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# Effectiveness of Learning Objects in Primary School Social Studies Education: Achievement, Perceived Learning, Engagement and Usability *

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**Abstract**

Learning objects originated from the object oriented approach in computer science and defined as "any digital resource that can be reused to support learning" (Wiley, 2001), and they are also used in learning and teaching environments. However, literature on learning objects focus on their technical characteristics and metadata. Research on the effects of learning objects on teaching-learning environments especially in social studies lessons is scarce. So, this study examines the effectiveness of learning objects in 6th grade social studies lesson in order to fill the gap between the theory and application of learning objects. The study was pretest-posttest control-treatment group quasi experimental study and was implemented in a primary school in Bolu with 137 students in 6th grade during 24 lesson hours in 8 weeks. At the end of the study, the learning objects developed for the study were evaluated by the students through Learning Object Evaluation Scale (LOES). The findings showed that when learning objects were used with teacher's guidance, academic achievement of students was higher than their achievement in traditional teaching environments. Further investigation revealed that students found LOs beneficial for their learning, highly engaging and well designed.

**Keywords**

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## Introduction

When teachers first obtain computer-based instructional materials, they often separate the materials into different pieces (Reigeluth & Nelson, 1997). Then they recombine or replace these parts to support their instructional goals. Similarly, Merrill (1999) stated similar problems of computer-based instruction that lead researchers and instructors to move from creating and delivering large and inflexible courses to producing content objects consisting of slots for different related elements of knowledge. Consequently, the design, development, delivery and utilization of instructional materials have changed, and one type of the approaches emerged is called "LO". An instructional technology called "LO" generally defined as any digital resource that can be reused to support learning is mentioned as a ring of the chain because of its reusability, scalability, adaptability, and potential generativity (Wiley, 2001).

* This study is a part of Melih Derya Gürer's doctoral thesis.

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Many researchers, namely the most enthusiastic proponents of LOs, believe that LOs approach has the potential to transform education to a new level (Gibbons, Nelson & Richards, 2002; Hodgins, 2002). The promises of LOs may include cost-effectiveness, reusability, modifiability, and adaptability (Nurmi & Jaakkola, 2006). Because of their flexible nature, LOs and LOs systems can be used to support a variety of learning theories and instructional strategies (Parrish, 2004). In addition, Kay and Knaack (2008) state that LOs have positive effects on teachers' and students' attitudes and performance in secondary school classrooms. Although LOs have many promises for learning and instruction process, they may be more complex and problematic at first glance for the learning environments in which the LOs would be used (Jonassen & Churchill, 2004; Kay & Knaack, 2007a; Li, Nesbit & Richards, 2006; Parrish, 2004).

Although there are many studies on the technical details, definitions, design and evaluation of LOs, there is lack of empirical evidence on the effectiveness of LOs in regard to learning, engagement in learning environments and design quality of LOs. There are some studies that show the positive effects of LOs on teaching and learning processes in higher education settings (Bradley & Boyle, 2004; Cochrane, 2005; Lim, Lee & Richards 2006; Santally & Alain, 2006; Schoner, Buzza, Harrigan, & Strampel, 2005). Only few studies on the use of LOs in middle (Akpinar & Bal, 2006; Liu & Bera, 2005; Nurmi & Jaakkola, 2006) and secondary school science classrooms (Kay, 2012; Kay & Knaack, 2007a, 2007b; Lowe, Schibeci, Cummings, Phillips, & Lake, 2010) were published. However, very scarce systematic research has been done to examine the effects of LOs on primary school students' learning outcomes (Yarar-Kaptan & Şeyihoğlu, 2011). Hence, it is important to investigate the effectiveness of LOs in social studies lesson in primary schools in regard to academic achievement, and students' evaluation of LOs in terms of perceived learning, engagement and usability.

In the last two decades, many researches had been done on learning objects and they have been used in teaching-learning environments. Moreover, many countries and European Union prepared large scale projects in order to create learning objects. In Turkey, Ministry of National Education in particular and some researchers (Çakıroğlu, 2010; Karaman, 2005) developed learning objects and learning object repositories. The results of Çakıroğlu's and Karaman's studies showed that learning objects had positive effects on students' learning outcomes in mathematics and chemistry lessons. However, the number of studies that examine the effects of learning objects on students' academic achievement in social studies lesson and effectiveness of learning objects is fewer. Therefore the purpose of this study is to investigate the effectiveness of using LOs in sixth grade social studies lesson in terms of learners' academic achievement and effectiveness of LOs in regard to their contribution for learning, quality and engagement. The research questions guided this study are as follows:

1. Is there a significant difference between the achievement scores of students who use LOs and who do not use LOs in social studies lessons?
2. How do students rate the LOs in terms of
   a. LOs contributions to their learning,
   b. quality of the LOs, and
   c. engagement in the LOs?

## Method

To evaluate the effectiveness of LOs in 6th grade social studies lesson in a public primary school, this study utilized the pretest-posttest control group quasi-experimental design (Fraenkel & Wallen, 2006). 137 sixth grade students (71 female, 66 male) from four classes with the age of 11 to 12 in a public primary school participated in this study. The students had computer literacy lessons during their 4th and 5th grades. All students had personal computers and Internet connection at their home. It was not possible to assign the students to the treatment or the control groups randomly due to the school regulations. Therefore, two classes were assigned to the experimental group, and two classes were assigned to the control group. The teachers of both control and experimental group students were the same. Hence, there were 67 students (35 female, 32 male) in experimental group and 70 students (36 female, 34 male) in control group.

### *Design of Learning Objects*

To design and develop LOs, Barritt and Alderman's (2004) model (Figure 1) focusing specifically on creating LOs and use of LOs in learning environments was adopted. This model is a modified version of ADDIE model for LOs and emphasizes that teachers need to think how the LOs should be reused in different learning contexts (Barritt & Alderman, 2004).

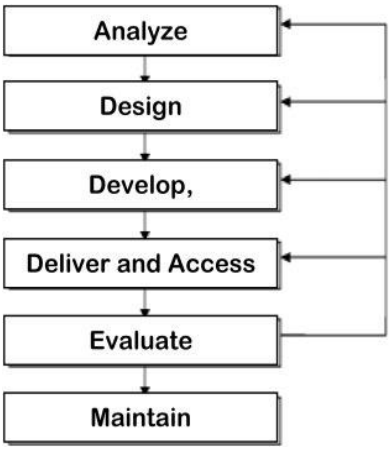


**Figure 1**. Learning Object Specific ADDIE Model (Barritt & Alderman, 2004)

Firstly, learning outcomes of "Sources of Our Country" and "Our Country and the World" units in sixth grade social studies lesson were analyzed. Then, learning outcomes were broken down into smallest objectives, so the granularity of the objectives was revealed. It was decided to design 54 LOs at the beginning of the design stage. As the teaching/learning strategies for each granule learning objective were not limited to a specific strategy, the LOs did not have the same teaching/learning strategy. Learning activities to support the strategies were identified in collaboration with two social studies teachers and an academician from social studies education department at a public university. The content (text, graphic, video, and so on) to develop the LOs were prepared or collected from teachers' and the academician's lecture notes, course textbooks, the Internet and LO repositories such as MERLOT and Wisc-Online. After identifying the learning strategies and activities for LOs, the prototypes of LOs were designed. Two LOs collected from the repositories and the Internet were modified in accordance with the needs of the course. The interface and tools that provide interactivity with the LOs were designed considering the characteristics of the students. Then LOs were created with an authoring tool. The prototypes of LOs were examined and evaluated by an expert in instructional design field, two social studies teachers and 11 6th grade students from a different primary school. After evaluation, inadequate content was determined and it was enriched or completed, and problems with the visual quality of images and videos were refined. The functional problems in the LOs were solved.

Totally 52 LOs were developed or modified for this study, and these LOs were categorized and combined according to nine learning outcomes of the two units in 6th grade social studies curriculum. 13 of them were for "Sources of Our Country" unit and 39 of them were for "Our Country and the World" unit. All developed and modified LOs were combined to form 9 LOs – one combined LO is an aggregation of the LOs developed for one learning outcome. Figure 2 and 3 show the screenshot of two examples for learning objects used in the study.


**Figure 2.** Screenshot of a Developed Learning Object


**Figure 3.** Screenshot of a Modified Learning Object

In order to organize, collect and package LOs within IMS and SCORM standards, the Reusable E-learning Object Authoring and Development (RELOAD) Editor was used. This editor is a tool of a project under 'The Joint Information Systems Committee (JISC) Exchange for Learning Programme (X4L)'. The editor supports IMS Metadata, IEEE LOM, IMS Content Packaging 1.1.4, SCORM 1.2, and SCORM 2004 (RELOAD, 2009). The organization and the navigation structure of LOs were edited, the metadata for each LO were input and packaged with this tool.

***Process***

Before the study, in order to eliminate the novelty effect and make students and teacher adapted to the new teaching and learning technique, learning objects which were developed for the "Silk Road and Turks" unit in 6th grade Social Studies Lesson Curriculum had been used by the teacher and the experimental group students for 12 lesson hours in 4 weeks in the Information Technology Classroom of the school. The actual study lasted 24 lesson hours within 8 weeks for both control and experimental groups. In control group, the teacher did not utilize LOs while instructing the course contents in the social studies classroom. The course was mainly teacher-directed in format, having lectures, question and answers, discussions, and solving standard questions, such as those at the end of the chapter in the course book. The teacher presented visuals such as concept maps, images, maps or videos via the projector, and the students were mainly passive.

In treatment group, instruction was implemented with LOs by the same social studies teacher in the information technology (IT) classroom equipped with 16 computers, a projector and an interactive whiteboard. There were 33 and 34 students in two experimental classrooms. So, two students had to use one computer in order to use the LOs during the study. As the Internet connection speed of the IT classroom was very slow (1 MBit/s), LOs were loaded to student and teacher computers at the beginning of each lesson. Treatment group students mostly interacted with the LOs in pairs. While the students were using the LOs, by circulating between students, the teacher monitored the students, encouraged them to pursue the learning activities and guided them to complete the activities in LOs. In addition, during students' use of LOs, he scaffold students to implement the learning activity by providing feedback and giving hints. If students had difficulty in learning the subject by using the LO, he used different instructional techniques such as lecturing and question and answer in order to help students learn the subject. He sometimes required students to read the text, examine the images or watch the videos at the same time. Later, he created a classroom discussion around the text, image or video. The teacher had the facilitator or guider role in the treatment classroom, and the students were mainly active in instructional activities.

***Data Collection and Analysis***

Data were collected through Social Studies Achievement Test and Learning Object Evaluation Scale (LOES). Social Studies Achievement Test was implemented as pre-achievement test in the beginning of the study, and as post- achievement test at the end of the study. The achievement test was developed by two social studies teachers, two academicians from Social Studies Education Department, an academician from Educational Measurement and Evaluation Department, an academician from Turkish Language Education Department and the researchers. The table of specification in relation to learning objectives in two instructional units was created; six objectives were related to Sources of Our Country unit, and five objectives were related to Our Country and the World unit. Initial forms of multiple choice items were constructed according to objectives of the two units. Opinions of three social studies teachers from a different public primary school in the same city and another academician in the social studies education department were taken. Moreover, the clearness and readability of the items were also evaluated by an academician from Turkish Language Education Department. The revised version of the achievement test included 50 multiple-choice questions. The achievement test was piloted with 288 seventh grade students at three public primary schools who were exposed to the same topics in social studies course previous year. During the analysis of test items, items which have discrimination index value smaller than .30 were eliminated, and items those have difficulty level between .40 and .60 were added to the test directly (Tekin, 2008). After consulting the academicians from Social Studies Education Department, other items were eliminated from the test as they did not affect the content validity. After final revision, the achievement test included 41 multiple-choice questions.

Another data collection instrument called Learning Object Evaluation Scale (LOES) adapted from Gürer and Yıldırım (2014) was administered at the end of the study to gather students' opinions about perceived learning, usability of LOs and engagement. LOES includes 30 items in 5 Point Likert type under three factors; perceived learning (7 items), usability (12 items) and engagement (11) items. Internal reliability coefficients of the three factors were .90, .87 and .87 respectively for this study.

In order to analyze the data, descriptive statistics (mean and standard deviation) were computed for describing experimental group's responses to LOES items and both groups' scores in achievement tests. A two-way analysis of variance (ANOVA) would be applied to make 2x2 comparison between the experimental and control group students' scores in pre and post achievement test (Büyüköztürk, 2010). However, Kolmogorov-Smirnov test showed that the scores on both groups' achievement tests were not distributed normally. So, the main research question investigating the difference between experimental and control group students' scores in achievement test was tested by examining the sub-questions in the main question. Independent samples t-test was applied in order to answer whether there is a significant mean difference between experimental and control groups' pre-achievement test scores, paired-samples t-test was applied to examine whether there is significant differences between pre and post-achievement test scores within experimental group, Wilcoxon Signed Rank was implemented to find the difference between control group's pre and post-test scores and Mann Whitney U-Test was implemented to investigate the significant difference between experimental and control group students' post-achievement scores.

## Results

### *Comparison of Achievement*

As the data of each group were significantly normal, independent samples t-test was implemented in order to examine whether the experimental group students' pre-achievement test scores is significantly higher than those of the control group. As shown in Table 1, mean scores of experimental and control groups on the pre-achievement test were 11.03 and 10.78 respectively. The t-test showed that this difference in the mean score was statistically not significant at a significance level of .05 ($t_{(135)}$= .26, p> .05). So, experimental and control group students' mean scores in the pre-achievement test are not different.

**Table 1.** The Results of Independent Samples t-test for Pre-Achievement Test Scores

| Group | N | $\bar{X}$ | s | df | t | p |
|---|---|---|---|---|---|---|
| Experimental | 67 | 10.78 | 5.75 | 135 | .26 | .79 |
| Control | 70 | 11.03 | 5.47 | | | |

In order to examine whether there is significant differences between pre and post-achievement test scores within the experimental group, paired-samples t-test was applied. Experimental group's post test scores ($\bar{X}$=32.25, s=6.27) was significantly higher than their pre test scores ($\bar{X}$=10.78, s=5.75) ($t_{(66)}$=21.31, p<.05). In addition, Wilcoxon Signed Rank test showed that control group's post-test scores were significantly higher than their pre-test scores (Z=7,26, p<,05) (Table 2).

**Table 2.** Paired Samples T-Test Results for Pre And Post-Achievement Test Scores of Experimental and Control Group Students

| Group | Achievement Test | N | $\bar{X}$ | s | df | t | p |
|---|---|---|---|---|---|---|---|
| Experimental | Pre-test | 67 | 10.78 | 5.75 | 66 | 21.31 | 0.00 |
| | Post-test | 67 | 32.25 | 6.27 | | | |
| **Group** | **Achievement Test** | **N** | **$\bar{X}$** | **s** | **Z** | | **p** |
| Control | Pre-test | 70 | 11.03 | 5.47 | 7,26 | | 0.00 |
| | Post-test | 70 | 28.29 | 5.81 | | | |

To test whether there is a significant difference between control and experimental group students' post-achievement test scores, as the data of students' post-achievement scores were not normally distributed ($p < .05$), Mann Whitney U-Test was applied. The mean scores of experimental and control groups on the post-achievement test were 32.25 (s=6.27) and 28.29 (s=5.81) respectively. The Mann Whitney U-Test results indicated that experimental group's post-achievement test scores was significantly higher than control group students' post-achievement test scores, U=1463.00, $p<.05$, at the end of the study (Table 3).

**Table 3.** Results for Mann Whitney U-test for Post-Achievement Test Scores

| Group | N | Mean Rank | Sum of Mean Ranks | U | p |
|---|---|---|---|---|---|
| Experimental | 67 | 82,16 | 5505,00 | 1463,00 | 0.00 |
| Control | 70 | 56,40 | 3948,00 | | |

Although there was no significant mean difference ($p > .05$) between control and experimental groups' achievement test scores at the beginning of the study, and both groups achievement scores increased significantly after the treatment ($p < .05$ for each group), experimental group's achievement scores were significantly higher than those of control group at the end of the study ($p < .05$).

***LOES Results***

In order to investigate students' evaluations on the LOs in regard to perceived learning, usability and engagement, LOES was administered to experimental group students. The scale was administered for each combined LO after students' use of LOs which were developed for each learning gain in two instructional units. Experimental group students filled out totally nine LOES, and the data gathered from nine LOES were analyzed through descriptive statistics. The mean scores of each item for nine LOES and overall mean score for each construct are provided in Table 4.

The means of the LOES items ranged from $\bar{X}$=4.25 to $\bar{X}$=4.57. The mean score for students' perceived learning (items 1 to 7) from LOs was 4.30 (s = 0.52) in a 5-point scale. This high mean score indicates that students believed that the LOs developed for this study had positive effects on their learning (Table 4). The mean score for LOs' usability (Items 8 to19) was 4.51 (s = 0.36). It can be concluded that students in this study thought that the LOs used in the study were of good quality (Table 4). Students rated their engagements with LOs (Items 20 to 30) with a mean score of 4.38 (s = 0.49) on LOES indicating that most of the students agreed that the LOs were engaging for them (Table 4).

**Table 4.** Descriptive Statistics for Students' Responses to Items in Learning Object Evaluation Scale

| Item # | Items | N | $\bar{X}$ | S |
|---|---|---|---|---|
| 1 | Studying with the LO helped me learn the subject. | 67 | 4.30 | 0.55 |
| 2 | I learned better by studying with the LO. | 67 | 4.25 | 0.52 |
| 3 | Visuals (graphs, animation, video etc.) helped me learn the subject. | 67 | 4.40 | 0.51 |
| 4 | I can answer the questions by using this LO | 67 | 4.26 | 0.55 |
| 5 | Using the LO provided me to make the learning activities faster. | 67 | 4.27 | 0.53 |
| 6 | I learnt something new about the subject thanks to this LO | 67 | 4.35 | 0.53 |
| 7 | I learnt this subject better with the help of LO. | 67 | 4.28 | 0.53 |
| 8 | I have enough computer skills to use the LO. | 67 | 4.54 | 0.35 |
| 9 | I used the LO easily. | 67 | 4.52 | 0.35 |
| 10 | Use of the LO was easy. | 67 | 4.53 | 0.34 |
| 11 | The subjects in the LO were clearly presented. | 67 | 4.49 | 0.39 |
| 12 | It was easy to learn to use the LO. | 67 | 4.48 | 0.41 |
| 13 | I liked the visuality of the LO. | 67 | 4.50 | 0.40 |
| 14 | The visual design of the LO was complicated. * | 67 | 4.49 | 0.39 |
| 15 | The LO was well organized. | 67 | 4.50 | 0.42 |
| 16 | The buttons (links) in the LO were easily understood. | 67 | 4.52 | 0.39 |
| 17 | The visuals (graphs, pictures, video etc.) in the LOs were of low quality.* | 67 | 4.46 | 0.40 |
| 18 | Text in the LO was readable. | 67 | 4.50 | 0.42 |
| 19 | Navigation in the LO was easy. | 67 | 4.57 | 0.37 |
| 20 | Generally I liked the subject in the LO. | 67 | 4.42 | 0.49 |
| 21 | I would like to use the LO again | 67 | 4.37 | 0.51 |
| 22 | The LO was fun. | 67 | 4.41 | 0.51 |
| 23 | This LO keeps me totally absorbed in the subject. | 67 | 4.39 | 0.51 |
| 24 | This leaning object excited my curiosity on the subject. | 67 | 4.37 | 0.53 |
| 25 | This LO increased my desire to learn the subject. | 67 | 4.37 | 0.52 |
| 26 | I carefully investigated the LO to make the activities in the classroom. | 67 | 4.33 | 0.52 |
| 27 | The LO helped me to completely make the classroom activities. | 67 | 4.39 | 0.52 |
| 28 | Having the course with LO was fun. | 67 | 4.40 | 0.51 |
| 29 | The LO increased my attention in the classroom activities. | 67 | 4.39 | 0.53 |
| 30 | The LO provided me to reflect upon the subject. | 67 | 4.37 | 0.53 |
| Perceived Learning | | 67 | 4.30 | 0.52 |
| Usability | | 67 | 4.51 | 0.36 |
| Engagement | | 67 | 4.38 | 0.49 |
| **Overall** | | **67** | **4.41** | **0.33** |

* Negative items were reversed.

## Discussion and Conclusions

This study aimed to investigate if LOs are effective tools for learning social studies topics, and how 6th grade students perceive LOs. The findings indicated that experimental group students' perceived learning was very high ($\overline{X}$=4.30), the students were highly satisfied ($\overline{X}$=4.51) with the usability of the LOs, and they were highly engaged ($\overline{X}$=4.38) with the LOs. The evaluation results of LOs showed that they provided good experiences for students in social studies lesson.

With respect to learning, students believed that LOs facilitated their learning of social studies lesson subjects. Additionally, students felt that using LO in a lesson was more beneficial in terms of learning gain than not using it. Especially, students liked meaningful visual support provided by the LOs. Similar findings have been reported in various previous studies (Baki & Çakıroğlu, 2010; Kay & Knaack, 2007a, 2007b, 2009; Lowe et al., 2010; Schibeci et al., 2008). Majority of research findings indicated that interactivity is the key factor in knowledge construction and cognitive skills development (Evans & Gibbons, 2007; Mayer & Chandler, 2001; Schaffer & Hannafin, 1986). Similarly, interactive nature of some LOs might have positively affected students' perceived learning in this study. Because of their potentials to facilitate student engagement in instruction process, to influence learners to increase their mental effort and to improve comprehensiveness (Schaffer & Hannafin, 1986), videos in the LOs might be perceived as beneficial for students' learning by them.

Students commented that they easily used the LOs and liked the visual characteristics of LOs such as colors used, the quality of visuals, and readability of text. Likewise, students found the LOs engaging and fun. In the development process of LOs, it is important to get feedback from the end users (Barritt & Alderman, 2004). The LOs used in this study were developed and revised based on the feedback gathered from the student groups similar to the participants of this study. It can be stated that such development and adapting process addressed usability issues and visual characteristics of LOs in accordance with the target group's needs and preferences.

It is clear that academic achievement of students who use LOs in learning process was significantly higher than control group students' achievement in social studies lesson. Lowe et al. (2010) emphasized that appropriate challenges and interactivity that provide sustained emotional and cognitive interest and student input are keys for student learning. The level of challenge provided in the LOs might have matched the student's skill level. Research shows that the quality of learners' engagement with educational software may significantly influence their learning (Bangert-Drowns & Pyke, 2001; Bangert-Drowns & Pyke, 2002). As it is indicated in the literature, results of this study showed that the students in the experimental group highly engaged with the LOs, they had fun while using them, used them to the end to finish the learning activities enthusiastically. So, experimental group students' engagement with the LOs might have influenced their achievement in the social studies lesson.

In control group, the teacher presented visuals such as concept maps, images, maps or videos through the projector. However, students were not able to investigate the visuals individually. In contrast, students in the experimental group had the opportunity to examine the visuals individually. Giving students opportunity to examine the LOs closely might have resulted in positive outcomes from the experimental group. It can be concluded that providing students involvement and having them control in using LO might result with better learning outcome. Visual representation of information, helping learners to visualize information, and its application facilitates many aspects of learning, such as encoding, comprehension and application of knowledge (Alessi & Trollip, 2001). In LOES, experimental group students concluded that the visuals such as graphics, images, and videos in the LOs enhanced their learning in the social studies lesson. Empirical evidence in the literature showed that audio and visual representations have more beneficial effect on learning social studies learning (Boster, Meyer, Roberto, Inge & Strom, 2006; Hammond & Lee, 2010; Hofer & Swan, 2005; van Hover, Berson, Swan & Bolick, 2004). Hence, it can be stated that the visual characteristics of LOs and having in control might have improved experimental group students' learning better than control group students.

Students' high rating of LOs might have been considered as one of the reasons for experimental group students' higher achievement. In contrast to this result, Akpinar (2008) found that the difference between pre and post-test scores did not correlate significantly with the teachers' or the students' ratings of the LOs in terms of LORI scores. He asserted that in his study students used LOs in a self-directed exploratory environment, with little input or interaction from the supervising teachers. The difference between his study and this study was the teacher's guidance for students while they were using LOs. Teacher's guidance and support could be important to have students benefit more from LOs.

It can be suggested that when selecting or designing LOs, it is beneficial to select or design those with meaningful visual supports in social studies lessons. Learning objects should satisfy enough interactivity in order to engage students in the learning activities. In addition, usability issues should be considered and implemented while selecting and designing LOs. To be able to establish those requirements it is important to get feedback from the target group. Lastly, the teacher's guidance and encouragement for students in the learning environment should be emphasized in order that the potential of LOs in the learning environment could be accomplished.

In further studies, in addition to the achievement, investigation of retention and transfer of knowledge in social studies course can be suggested. It is recommended that to be able to see the contribution of LOs for learning and satisfaction, further research studies in different subject area, with different learners groups, and at different grade levels, with and without teacher's guidance are needed.

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