THE EFFECTS OF USING LEARNING OBJECTS IN TWO DIFFERENT SETTINGS

Ünal ÇAKIROĞLU
Department of Computer Education and Instructional Technology
Karadeniz Technical University
Turkey
cakiroglu@ktu.edu.tr

Adnan BAKİ
Department of Secondary School Science and Mathematics Education
Karadeniz Technical University
Turkey
abaki@ktu.edu.tr

Yaşar AKKAN
Department of Mathematics Engineering
Gümüşhane University
akkanyasar61@hotmail.com

ABSTRACT
The study compared the effects of Learning Objects (LOs) within different applications; in classroom and in extracurricular activities. So in this study, firstly a Learning Object Repository (LOR) has been designed in parallel with 9th grade school mathematics curriculum. One of the two treatment groups was named as "classroom group" (n=24) used LOs with the guidance of the teacher during lessons in a computer lab, another group named as "project group" (n=26) used LOs at home with the aim of preparing projects and assignments. Students in both groups used LOs during 11 weeks. A pre-test and post-test quasi-experimental design was used. Test results are compared in different learning domains (sets, numbers, relations and functions). In addition the interviews with the teacher and the observations inside the class were taken into account for revealing the reasons about the change on academic achievements. The results of the study about students' academic achievements showed that; LOs use in classroom activities were more effective than LOs use in extracurricular activities if sets, numbers, relations, functions and operations domains are considered together. Nevertheless this study supported the idea of "LOs can be used in both in classroom activities and in extracurricular activities".
Keywords: Learning objects, High school mathematics, Mathematics curriculum, Web based learning

INTRODUCTION

Web services facilitate transmission of the information through internet. This transmission supported learning environments to be developed rapidly. The last few years, worldwide interest about web based learning has been tended to LOs. As indicated in the term; instead of the word "material", "object" is used to impress on the real potential of this approach. Although LOs have not had a long history, the researchers have made many different definitions about LOs. For instance, LOs are defined as discrete chunks of reusable materials or activities that can be come together with other LOs to construct learning contents (Koppi et al., 2005). Despite the fact that there has been no definition universally agreed on yet, some common opinions have been put forward about LOs like; "LOs can be united in order to be used in different areas, can be reused, and can be arranged easily". So, LOs can be designed to support exploration, investigation, constructing solution by manipulating content or parameters. Student with different learning needs may also benefit from LOs like doing homework, reviewing subjects or making projects.

It is possible to organize reusable learning environments by using LOs on web. Longmire (2000) has stated that it is necessary for the object to be arranged as a part of a learning content (topic or lesson) which is greater than itself or to be used as meaningful learning source on its own in order for the learning contents prepared on web to be reused. This makes traditional instruction methods to be re-designed with the aim of being used on web environment for the web based courses (Hamel & Ryan, 2002). Within this idea, Wagner (2002) clarified that; it is necessary to construct content design models for re-united LOs according to the basis of dividing content into segments for special learning targets. Thus, instead of static and wide contents on web environments the dynamic course contents can be designed by the union of LOs.

Recently, the research studies related to LOs have tended to the sub-fields such as the relationship between LOs and instructional designs, the classification of LOs, principals for interactive LO design and the evaluation

process of LOs. But the research studies including LO based long-term applications are rather insufficient. The studies including the applications such as presenting LOs designed for university level different courses via distance learning have been considered (Farha, 2007; Stamey et al., 2005). Some research studies have expressed the ideas that LOs can be used as learning tools at classroom settings on guidance of a teacher or when used individually (Bradley & Boyle, 2004; Churchill, 2007; Haughey & Muirhead, 2005; Kay & Knaack, 2007; Kenny et al., 1999). Even if LOR have started to be prepared for primary and secondary education recently, the number of LOs directly related with the outcomes from curriculums is limited (Ally et al., 2006; Gronn et al., 2006). In this study, we have especially focused on the student outcomes in parallel with LO design. Therefore LOs in this study are surrounded with metadata structure and designed so as to prioritize student-computer interaction, to be able to set different problem cases including exercises, trial and special tutoring activities, animations, and also to teach different concepts in detail. The designed LOR can be extended and a great part of the outcomes in accordance with Turkish 9th grade mathematics curriculum has been transferred to object repository as being modeled in the form of LOs. In this study a specific instructional design model consisting Analysis, Design, Development, Implementation, and Evaluation phases (ADDIE) is used to create LOs. The objects have been produced with java and action script codes.

Thus, the goal of this study is to investigate effect of the use of LOs in high school mathematics courses. This impact has been revealed by defining the differences, according to academic achievement, appearing among the students using LOs at an authentic classroom environment and with the extracurricular activities.

RELATED STUDIES

A less number of experimental studies have completed about LOs that some of them were case studies planned especially for high school students in order to define fundamental principals of LO use. It has been suggested so often that real potential of LOs can appear with the long-term experimental studies but this has been made rarely (Kay & Knaack, 2007; Sedig & Liang, 2006). Some examples from case studies and experimental studies about the usage of LOs have been presented below.

A case study including difficult mathematics concepts are taught by using LOs and a positive increase has been seen on academic achievement of students who are learning by using the objects (Sedig & Liang, 2006). Another study has indicated that 400 students from Department of Computer Sciences using LOs at mathematics courses had a high performance during the courses (Chalk et al., 2003). However, study results have shown that this achievement has not only been the result of the LOs, but also both the usage of LO and the level of readiness for the course have a high correlation in the issue of the achievement of the student. The study carried out at Indiana State University has tried to explain the learning outcomes of the students from two different classes by using LOs and course books during the course in these different classes. The findings at the end of the courses have pointed out that the academic achievements of the groups who used LOs are higher than the ones having used the course books (Farha, 2007). There are also qualitative studies indicating that LOs have been developing the learning performance of the students (Kenny et al., 1999; Lim et al., 2006; Windschitl & Andre, 1998). Besides, two research studies bring up their findings via descriptive analysis that LOs have enhanced learning. One of these studies addressed some changes at the assignments of many students (Bradley & Boyle, 2004), and in another study the ratio of the achievement at exams has increased from 12% to 23% (MacDonald et al., 2005). Rieber et al. (2004), has pointed out that the achievement of the students benefiting from LOs is higher than the ones depriving of this support. At Windschitl and Andre's (1998) studies it has been concluded that the students who have studied with the LOs in two subjects out of six are more successful than the ones who have not studied with LOs. On the other hand, Kay and Knaack (2007) have expressed that the studies related to LOs have not been at adequate level, there should be done actual experimental studies, and studies about content design models constructed by using LOs.

As stated above, the effects of LOs which are used in classrooms are generally compared to traditional methods used in the classrooms. Even if there are some suggestions about extracurricular use of LOs (Ally et al., 2006; Kay & Knaack, 2007), but limited number of studies have been done yet. Thus; in this study, the in classroom and extracurricular use of LOs are dealed together and the academic achievements of students have been examined in this process.

DESIGN AND PROCESS

Within the study, firstly the Turkish 9th grade mathematics curriculum has been examined and the scenarios have been provided for LOs in order to be conformable to the level of students. We focused on LOs that the interaction levels should be high and different problem cases should be formed by LOs in LOR. The LOs have been located at LOR as integrated with object management system. In this study, widely accepted the Institute of Electrical and Electronics Engineers Learning Object Metadata (IEEE LOM) standards have been used for

the developed LOR. Object repository consisting of LOs which are mostly convenient for 9th grade mathematics program has been published on the website "www.ogrenmenesneleri.org".

Study was conducted during spring term at a high school. The LOs in the program include; drill and practice, problem solving, decision making, conceptual learning activities including sets, numbers, relation and functions learning domains. The course schedule is presented in Table 1.

Table 1: Course schedule

LEARNING DOMAIN	Sub Learning Domain	Schedule	Duration	Number of Related questions in post test
NUMBERS	1. Natural Numbers	1st week	5 weeks	2
	2. Whole Numbers			1
	3. Real Numbers	2nd week		1
	4. Rational Numbers			1
	5. Modular Arithmetic			1
	6. Absolute Value	3rd week		2
	7. Exponential Numbers			1
	8. Squared Numbers			1
SETS	9. Problems	4th- 5thweek	2 weeks	4
	10. Basic Concepts in Sets	6th-7th week		1
	11. Set Operations			3
RELATION, FUNCTION AND OPERATION	12. Relation	8th week	4 weeks	2
	13. Operation	9th week		2
	14. Function	10th week		1
	15. Operations in Functions	11th week		2

This kind of LOs support has enabled LOs to be used as supporting tools for learning. Vygostky (1986), defines the support for the student as the main locomotive of learning and defines this role as scaffolding. The mentioned role, "scaffolding", was tried to be gained from learning environment formed with LOs and guided by the teacher. The learning environment is aimed to fill the information gap between the student's readiness and zone of proximal development cases.

First, the teacher and the students in a pilot study are informed about the use of LOs and the LOR. At the pilot study, the deficiencies in LOs evaluated by students in two different classes (n_1=20 and n_2=24) and also by their mathematics teachers, then the LOR is updated through the comments of students and teachers.

METHODOLOGY

Since the study has been planned as quasi-experimental, two 9th grade classes taught by the same teacher have been randomly selected classes as two groups used LOs in different ways. The teacher's guidance in both groups was only designing learning environments for students. During eleven weeks period the students from classroom and project groups have studied by using 38 objects from LOR. In both two groups, we did not intervene the teacher's usage ways of LOs, so she used LOs completely towards her planning in both groups. Before the study, the interview with the teacher showed that; the teacher has tried to benefit from computer and internet in so far as it's possible. The teacher has used internet for annual plans, course presentations, and sometimes for downloading different exam questions. She has pointed out that she encouraged students use internet for researching, but since some of the students do not own computers or some of the parents limits their children in the issue of using internet, some difficulties can appear while benefiting from internet. The data indicating the students' properties of computer usage is listed in Table 2.

Table 2: Computer usage of groups

Group	Number of Student(n)	Gender		Average Age	The average age that students begin to use computer
		M	F		
Classroom Group (A)	24	9	15	15.66	10
Project Group (B)	26	11	15	16.1	11

Students of Group A have had their courses at a PC lab which includes at least one PC to one student. Students of Group B have used the PC lab when it is free from Group A and could have prepared their assignments and projects here in the laboratory. In addition, most of the students have prepared their assignments and projects out of the school, when they find PC to prepare them at their home or in different places.

Group A: In this group the teacher has prepared lessons by using LOs towards course objectives and planned the course related to the objects. The teacher introduced LOs to students with brief notices. She sometimes let students use LOs individually. She sometimes solved instance problems on LOs and she used tutorials as demonstration. Students were not directly pushed to reach intended learning outcomes and no special effort was spent to support students who had difficulty to understand by using LOs. So, in our case the practice of teacher's using LOs and trying to make students use them in the classroom happened only as preparing the learning environment for only scaffolding students by LOs. This can be interpreted as the teacher did not directly affect development in cognitive learning domain of the students

Group B: In this group, students used the objects out of the class. The teacher has assigned students certain number of projects about to the objectives of related learning domains. While the projects are being carried out, similarly in Group A the teacher explained to the students in this group how to use LOs in projects and how to keep records of details and solutions of the questions in projects. Additionally, she briefly explained how to use LOs as she did for group A. She asked students to explain how they used LOs while they were dealing with the project. She directly covered activities on LOs with different questions, as well as she sometimes engaged in activities that require different investigations on LOs. During project process, teacher only provided clues to explain project questions but she did not give information about which solution algorithm to be used. In this setting the teacher also tried to create a learning environment but she did not put any encouragement or pressure on students to make them attain the goals. So, again it is possible to comment that the practice of the teacher on this group did not affect the development in cognitive learning domain of the students. These groups can be defined in Table 3.

Table 3: The use of LOs in different settings

Group A	Group B
LOs have been used during classroom setting	**LOs have been used outside of the classroom setting**
• Using objects at some part of the course • Using LOs as scaffolding • Teaching lesson by using objects completely • Using objects one by one or by developing content	• Teacher Suggestion, Orientation • Assignment, Project • Research • Exercise - Practice • Game

So the teacher tried to avoid directly affecting the development in cognitive learning domain of the students in both groups. "Students' different usage of the instructional tools in different learning environments" can be accepted as the factor whose effect cannot be controlled and the matter of concern for this study with experimental design.

INSTRUMENTS

In order to reveal the effects of LOs, the qualitative data is also used together with quantitative data. The quantitative data collection instruments were two achievement tests. The interviews and observations in classroom were other instruments. The two achievement tests were pre-test and post-test. Pre-test were administrated at the beginning of the study with the aim of determining students' levels at previous mathematics courses. The post-test composed of 25 multiple choice questions prepared by taking into account the opinions of the teachers and field experts. The pre-test items were selected from the 7th and 8th grade mathematics topics and the post-test has been prepared related with the outcomes from 9th grade mathematics. Both of the pre-test and post-test have been conducted to 70 students before the study, and the alpha reliability coefficients have been in turn determined as R(pre-test)=0.79 and R(post-test)=0.78. Cronbach and Richard (2004) noticed that 0.8>R>0.7 is acceptable for reliability of tests. Item analysis is conducted by computing the results for discrimination index and difficulty index on 33 questions for pre-test and on 34 questions for post-test. There were a few questions having low difficult index value which means too difficult and low discrimination index which means too easy. After eliminations in item analysis, the pre-test is reduced to 26 items and post-test is reduced to 25 items in order to derive reliability. After item analysis computations 4,17,19,20,23,25, and 28th questions are removed from the pre-test. Also 2,8,10,14,21,22,25,27 and 34th questions are removed from post-test for determining the reliability as 0.78 because of their discrimination indexes were less than 0.19.

The content of the items included the learning outcomes which were about numbers, sets, relations, functions and operations learning domains. As Anastasi and Urbina (1997) suggested the test has content validity of tests

were built into it by careful selection of which items to include. Items are chosen so that they comply with the test specification which is drawn up through a thorough test of the subject domain. The numbers of the items were determined according to the learning outcomes by illustrating the outcomes on table of specifications. The number of items of post-test and the related learning field is seen in Table1. Bailey (2004) noted that by using a panel of experts to review the test specifications and the selection of items the content validity of a test can be improved. So two experts in mathematics education and a mathematics teacher of 9th grades reviewed the items and commented on whether they are appropriate for 9th grade mathematics curriculum outcomes and cover a representative sample of the behavior domain. Then they discussed each other until they come to exact agreement on each item. It can be concluded that they shared a common understanding of the items, distractors and the correct answers.

In addition to pre-test and post tests; teachers' opinions about the students 'academic achievements acquired with the students' usage of LOs by the semi-structured interviews with teacher have also been obtained. The teacher is interviewed generally related to the "learning" and "engagement" effects of LOs. The interviews are constructed via semi-structured items which are designed by contribution of "Learning object evaluation scale for teachers" which Kay and Knaack (2008) developed it for teachers to evaluate the effect of LOs. The items on this scale which include motivation, feelings, interaction, learning easy, understanding dimensions is reconsidered through the treatments in two groups. Also, an instrument which has 14 criteria for "learning" and "value" dimensions for evaluating learning environment designed by using LOs developed by Haughey and Murihead, (2007) is also taken into account. Besides, the achievement tests, the interviews also, the courses carried out by the teacher during the study have been observed and interpreted with the quantitative data.

DATA ANALYSIS

The highest grade has been 100 while evaluating the pre-test conducted for determining students' general mathematics adequacies before the study and the post-test applied with the aim of determining their achievements in related with the topics they dealt with during the study. The pre-test and post-test results for both groups have been analyzed statistically. The data acquired from pre-test and post-test provide the conditions of parametric tests. So, independent sample t-test is carried out to define if there is a significant difference among the grades of pre-test and post test. Similarly, according to the results of post-test; independent sample t-test is applied if there is a significant difference among two groups. The opinions of teacher have been presented as research problems in accordance with direct quotation. While the change of students' academic achievements in different classes is being interpreted, observation data is also used.

FINDINGS

The average of grades taken from pre-test and post-test have been presented in Figure 1.

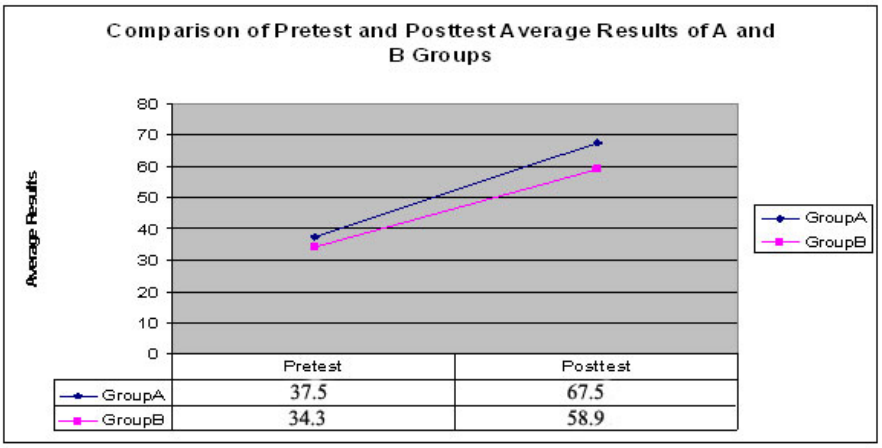

Figure 1. Pre-test and post-test averages of groups

The results of t-test carried out with the aim of defining statistically if there appeared significant differences among the pre-tests of the groups at the beginning of the study have been presented in Table 6 and in Table 7. In order to use independent t-test the data must verify the assumptions of t-test. The assumptions for independent t-tests are;

- *The dependent variable is normally distributed.*

When testing for normality, we are mainly interested in the tests of normality table. In this table Shapiro-Wilk Test is more appropriate for small sample sizes (< 50 samples). If the value of the Shapiro-Wilk Test is greater the 0.05 then the data is normal. For this reason, we used the Shapiro-Wilk test as our numerical means of assessing normality shown in Table 4.

Table 4: Test of normality results for pre-test and post-test

		Shapiro-Wilk		
Tests	Groups	Statistic	df	Sig.
Pre-test	A	0.909	24	0.134
	B	0.954	26	0.286
Post-test (Section1)	A	0.945	24	0.208
	B	0.952	26	0.255
Post-test (Section2)	A	0.862	24	0.104
	B	0.884	26	0.107
Post-test (Section3)	A	0.931	24	0.104
	B	0.952	26	0.252
Post-test	A	0.953	24	0.309
	B	0.947	26	0.192

We can see from Table 4 that for the Group A and Group B, both Pre-test, Post-test (Section1), Post-test (Section2), Post-test (Section3) and Post-test (Total) was normally distributed.

- *The two groups have approximately equal variance on the dependent variable.*

It can be checked by looking at the Levene's Test. The Levene's Test for pre-test and post-test is seen on Table 5.

Table 5: Levene's Test for pre-test and post-test

	Levene's Test for Equality of Variances	
Tests	F	Sig.
Pre-test	1.227	0.274
Post-test (Section1)	0.107	0.705
Post-test (Section2)	1.601	0.212
Post-test (Section3)	0.230	0.634
Post-test(Total)	0.351	0.556

As the significance for Levene's test is 0.05 or upper for each tests the variances are assumed equal.

- *The two groups are independent of one another.*

The groups are naturally occurring groups which are assigned to the students in two different classrooms.

The results of verifying tests showed that both samples come from normally distributed populations with equal standard deviations, so the independent samples t-test may be used for determining the significance difference among two groups' achievement test results.

Table 6: The descriptive statistics of students' pre-test scores

Groups	N	Mean	SD
Group A	24	37.5	13.490
Group B	26	34.3	11.491

Table 7: Independent samples t- test scores within groups before treatment

Groups	N	df	t	P
Group A	24	48	0.903	0.371
Group B	26			

According to pre-test results owing to the data, $t(48) = 0.903$ and $p>0.05$ there was no significant difference among the mathematical knowledge of the groups. On the Figure 1 it is seen that the pre-test averages of the

groups A and B are close to each other (37.5, 34.3). The highest and the lowest grades of two groups are also close to each other (A:16–64, B:12–52). At the end of the study, in order to define if the post-test grades of the groups have caused a significant difference; independent sample t-test applied for bringing up the significant difference among groups is shown in Table 8.

Table 8: Independent sample t-test results of A and B groups within post-tests

Measure	Group	N	Mean	SD	df	t	p
Section1 (48)	A	24	33.17	10.51	48	0.404	0.688
	B	26	32.00	9.92			
Section2 (20)	A	24	15.66	3.31	48	1.196	0.237
	B	26	14.46	3.76			
Section3 (32)	A	24	18.66	6.84	48	3.330	0.002
	B	26	12.46	6.33			
Total (100)	A	24	67.5	13.77	48	2.147	0.037
	B	26	58.92	14.42			

This evaluation shows that as a result of the treatments, there was a significance difference in the students' total academical achievements. The total test results $t(48) = 2.147$, ($p<0.05$). This result reveals that the different use of LOs has different effects on academical achievements. This result was observed with respect to the test results taken as a whole. In addition, when the ($\eta^2 = .1415$) assessment has been taken into consideration, it illustrates that teaching ways in different classes have a large influence on students' achievements. In fact, in classifications (for the sample) impact size indexes indicate how much of the variance at test grades is resulted from the independent variable (Cohen & Manion, 1988). That the values are .01, .06 and .14 define the impact size by order of small, medium and large.

No significant differences were observed between the answers of the two groups of students for the 1st and 2nd sections in the final tests (p section1: .688, p section2: .237). So, we can say that there is no significant difference between the academic achievement scores of the students for "Numbers" and "Sets" units. For the 3rd section, however, there is a significant difference for "Relations and Functions" unit favoring Group A (p section3< .05).

A semi-structured interview was administered three times periodically in order to obtain the qualitative data of the study. We captured data from teacher's opinions about the use of LOs in authentic classroom environment and in extracurricular activities during the process of using the tools in Group A and during the process of using the course pages prepared by the assigned projects by Group B. At the end of the analysis, the codes determined for each question, themes assembled by the codes and the frequencies of the codes were presented in Table 9. The interview questions were generally about learning and engagement effects of LO based learning environment. Appendix-1 illustrates some examples from the interviews.

Table 9: Teacher's opinions about the effect of learning environment

Theme	**About Group A**			**About Group B**		
	Numbers	Sets	Functions	Numbers	Sets	**Functions**
Not getting bored	2	1	1	1	1	**1**
Learning Easily	1	2	1	2	-	**2**
Interest	3	1	2	2	2	**1**
Motivation	2	1	2	1	1	**1**
Being active	2	2	4	2	1	**1**
Learning individually	1	1	1	3	2	**1**

The teacher used more positive expressions about establishing and sustaining motivation of the student in Group A (5 times) than the expressions about sustaining project motivation in Group B (3 times). The teacher noted that the students in both groups were active while they were working with tools and this was one of the most frequently repeated statements. Particularly, the teacher more frequently mentioned that the students were even active for 'functions' unit, which they have not faced previously. It is interesting that the teacher commented Group B students as active although they did not use the tools in the lesson. Besides, the teacher used expressions like "they are more independent from teacher" and "they can learn by themselves" more frequently for Group B than Group A. The frequencies of the positive codes mentioned by the teacher in each group were the same. This can be taken as the indicator of that the teacher gave similar opinions for both groups with regard to the effects of the tools on students. That the teacher more frequently mentioned that the students using LOs

were active in "functions unit" than she mentioned for Group B students, can be interpreted as using LOs in classroom render students more active.

RESULTS AND DISCUSSIONS

At the end of the study an increase at a little deal at all two groups A and B has been seen (Figure 1). For all two groups when it is looked for the average grades taken at the beginning and at the end of the study, it has been noted as A: 37.5–67.5 and B: 34.3–58.9. As evaluated in percentage, the increase of the achievement for Group A it is 80%, for Group B 71%. Even if the pre-test measures general mathematics achievement and the post-test measures the achievement related to the subjects studied during study, it is seen that while there is no significant difference between the groups' achievements at pre-test but significant difference is recognised according to the post test results of Group A and B.

After the interviews with teacher it has been designated that the visual and interactive features of LOs increased the motivation and the achievement of A and B groups and this motivation influenced students' achievement in positive way. It is known that learning environments based on LOs especially with high interaction enables positive impact on students' academic achievement (Lim et al., 2006; Sedig & Liang, 2006). It has been pointed out by focusing on the interview with the teacher carrying out the study that the teacher has no negative opinions about using internet for teaching. Also she has no experiences on designing course or planning web-based teaching on internet, but has the ability to use computer at an adequate level. In addition, there are some research studies available indicating that the negative opinions of teachers about using internet based instruction have a negative impact on academic achievement (Becker & Ravitz, 1999; Ertmer et al., 1999). Thus, the positive ideas of teachers about using internet in instruction have contribution to the success of application at class. Besides, it can be stated that at this treatment the minority of technical faults occuring frequently at web-based teaching applications like the study of Karaman (2005) have had positive contribution to achievement. However, against some researchers having the idea that the impact of LOs on learning can only occur with the teacher's help (Buzza et al., 2005). The findings of the study are seen to be opposite of these researchers as the application in Group B.

The study indicates that one of the reasons of the increase in the achievement of A and B groups can be the student-centered activities in learning environment and the success of the teacher with perfect guidance helping the students while using these activities. It has been considered that the impact can also be seen the average grade results of Group A on post-test. So, the parallel can be seen between the findings of this study and some of the studies in which using computer-based instruction materials in classroom environment can have positive impact on students' achievements (Bradley & Boyle, 2004; Jimoyiannis & Komis, 2001).

Even if students from Group B have had courses with traditional methods, they studied with LOs on projects. The students observing LOs and studying in order to perform the projects have indicated that they studied on the projects seriously and delivered their works to their teachers by completing them. Group B has not reached the same increase in achievement as Group A, but LOs had also great impacts on Group B students' achievements. This point out that usage of LOs at extracurricular activities may perform positive results. The findings of the study concerning Group B supports the idea at Kay and Knaack's (2008) studies that when LOs arrange the student control at a convenient level, the appropriate content is prepared and also when LOs involve motivation items, LOs can also be used out of the class. So based on this idea, we can say that LOs can also support the students not only inside classes but also out of the classes. Thereby, it can be mentioned that the support called "scaffolding" by Vygotsky (1986) is possible to be enabled from LOs. Jonassen et al. (1993) defined scaffolding as any help intentionally given to students so that they could fulfill a task. From this point of view, the help that the students in group B got from LOs to complete their projects can be referred as scaffolding. Surely, one of the preconditions of this aspect is to prepare the project contents in quality. However, while preparing projects the students have often used objects for different aims such as learning concepts, drill and practice or solving problems. In addition, group studies have also positive impact on the increase of students' achievement at a percentage of 70% during the preparation of the projects.

In the study when the students whose academic achievements have increased are observed one by one, it is seen that some of the students who had low grades at pre-tests have increased their achievements at post tests. At this point the result such as the level of students' readiness for the course should be high, the research of Chalk et al. (2003) has not been confirmed with this study in order to be successful with LOs at the studies.

The students who gave right answers to the questions related to "numbers" and "sets" in the pretest could also give right answers in the post-test. Moreover, most of the Group A and B students who had lower averages in the pre-test, managed to have good scores in the "numbers" and "sets" units in the post-test. However for the

answers given for the questions about "relations and functions unit", which the students faced for the first time, using LOs in the classroom had greater impact on academic achievements comparing to using LOs in extracurricular activities. This may be showing that; LOs can be more effective on the performance in classroom for the subjects that students have not faced before. Besides, it was observed that some difficulties were experienced while students were preparing projects with LOs for the subjects they have not encountered before. The reason for this was the projects prepared by the teachers focused on consolidating concept knowledge and solving problems rather than conceptual learning.

CONCLUSIONS AND RECOMMENDATIONS

The findings reveal that a proper planning is needed in order to increase academic achievement depending on the systems with LOs, and for the students to perform the expectations, for the teachers to adopt their roles in the application of the system and to carry out them well. So both the design features of the LOR and teachers', students' views include the items which can effect to the academic achievement.

In addition it has been concluded that there has been significant difference between Group A and Group B according to the result of post-test. The increase of achievement as a result of applying LOs in class environment depends on the items given below.

- Teacher's positive ideas about the success of the study,
- Enable students to work independently in a classroom by providing them motivation,
- Not meeting with technical problems so much,
- The quality of LOs,
- The interests of students.

Group B used LOs for preparing projects and the results obtained from the treatment at Group B as follows;

- LOs prepared properly for the curriculum has enabled to prepare a project which is proper for the level of students,
- When the projects have been prepared, the LO based projects are also effective on academic achievements,
- The process of preparing projects from LOs is not simple and the usage of the system of designing course prepared by this aim is very influential within this process,
- The projects based on LOs can also be carried out in a successful way of collaboration,
- The usage of the systems purified from technical problems by teachers who are going to assign projects and the teachers' beliefs in the benefit of such kind of systems,
- The need for LOs at a sufficient number to be selected by the teacher for preparing projects.

By this study it is concluded that LOs can be used as supportive means (scaffolding) for learning via projects and assignments, and they can also be used to enhance learning in classroom activities using LOs with different instructional methods together. It has also been deducted that it is possible to prepare learning environments which are appropriate for students' levels by planning proper LOs and in addition, and these learning environments may have positive impact on learning. Being used of these kinds of systems at pilot schools to be selected by volunteer teachers, internet use in instruction should become widespread in order to remove the deficiencies at this point. In addition, it is needed to exhibit presentations to use it both for the courses out of the school by students.

This study addresses that; if the LOs used for the subjects which the students have not faced before; in classroom activities would be better for this case. Considering this case; LOs for new concepts should be designed and especially when the new concepts are taught, the in classroom activities should be planned to be conducted. Besides, when the LOs are planned to be used in projects, it would be better to use them in the subjects which the students are encountered before and have some knowledge about them.

When LOs are arranged to be studied with learning management systems, they can be considered as tools to be used in instruction. The design process of LOR takes a long period and it is needed to cooperate with experts for proper LO designs for the study. In future applications with students in low number should be preferred and it should be noticed for the laboratory to include all technical equipments. Considering the economic dimension of LOs, learning outcomes should be determined to be presented in the form of LOs concerning many courses and the LOs to be prepared with this idea should rapidly take place within the education system.

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Appendix-1. Examples from interview questions

- Did you observe differences among groups about students' interests to the subjects?
- Was the motivation of students different according to the previous courses?
- Could they learn from LOs in the classroom?
- Did students' conceptual understandings and problem solving develop?
- Did you see change in students' behavior for both classes studying with LOs?
- Did you feel tightness in groups?
- How were students' engagements in projects?
- Did you note changes on interactions among students and interactions with you?
- How do you evaluate students' strategies for homework or projects?