# Effects of Augmented Reality Applications on Academic Success and Course Attitudes in Social Studies

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**Abstract**
*The overall purpose of this study is to determine the effect of augmented reality applications on students' success in social studies course and their attitudes towards social studies courses. In this research, quantitative and qualitative methods were used. In the quantitative method, there is a pre-test, post-test control group as a semi-experimental method. In the social studies course, the unit acquisition related to volcanic events was aimed to be instructed to the students in the experimental group through the augmented reality application. Before and after the application, to evaluate the success levels of the students in the experimental and control groups, social studies course achievement test was given, and to evaluate their attitudes towards the course, social studies course attitude scale was applied. At the end of the application, interviews were done with 5 of the students in the experimental group with a semi-structured interview form. In the analysis made as a result of the application, no significant difference was observed between the achievement levels of the children studying with augmented reality technology and the achievement levels of the children studying with the smart board and the current textbook. Since the group learning technique was used in the study, students' failure to progress at an individual pace may have prevented an increase in success. According to the post-test social studies course attitude scale results of the experimental and control groups, the scores of the experimental group students showed a significant increase compared to the control group. Also, students stated that they liked the augmented reality application in the interviews, and they wanted it to be in other lessons. It is thought that it will be beneficial for education to put the augmented reality technology in other courses.*
**Keywords: Augmented reality, Social studies, Success, Attitude, Secondary school students and Mixed methods**

## Introduction

Considering the developments in the 21st century, the use of technology in all areas of our lives has also increased its importance in the field of education. When the technological developments in the field of education are taken into account, traditional boards have been replaced by computer and internet systems. With the development of artificial intelligence technologies, it has been observed that education tools are also directed towards this area (Özsevgeç & Eroğlu, 2017). Education and technology are two areas that avail human development, and it is impossible to think of these areas independent of each other. It is important to use technology to enable students to learn on their own and to provide permanent learning (Yüksel, 2010). Especially, the use of technology in mobile devices has increased gradually, and recently it has brought forth the concept of augmented reality (AR).

1. This study is a part of the first author's master thesis.

AR is the technology of developing real objects, which are supported by the applications, directly or indirectly, by inputs such as audio, video, graphics. (Abdüsselam, 2014).

Social studies course appeared in America towards the end of the 19th century, and social scientists used the social studies course as a tool to offer solutions to social, cultural, and economic problems and to transfer them to the society. (Bilgili, 2006).

It can be stated that AR offers an interactive environment, and it creates this environment by bringing the real world together with virtual objects (İbili and Şahin 2015; Milgram & Kishino, 1994). With AR, students will be able to access to the environments that cannot be reached through traditional learning, and these environments will be enriched virtually, and they will be able to interact with them (Uluyol & Eryilmaz, 2012).

AR is effective in the permanence of learning because it does not separate the learners from the objects in the real environment and causes a sense of curiosity in learners with self-experiencing (Bujakvd, 2013). The fact that students see three-dimensional virtual objects together with real-world assets in the learning environment causes them to experience the excitement that they have not experienced before. Wu, Lee, Chang, and Liang (2013) mentioned the following benefits of AR in their work; AR technology visualizes learning and enhances permanence by presenting the content in three dimensions, encourages students to cooperate and learn with the group, makes invisible situations visible and becomes a bridge between formal-informal learning processes. In students' learning processes, AR technology helps them to actively observe and to carefully evaluate the hypotheses which are confessed in this process and to form a final hypothesis after refuting most of the proposed hypotheses (Chiang, Yang, and Hwang, 2014). Some of the studies in the literature are as follows:

Demirer and Erbaş 2015, evaluated the use of mobile AR applications in education in their study and determined similar and different features by analyzing more than one AR applications. In their studies, they pointed out that the applications are essentially created based on the same system and can be used interchangeably when it is necessary. They stated that AR applications are becoming increasingly popular and can be used in the field of education. They mentioned that it would not be difficult to incorporate AR practices into the teaching, and it will make the lessons effective, especially considering that the FATIH project is carried out in every school. They stated that AR would be advantageous for education since it makes embodying possible in the fields that require abstract thinking and offers virtual laboratory facilities.

In the experimental study conducted by Ersoy, Duman, and Oncu (2016), the subject of visual design principles in visual arts lesson was instructed to the children studying in 5th and 6th grades in a secondary school in Bursa, by using different materials to the experimental and control groups. While students in the experimental group carried out their activities with AR materials, students in the control group used the materials provided by desktop computers. The achievement test was given, and the motivation scale was applied to the students after the activities. When the data were analyzed, it was observed that teaching with AR brought higher motivation and success. After this study, the researchers stated that AR could be used in secondary schools since it makes a positive contribution to the student's teaching activities.

Kırıkkaya and Şentürk (2018) researched the effect of using AR technology on the students' success in the unit of the solar system. Beyond in the district of Kocaeli (a city in Turkey), The research was conducted with 45 students from 7th grade, and the semi-experimental method with the pre-test - post-test control group was used. Teaching activities were carried out in the experimental group with the Space 4D program, which provides 3D visuals to the students on an abstract subject such as the solar system. Then a questionnaire was conducted as a qualitative research method. Traditional teaching activities continued in the control group. When the data were analyzed, the change in the level of the lesson success of the students was examined, and according to the research findings, it was concluded that the opinions about the lesson of the children studying with AR technology and their academic achievements differ positively.

The aim of the study is to investigate the effect of AR application on secondary school students' success in social studies course and their attitude towards it. In line with the purpose, it was aimed to evaluate the success levels of the students in the social studies course and their attitudes towards the social studies course with the AR application for the ' I am Getting to Know the Earth' unit in the social studies course of the 5th grades. Also, students' thoughts about the practice were tried to be determined.

In this study, answers to the following questions were sought in line with the general purpose of the research:

1. Does AR application increase the success of students in the social studies course?
2. Does the AR application affect students' attitudes positively in social studies courses?
3. What are the student opinions about the usability of the AR application?

Considering the social studies course which students think verbally and try to learn by rote all the time, it is thought that AR applications, by boosting the memorability and embodying the concepts, will not only increase the effectiveness and the efficiency of the course but also it will improve the attitudes towards it. The fact that the researches for the social studies course about AR in the literature are thin on the ground and considering the obtained data will bring light to such studies and contribute to the field of education using AR technology, increase the importance of the study. The limited number of studies on AR education in Turkey is another factor that draws attention to the importance of the study.

## Method

The model used in the research is mixed. Both quantitative and qualitative (interview form) research methods were used. In the quantitative method, a semi-experimental model with a pre-test - post-test control group was used. There are two neutrally formed groups, which are the control and the experimental group. The achievement test was given, and the social studies attitude scale was applied to the groups as pre-test and post-test. In the qualitative method, interviews were done with five students selected from the experimental group voluntarily.

### Table 1: Research Model

| Groups | Pre-test | Method | Post-test | Interview |
|---|---|---|---|---|
| Experimental | The Achievement Test Attitude Scale | With AR | The Achievement Test Attitude Scale | Student |
| Control | The Achievement TestAttitude Scale | With Textbook | The Achievement Test Attitude Scale | ---------- |

At the beginning of the study, the achievement test was given, and the social studies attitude scale (as a pre-test) was applied to the control and experimental groups. The teaching was done according to the lesson plans in the curriculum. While the students in the control group continued their education with the method of direct instruction using the smart board, the students in the experimental group were divided into groups of 5 without taking into account the individual success differences, and the group learning method was used with AR. At the end of the application, post-tests were given to both groups, and it was checked with the attitude scale and the achievement test whether the attitudes to the lesson and academic achievement changed or not.

In this study, independent variables are classical method teaching, which is instructed with textbooks and AR applied to teach. Dependent variables are academic achievement and attitude towards social studies lessons. In the qualitative method, the students, who were taught with AR application, in the experimental group, and teachers who instructed during the process of the application interviewed with the semi-structured interview form and their opinions about AR applications and the applicability in other courses were discussed.

## Participants

The participants are 5th-grade students consisting of 60 people (32 of the students were female and 28 were male)in two different classrooms studying in Istanbul in the 2018-2019 academic year. These 60

students were divided into two groups, and 30 of the students to the experimental group and the other 30 to the control group were appointed impartially.

**Data Collection Instruments**

In the study, achievement test and semi-structured interview form developed by the researcher and Social Studies Course Attitude Scale (Gömleksiz & Kan, 2013) were used. The social studies course attitude scale is a five-factor valid and reliable scale developed for elementary school students.

**Findings**

In this section, primarily, the analysis of the pre-test and post-test values obtained from the achievement test and the attitude scale applied to the experimental and control groups are included. Afterward, it was examined whether there was a significant difference between the scores of the achievement test, attitude scale applied to the experimental group, the control group, and the scores of the groups in the pre-test / pre-test, post-test / post-test, pre-test / post-test analyses.

**Information on Post-Test Success and Attitude Scores of Experimental and Control Groups**

The results of the analysis to examine the difference between the post-test success scores of the experimental and control groups are given in the Table 2.

**Table 2: Comparison of the Success Scores of the Experimental and Control Groups**

| Groups | | Mean | N | SD | t | df |
|---|---|---|---|---|---|---|
| Success | Experimental | 5.2 | 30 | 1.5 | 1.07 | 58 |
| | Control | 5.6 | 30 | 1.8 | | |

An Independent sample t-test was performed to determine whether there is a difference between the two groups. (t = -.078, p > .05). After the application, according to the t-test results, it can be stated that there is no statistically significant difference between the success levels of the students in the experimental group and the students in the control group. AR application affects students' social studies course success at the same level with smart board applications.

The results of the analysis to examine the differentiation between the post-tests of the social studies course attitude scale, which was applied to experimental and control groups are given in Table3.

**Table 3: Comparison of the Attitude Scale Scores of the Groups**

| Groups | | Mean | N | SD | t | df |
|---|---|---|---|---|---|---|
| Attitude Scale Total Score | Experimental | 69.9 | 30 | 9.65 | 6.54 | 58 |
| | Control | 52.7 | 30 | 10.72. | | |

An Independent sample t-test was performed to determine whether there is a difference between the two groups. (t = 6.54, p < .05). After the application, according to the t-test results, it can be stated that there is a statistically significant difference between the attitude scores of the students in the experimental group and the students in the control group. The post-test attitude scale score of the experimental group is higher than the score of the control group. AR application affects students' positive attitudes towards social studies courses more than smart board applications.

**Analysis of Qualitative Findings**

At the end of the research, five students volunteered (Families that allow interviews with their child), and they were asked to answer the questions in the interview form. Their opinions about the application were tabulated on certain topics. The collected data were analyzed according to the content analysis technique, and themes were created by grouping similar items in the expressions. Table4 contains detailed information. The data obtained by the interview technique were digitized and expressed as frequency. Also, direct quotations from the participants' opinions are included.

**Table 4: Themes Regarding the Qualitative Findings**

| Themes | f |
|---|---|
| **Evoked feelings** | |
| Enjoyable | 5 |
| Good | 3 |
| Different (extraordinary) | 3 |
| **Effect on Learning Process** | |
| Meaningful and permanent learning | 5 |
| Increasing interest in the lesson | 5 |
| **Courses they want to use** | |
| Mathematics | 4 |
| Science | 5 |
| **Reasons for Requesting AR Applications** | |
| Because it makes the lesson more entertaining | 5 |
| Because it makes it easier to understand difficult lessons | 3 |

The answers given by the students to the questions in the interview form were generally examined under four titles. There are three titles under the theme about the evoked feelings by AR application. Students stated that they felt good, enjoyed, and extraordinary while using the application. There are two titles under the themes "Effect on Learning Process," "Courses they want to use," and "Reasons for Requesting AR Applications. "All of the students wanted to use the AR application in science lessons. Also, all of the students stated that the AR application increased the interest in the lesson and made the lesson more fun. Some student views are as follows:

**S2:** 'It made me very excited to see the events animated, we had never done anything like that in other classes.'

**S4:** 'I was surprised at first that we did not have such a lesson before, I was amazed by the fact that we painted the papers and then the shapes became 3D, it was very beautiful, it was more exciting than the other lessons. It is a good application for us to understand the information easily.'

**S5:** 'There is a superiority because we saw it animated there it is different from the traditional method, previously we used the models, and we could not open the model and see the explosion part. I liked being able to see it; it is so good that it enables us to understand better.'

**S2:** 'I wish it were used in math and science. It would be impressive and permanent to see the electrical circuits in science in this way.'

**Discussion and Conclusion**

As a result of the tests performed to examine the difference between the use of AR application in the experimental group and the traditional methods in the control group, no significant difference was observed between the experimental group and the control group. Based on these results, it can be said that teaching with AR technology does not affect the success of the course when compared to the traditional method. AR activities increased student success (Ersoy et al., 2016). In their study, students used AR applications individually. Since students in the experimental group worked in groups rather than individually, and therefore individual speeds are not considered, there may have been no change in the students' achievement assessments. Moreover, in qualitative findings, students thought that AR applications would increase success. However, as mentioned, success may not have increased since individual work, and individual progression rates could not be given.

In the research, it has been examined whether the attitudes towards social studies courses have changed between the experimental group where teaching made with AR technology and the control group where traditional methods were used to teach. Based on the findings, post-tests of the experimental and control groups showed a significant difference in favor of the experimental group. Also, based on the qualitative findings in the study, it can be interpreted that the attitudes of the students who were educated with AR technology in the social studies course were positively affected. In the literature, Ersoy, Duman, and Öncü (2016) pointed out that in their studies with 5th and 6th-grade students, AR applications positively contributed to their motivation. In the study they conducted with the 7th-grade students of Sırakaya and Alsancak Sırakaya (2018), it was stated that their attitudes and motivations towards AR applications in science education were remarkably positive.

According to the obtained results, the use of AR technology in social studies courses did not change

the course success. Still, it caused a significant increase in students' attitudes towards the course. AR applications should be used individually in classrooms. English materials suitable for AR applications are available on the internet in large numbers. AR applications can be applied to societies whose native language is English.

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