	38	12.87	3.12	6.657	69	0.000*
	Control	33	8.27	2.63			

* $p < 0.05$

The post-test results of the experimental group ($\bar{X} = 12.87$) was found to be higher than the post-test results of the control group ($\bar{X} = 8.27$). A statistically significant difference was found between the post-test results of the experimental group and control group ($p < 0.05$). In other words, the control group and the experimental group of fractions was measured at different gains for the lower areas of learning. This difference found in favor of the experimental group. The success of the concept mapping method applied here has been found to greatly increase the experimental group.

- Is there a significant difference between the pre-test and the post-test scores in the experimental group?

Is there a significant difference the experimental group between pre-test and post-test scores were analyzed using t test for independent samples and the results are shown in table 5.

Table 5: Comparison of the experimental group pre-test and post-test results

Group	Test Type	N	Median	Std. Deviation	t	Sd	p
Experimental	Pre-test	38	8.89	2.81	5.489	37	0.000*
	Post-test	38	12.87	3.12			

* $p < 0.05$

The post-test results of the experimental group ($\bar{X} = 12.87$) was found to be higher than the pre-test results of the experimental group ($\bar{X} = 8.89$). A statistically significant difference was found between the post-test results of the experimental group and control group ($p < 0.05$). Is there a significant difference between the pre-test and the post-test scores in the control group?

Is there a significant difference the control group between pre-test and post-test scores were analyzed using t test for independent samples and the results are shown in Table 6.

Table 6: Comparison of the control group pre-test and post-test results

Group	Test Type	N	Median	Std. Deviation	t	Sd	p
Control	Pre-test	33	8.36	3.24	0.126	32	0.900
	Post-test	33	8.27	2.62			

The post-test results of the control group ($\bar{X} = 8.27$) was found to be lower than the pre-test results of the control group ($\bar{X} = 8.36$). A statistically significant difference was not found between the control group of the post-test and pre-test results ($p > 0.05$). Considering the results of the traditional teaching that was applied to the control group was not effective than the concept map was applied to the experimental group.

- Is there a significant difference between the average of the difference between the pre-test and post-test scores of the experimental group and the average of the difference between the pre-test and post-test scores of the control group?

Is there a significant difference between the experimental and the control group access points were analyzed using t test for independent samples and the results are shown in Table 7.

Table 7: Comparison of the Experimental and Control Group Access Points

Test Type	Group	N	Median	Std. Deviation	t	Sd	p
Access	Experimental	38	3.52	4.54	3.786	32	0.001*
	Control	33	0.09	4.13			

* $p < 0.05$

The access points results of the experimental group ($\bar{X} = 3.52$) was found to be higher than the access points results of the control group ($\bar{X} = 0.09$). A statistically significant difference was found between the post-test results of the experimental group and control group ($p < 0.05$). In other words, the measured outcomes related to sub-fractions of the control group and the experimental group learning areas are difference. This difference found in favor of the experimental group.

Conclusions and Discussion

The necessity of the use of new techniques in the teaching of mathematics, the results of our country as an international exam and various tests conducted in our country is emerging from the math average. Concept maps are used in science education and primary education is given in the application of science and technology textbooks. In mathematics teaching done some work on concept maps and concept maps revealed that the successful results of the math instruction.

In this study, 2008-2009 academic year on a total of 71 sixth grade students studying in a secondary school attached to the Ministry of Education in Ankara, the numbers learning space "fractions" has been associated with lower learning area. Work to be an experimental and a control group was conducted on two groups. The research applied in experimental and control groups in the pre-test and post-test, the results were analyzed with SPSS. The concept maps and the traditional methods to the experimental group, while the control group only traditional methods were administered. The effect of concept maps assessing student achievement test scores of these two groups were determined.

Results on the findings of the study are as follows.

There are 38 students in the experimental group and 33 students in the control group who participated in the study. The success rate of the experimental group in the pre-test results 8.89, the success rate of the control group in the pre-test results 8.36 that there wasn't determined to be a significant difference between groups. When the final test results; the success rate of the experimental group was 12.87 and the control group was 8:27.. While the success rate of the test groups with regard to access to the results of the experimental group was 3:52; the control group was 0:09. When the results are examined in general who participated in the mathematics teaching methods in terms of both concept mapping method, as well as the students who participated in the traditional teaching method "fractions" can be said to be an increase in information about the sub-learning area. But when we look at the success rate according to the latest test results and access by the traditional method of concept mapping method, students "fractions" in improving the information on the sub-areas of learning is understood to be more effective. Already according to the latest test results and access; there were significant differences between the experimental and control groups were statistically significant. Differences found in favor of the experimental group.

The use of concept maps, math lesson learning areas of the numbers "fractions" in increasing student achievement related to the sub-areas of learning appeared to be more effective. This result supports the concept map shows that the positive effects on student achievement and the use of concept maps in a variety of different education levels and the use of Surveys found that the increase of success in different subject areas. This research supports Erdogan (2007) Calculus-I course, the Şahin (2003), 3rd, 5th, 6th, and 7th grade math class, Altınok (1998) 5th grade their work in math class.

Researchers will undertake research in this area; before you start teaching the concept map concept map should be explained to the students and giving examples, students should be built application. This way, you avoid the confusion associated with the use of concept maps.

This research 6th grade math lesson learning areas of numbers "fractions" is limited to the lower area of learning. The work done by researchers in different subjects more accessible to different conclusions about the effect of concept maps in mathematics education.

Concept maps, using widely used in science and technology education, we see that it is limited to the application of mathematics. In this case, in the teaching of mathematics concept maps shows not clear enough. To remedy this situation; Teachers in training institutions, concept maps with more teachers should be informed about education and the Ministry of Education, teachers, courses, seminars and in-service training should be informed about the concept map.

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