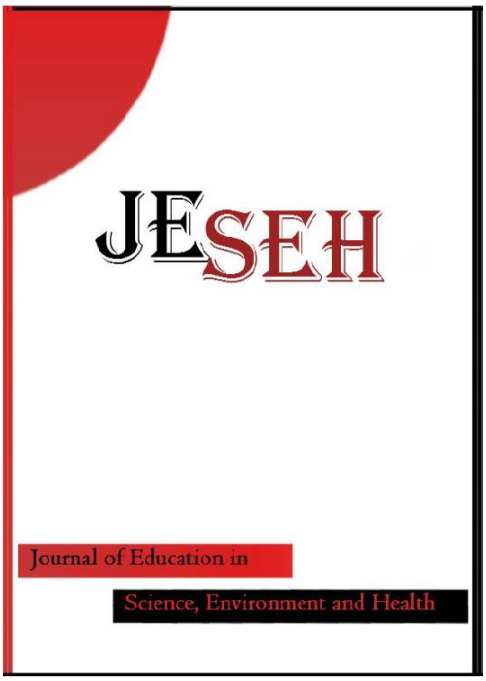


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# The Effect of Educational Film Supported Augmented Reality Applications on Academic Achievement and Motivation for Science Learning

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# The Effect of Educational Film Supported Augmented Reality Applications on Academic Achievement and Motivation for Science Learning

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## Abstract

The aim of this research is to investigate the effects of educational film-supported augmented reality applications in the teaching of the Solar System and Eclipses Unit of the 6th grade Science course on the academic success of the students and their motivation levels for learning science. The study group of the research consisted of 42 students attending the 6$^{th}$ grade in Kahramanmaraş in the fall semester of the 2021-2022 academic year. In this research, quasi-experimental design was used. The participants from whom the data were collected were determined by convenient sampling method. The experimental group (N=22) of the study consisted of the learning group with educational film supported augmented reality applications, and the control group (N=20) was the group that studied with the learning method specified in the current science curriculum. The results obtained from the study revealed that there was no significant difference between the achievement test and motivation scale pre-test scores of the experimental and control groups. Another result obtained from the study is that there is a significant difference in favor of the experimental group between the achievement test and motivation scale posttest mean scores of the groups as a result of the application process.

## Introduction

Today, most of the developments and changes in the world are undoubtedly taking place in the fields of information and technology. These technological developments provide convenience to individuals in numerous areas in daily life. The conveniences brought by these developments are also used within the scope of science courses. And it is stated that the use of technology in lessons is beneficial in terms of gaining students the desired features (Hancer, Sensoy, & Yildirim, 2003). In this context, it is not possible to think of the education system independently of the developments in technology at the point of raising individuals in accordance with the age, and it is almost a necessity to use technology in education in our age (Sahin, 2017). The use of technology in education is of great importance in terms of easier access to information as a result of rapid developments in technological tools, providing comfort to both the teacher and the student in terms of environment and time, and keeping up with the rapid changes in science and technology (Kenar & Balci, 2013).

While technology is used during learning and teaching activities in many different educational fields, technology is also used at various points while conducting science education. With the use of different types of teaching elements and technology in science education, students can associate the knowledge they have acquired with daily life. In addition, the use of educational technologies in science courses raises students' interest and attitudes towards the course even higher (Kirilmazkaya, Kececi, & Zengin, 2014). In addition, teaching using visual and auditory materials contributes positively to the permanence of the learned information, and the teacher undertakes a guiding task for the student in this process (Fidan, 2008). In this context, Sagliker (2009) emphasizes the necessity of increasing the richness levels of the environments in terms of visual and auditory in order to raise individuals who are interested in science and have the effort to succeed. Due to this and similar reasons, it is seen as a necessity to develop both the education and training environments and the teaching programs in a way that will allow the use of technological tools. Therefore, it is seen as a necessity to develop both the education and training environments and the curricula in a way that will allow the use of technological tools. At this point, individuals born in the period between 1995 and 2010, called the Z generation, actively use social networks as a generation that grew up with tablet computers and mobile phones. The concept of augmented reality has come to the fore in recent years in terms of providing a flexible learning process and environment for these individuals, diversifying education and creating an efficient learning environment for enriching (Yildirim, 2018).

Azuma (1997) defines augmented reality as a technology in which virtual and real objects are combined with simultaneous interaction. Augmented reality brings together the real world and virtual environment in which students continue their lives, to learners; It is a technology that supports the internalization of abstract concepts and provides a learning experience (Erbas & Demirer, 2014). Kara (2018) defines augmented reality as an information technology that provides experience to individuals, in which real life is extensively reproduced using virtual contents. Augmented reality technology is based on the principle of transmitting the image to the real environment after the information obtained with the help of different sensors (camera, glasses, etc.) from the real environment, after certain processing processes. When using augmented reality applications, reality emerges by adding sound, 2D - 3D object, video, text, animation or simulations obtained on the computer to the image of the real world environment (Altıntas, 2018). Recently, different augmented reality applications have been developed in order to enable a beneficial learning environment in which active participation of students is ensured. With these applications, it is possible to teach science subjects by providing visualization, and it is possible for students to internalize real-life situations and problems in a simpler way (Bulus Kirikkaya & Sentürk, 2018). The awareness level of augmented reality applications, which add different dimensions to the methods of increasing interaction among learners in educational environments, is increasing day by day. For this reason, many mobile applications are being developed for educational purposes. Since augmented reality applications provide high motivation to learners, it has been expressed as a subject worth researching in recent years (Bulus Kirikkaya & Sentürk, 2018).

Educational films are one of the learning objects that researchers focus on in educational environments with the recent introduction of technology into classroom environments (Barnett & Kafka, 2007; Bixler, 2007; Derjani Bayeh & Olivera Fuentes, 2011; Freudenrich, 2000; Gess, 2017; Liberko, 2004). Educational films are important technological materials that enable learners to gain a general experience on subjects they do not have knowledge about, embody abstract concepts, and also help students see theoretical knowledge in practice (Guven Yildirim, Koklukaya, & Selvi, 2015). Bruner (2008) also states that educational films are materials that allow learners to learn an idea easily when they are watched, provide guidance to them, include other necessary activities for students, and contribute to the learning process. In the light of this information, the importance of the use of augmented reality applications and educational films in education emerges once again. When the literature was reviewed, previous studies emphasized the contribution of augmented reality applications to science teaching (Akcayir, 2016; Eren, 2019; Kerawalla, Luckin, Seljeflot, & Woolard 2006; Lin, Hsieh, Wang, & Chang, 2011; Rosenbaum, Klopfer, & Perry, 2007; Sariyildiz, 2020) are studies. Similarly, studies in the literature using educational films in science teaching (Cavanaugh & Cavanaugh, 1996; Guven Yildirim, Koklukaya, & Selvi, 2015; Fraknoi, 2003; Gess, 2017; Kizilcik, Damli, & Unsal, 2014; Kizilcik, 2021; Liberko, 2004; Topal, Guven Yildirim, & Onder, 2020; Uzun, Guven Yildirim, & Onder, 2020). However, in previous studies, no other study was found in which augmented reality applications in science teaching were supported by educational films. With this aspect of the study, it is thought that it will contribute to the field as an original and important study. Therefore, with this research, it is aimed to examine whether augmented reality applications supported by educational films have an effect on students' academic achievement and motivation towards science learning in the $6^{th}$ grade Solar System and Eclipses Unit.

## Method

### Research Model

The designs that aim to define the relations of cause and effect between the variables are called experimental designs (Buyukozturk, 2010). Experimental studies to determine cause-effect relationships are studies in which data to be observed are produced under the control of the research (Karasar, 2012). In this research a quasi-experimental design with pretest-posttest control group was used in order to obtain the data. In this design, one of the predetermined groups is assigned as the experimental group and the other as the control group, and pre-test and post-test are applied to both groups (Fraenkel & Wallen, 2008; McMillan & Schumacher, 2010). Quasi-experimental research designs are frequently used in educational research when all factors cannot be fixed (Cohen, Manion & Marrison, 2007).

### Study Group

In this study, the participants from whom the data were collected were determined by the convenient sampling method (Cohen, Manion, & Morrison, 2007). In convenient sampling, the researcher selects the participants from whom the data will be collected from individuals who are easy to reach, suitable for the research and

volunteer (Gravetter & Forzano, 2012). In this study, the researcher chose to work with the relevant participants because it was easy to reach. The study group of the research consisted of 42 students attending the 6th grade in Kahramanmaras in the fall semester of the 2021-2022 academic year.

**Data Collection Tools**

In the study, the "Academic Achievement Test for the Solar System and Eclipses Unit" developed by Yesiltepe (2019) and the "Motivation Scale for Learning Science" developed by Dede and Yaman (2008) were used as data collection tools.

The achievement test developed by Yesiltepe (2019) consists of 25 multiple-choice questions in total. The reliability of the test was found as .85 by the researcher. Again, as a result of the analyzes carried out by the researcher, the item discrimination (rjx) index of the items in the test was calculated as .61 and the item difficulty (pj) value was calculated as .56. Another data collection tool used in the research is the "Motivation Scale for Learning Science" developed by Dede and Yaman (2008). This scale is in the form of a five-point Likert scale and consists of 23 items. The reliability coefficient of the scale was found by the researchers as $\alpha$= .80.

**Data Collection Process**

The data collection process of this research was carried out during the Science course, the 6th grade Solar System and Eclipses Unit. In the study, an experiment (N=22) and a control group (N=20) were formed and the groups were randomly assigned.

Before the implementation process, both groups were given the Solar System and Eclipses Unit Achievement Test and the Motivation Scale for Learning Science as a pre-test. The experimental process covered the weeks (4 weeks), 16 lesson hours, in which the Solar System and Eclipses Unit would be covered. After the experimental process was over, the test and scale applied as a pre-test were applied to the groups as a post-test. A calendar has been created for the application to be carried out in the research. Lesson plan was prepared in accordance with the methods of the research within the framework of the achievements and lessons were taught in accordance with these lesson plans every week.

Table 1. Educational films selected in accordance with the unit outcomes

| Outcomes number | Subject | Link | Screen time |
|---|---|---|---|
| F.6.1.1.1. | Solar system | https://www.youtube.com/watch?v=Ze7_-36qb20<br>https://www.youtube.com/watch?v=QNbs7aghFT8<br>https://www.youtube.com/watch?v=rGGZnh8W7Oo<br>https://www.youtube.com/watch?v=qD6XB8o0STg | 5 min 49 sec<br>4 min 39 sec<br>3 min 26 sec<br>3 min 9 sec |
| F.6.1.1.2 | Planets in the solar system | https://www.youtube.com/watch?v=3C3Jbr9xpSU<br>https://www.youtube.com/watch?v=nyAZoieovC4 | 7 min 53 sec<br>2 min 25 sec |
| F.6.1.2.1 | Solar eclipse | https://www.youtube.com/watch?v=vthxNOeIb6g<br>https://www.youtube.com/watch?v=WvDF31EdJxM | 2 min 22 sec<br>3 min 20 sec |
| F.6.1.2.2. | Lunar eclipse | https://www.youtube.com/watch?v=44tuIey8f10<br>https://www.youtube.com/watch?v=aa2qkl9b5kA | 2 min 10 sec<br>3 min |
| F.6.1.2.3. | Solar and lunar eclipse comparison | https://www.youtube.com/watch?v=BIC2HExXChg<br>https://www.youtube.com/watch?v=rcDAqCYSiVI | 2 min 31 sec<br>3 min 55 sec |

During the teaching of the unit in the experimental group, Galactic Explorer (Merge Cube), Solar System Scope, Space 4D+, Space Explorer 4D, Space4D, Planets AR, AR Solar System etc. Augmented reality applications were used These augmented reality applications, prepared by the researcher in accordance with the unit outcomes, were supported by educational films with scientific content. In the study, 18 educational films related to the unit topics and decided to provide content validity were selected by the researcher and watched several times. It has been taken into account that the films determined for the application meet the unit gains. While determining the films, attention was paid to the affective, cognitive and psychomotor developments of the age group, and the duration of the films that would not cause distraction. Expert opinions were received for 18

educational films that met these criteria, and the films were examined by experts in terms of content validity, language, and intelligibility for age groups. According to the feedback received from the experts, some educational films were produced and 12 educational films were included in process. The links of the films selected considering the unit objectives and the information about which films are used in the teaching of which unit outcomes are given in the table below (Table 1). The photographs related to the practices carried out in the experimental group during the teaching of the unit during the experimental process are given below (Figure 1).


Figure 1. Photos of the application process

In the control group, the lessons were taught in accordance with the 2018 Science Curriculum. In this group, the teaching of the relevant unit was limited to the textbook prepared by the MEB (2018) and the activities included in this book. In the teaching of the relevant acquisitions of the unit, importance was given to the active participation of the students in the activities. After the end of the application process, the achievement test and the motivation scale, which were given as a pretest at the beginning of the research, were applied to both groups as a posttest and the data collection process of the research ended.

### Analysis of Data

Microsoft Excel 2010 spreadsheet program and SPSS 25.0 statistical analysis package program were used in the analysis of the data of the research. Descriptive statistics techniques were used to reveal the general distribution of the answers to the items of the test and scale used in the research. The central tendency and central distribution values of the test scores were calculated and it was examined whether the data showed a normal distribution. Independent groups t-test was used to compare the pre-test and post-test mean scores of the groups.

## Findings

In this study, firstly, which statistical method will be used to the data was examined. In quantitative studies, parametric and non-parametric analyzes can be used in the analysis of the data collected as a result of the study. In order to perform parametric analyzes on the obtained data, the data collected from the participants should show a normal distribution (Cepni, 2007; Sim & Wright, 2002). For this reason, first of all, descriptive analyze

was applied in order to determine the statistical method to be used to the data collected from the Solar System and Eclipses Unit Achievement Test, and the analysis results are given in Table 2.

Table 2. Descriptive data regarding achievement test pretest and posttest scores of the groups

| Tests | Group | N | M | Sd | Med. | Mod | Kurt. | Skew | Var. |
|---|---|---|---|---|---|---|---|---|---|
| Pretest | Experimental | 22 | 47,64 | 7,89 | 48 | 48 | -,52 | -,352 | 62,33 |
| | Control | 20 | 43,80 | 10,17 | 42 | 36 | 1,58 | -,528 | 103,53 |
| Posttest | Experimental | 22 | 70,36 | 15,88 | 70 | 80 | -,721 | ,208 | 252,43 |
| | Control | 20 | 60 | 14,03 | 60 | 52 | -1,34 | ,114 | 197,05 |

The descriptive data regarding the pretest and posttest scores of the Solar System and Eclipses Unit Achievement Test of the groups are given in Table 2. When the data in the table is examined, it is seen that the median, mean and mode values of the Solar System and Eclipses Unit Achievement Test pretest scores of the participants in both the experimental and control groups are close. Similarly, the median, mean and mode values of the post-test scores of the groups are close to each other. The fact that these values are close to each other for the data obtained from the test and that the kurtosis and skewness values are between -2 and +2 are interpreted as the data are normally distributed (Buyukozturk, Cokluk, & Koklu, 2018; George & Mallery, 2003). In addition, when the sources in the literature are investigated, it is stated that the data are normally distributed when the sample size is n > 20 (Buyukozturk, 2010).

As a result of the descriptive analysis, it was accepted that the data obtained from the test showed a normal distribution and parametric tests were preferred for the analyses. Independent groups t-test was used to examine whether the mean scores of the groups differed significantly from the achievement test. The obtained results are given in Table 3.

Table 3. Independent groups t-test results regarding achievement test pretest scores

| Group | N | M | Sd | t | p |
|---|---|---|---|---|---|
| Experimental | 22 | 47,64 | 7,89 | 1,37 | ,18 |
| Control | 20 | 43,80 | 10,17 | | |

When Table 3 is examined, the Solar System and Eclipses Unit Achievement Test' score of the students in the experimental group is M= 47.64, and the Solar System and Eclipses Unit Achievement Test mean score of the students in the control group is M = 43.80. There was no significant difference between the pretest achievement scores of the students in the experimental and control groups ($t = 1.37$, $p > .05$).

It was examined whether there was a significant difference between the post-test achievement mean scores of the students in the experimental and control groups, and the results of the independent groups t-test applied to the posttest scores of the groups are given in Table 4.

Table 4. Independent groups t-test results regarding achievement test posttest scores

| Group | N | M | Sd | t | p |
|---|---|---|---|---|---|
| Experimental | 22 | 70,36 | 15,88 | 2,23 | ,03 |
| Control | 20 | 60 | 14,03 | | |

Table 4 shows that the Solar System and Eclipses Unit Achievement Test posttest mean score of the experimental group students is M = 70.36, and the Solar System and Eclipses Unit Achievement Test post-test mean score of the control group students is M = 60. After the application process, there was a statistically significant difference in favor of the experimental group students between the Solar System and Eclipses Unit Achievement Test scores of the groups ($t = 2.23$, $p < .05$).

Before the motivational findings of the research are presented, the statistical method to be used to the data collected from motivation scale in the study was investigated. For this reason, the data collected from the motivation scale were analyzed and the normality of the obtained scores was examined (Table 5).

Table 5. Descriptive data on motivation scale pretest and posttest scores of the groups

| Tests | Group | n | M | Sd. | Med. | Mod | Kurt. | Skew. | Var. |
|---|---|---|---|---|---|---|---|---|---|
| Pretest | Experimental | 22 | 93,68 | 10,06 | 91,50 | 90 | -,71 | -,04 | 101,27 |
| | Control | 20 | 92,90 | 8,69 | 94 | 94 | ,28 | -,70 | 75,56 |
| Posttest | Experimental | 22 | 103,36 | 7,22 | 103 | 99 | -,31 | -,24 | 52,14 |
| | Control | 20 | 96,55 | 7,14 | 98,50 | 92 | ,32 | -,82 | 51,10 |

Looking at the data in Table 5, the median, mean and mode values of the mean scores of the pretest and posttest scores of the groups from the scale are close to each other. The closeness of these values, skewness and kurtosis values in the table are in the appropriate value range (between -2 and +2), which is interpreted as the data being normally distributed (Buyukozturk, Cokluk, & Koklu, 2018; George & Mallery, 2003).

As a result of descriptive analysis, it was found that the data showed normal distribution and it was decided to applied parametric tests in the analysis of the data. Independent groups t-test was used to test whether there was a significant difference between students' Motivation Scale for Learning Science pre-test and test mean scores (Table 6).

Table 6. Independent groups t-test results regarding motivation scale pretest scores

| Group | N | M | Sd. | t | p |
|---|---|---|---|---|---|
| Experimental | 22 | 93,68 | 10,06 | ,26 | ,79 |
| Control | 20 | 92,90 | 8,69 | | |

According to the data in Table 6, the pretest mean score of the Motivation Scale for Learning Science of the students is M = 93.68 for the students in the experimental group and M = 92.90 for the students in the control group. There was no statistically significant difference between the groups' mean scores on the Motivation Scale for Learning Science ($t = ,26$, $p > .05$).

No statistically significant difference was found between the pretest mean scores of the Motivation Scale for Learning Science in the experimental and control groups, and whether there was a significant difference between the posttest scores of the groups was examined using the independent groups t-test (Table 7).

Table 7. Independent groups t-test results regarding the motivation scale posttest scores

| Group | N | M | Sd. | t | p |
|---|---|---|---|---|---|
| Experimental | 22 | 103,36 | 7,22 | 3,06 | ,00 |
| Control | 20 | 96,55 | 7,14 | | |

When the data in Table 7 are examined, it was found that the experimental group students' Motivation Scale for Learning Science posttest mean score was M = 103.36, while the control group students' Science Learning Motivation Scale posttest mean score was M = 96.55. There is a statistically significant difference in favor of the experimental group between the motivation scale scores of the students in the experimental and control groups after the study ($t = 3.06$, $p < .05$).

## Results, Discussion and Recommendations

This research was conducted to determine the effects of educational film-supported augmented reality applications in the teaching of the Solar System and Eclipses Unit of the 6$^{th}$ grade Science course on the academic success of the students and their motivation levels for learning science. In the study, firstly, it was found that there was no statistically significant difference between the groups' mean achievement pre-test scores on the solar system and eclipses unit. On the other hand, it was found that there was a statistically significant difference in favor of the experimental group between the students in the experimental and control groups after the study, in favor of the experimental group. These results show that augmented reality applications supported by educational films positively affect the academic achievement of students. It is thought that this result of the study is due to the fact that augmented reality applications supported by educational films are seen as a new learning environment for students and this situation increases the academic achievement of the lesson. When the literature is examined, it is stated that combining education with new technologies attracts the attention of learners, increases their efforts and motivation, enables them to be active in the learning process and facilitates the understanding of the subject (Kucuk, 2015; Kreijns, Acker, Vermeulen, & Buuren, 2013; Shen, Liu, & Buuren, 2013). Wang, 2013). Another reason for this result is thought to be that the objects on the papers appearing in three dimensions through augmented reality technology are perceived as almost like magic by the students (Billinghurst, Kato, & Poupyrev, 2001).

When the literature on the subject is examined, no other study has been found in which augmented reality applications are supported by educational films, similar to this study. However, in parallel with this finding of the research, it is seen that educational films and augmented reality applications increase academic success in science education and contribute to students' understanding of science subjects and concepts (Sumadio & Rambli, 2010; Sahin, 2017). In his study, Eren (2019) investigated the effect of augmented reality applications

on the success and permanence of 7th grade students within the scope of Elements and Compounds. As a result of this study, it has been determined that AR applications are more effective on the academic success of students and the permanence of their knowledge than the current curriculum. Sentürk (2018) examined the effects of teaching activities supported by augmented reality in science teaching within the scope of the Solar System and Beyond unit on students' academic achievement, motivation, attitudes towards science, technology and augmented reality applications. As a result of this study, it has been stated that the academic success of the students who teach by using augmented reality technology has increased. This result is in direct parallel with our study. Similarly, in Ates (2018)'s study in which he examined the effect of AR technology on academic achievement in the Particulate Structure of Matter and Pure Substances unit, the results of the analysis of the pretest and posttest scores of the experimental group students revealed that the application increased academic success of the students. Similar to the results of this study, many studies have emphasized that the use of AR applications has an impact on students' academic achievement (Bujak et al. 2013; Cankaya, 2019; Fleck & Simon, 2013; Hwang, Wu, Chen, & Tu, 2016).

When the relevant literature is examined, there are different studies that show that educational films increase academic success, similar to augmented reality applications. In this study, it is seen that educational films have a positive effect on student achievement. The educational films used in the study allowed the subjects related to the solar system, which are difficult to understand and abstract, to be conveyed in a more visual way. It is thought that this situation provides students with a better understanding of the subject. According to Ince Yakar (2013), educational films used in learning environments help to learn subjects that are difficult to understand more easily. It creates learning experiences that enable individuals to be successful. In addition Wenger (1943) and Bruner (2008) state that educational films are effective digital learning objects that can be used to ensure the success of teaching. As a result of their study, Pekdag and Marechal (2007) state that use of films in science teaching contributes to the understanding, learning and transmission of new scientific concepts. As a result of many researches on the subject, it is stated that films are an efficient learning object in terms of teaching the subject. In addition, it is said that educational films contribute to students' understanding of scientific concepts, their internalization and the formation of their mental structures (Anderson, Huston, Schmitt, Linebarger, & Wright, 2001; Linebarger, Kosanic, Greenwood, & Sai Doku, 2004; Cavanaugh & Cavanaugh, 2004; Michel, Roebers, & Schneider, 2007).

Another result obtained from the research is the effect of educational film supported augmented reality applications on motivation towards science learning. As a result of the analyzes made on the data obtained from the study, no significant difference was found between the pre-test mean scores of the students in the experimental and control groups of the Motivation Scale for Learning Science before the application. However, there was a statistically significant difference between the groups' Motivation for Science Learning Scale post-test scores. When the relevant literature is examined, it is noteworthy that there is no study that directly investigates the effect of educational film-supported augmented reality applications on motivation towards learning science. However, there are various study results in the literature that both augmented reality applications and educational films increase the motivation of students separately. In the study conducted by Cankaya (2019), the effect of augmented reality applications on the success, attitude and motivation of secondary school students in science lessons was examined and it was observed that augmented reality applications increased their attitudes and motivations towards the lesson and the subject. The results of the study conducted by Sentürk (2018) also revealed the positive effect of augmented reality applications on motivation. In parallel with this result, Di Serio, Ibáñez, and Kloos (2013) stated that increasing the interaction of students with their learning environment with the help of augmented reality activities increases their motivation. Again, as a result of the study by Wojciechowski and Cellary (2013), it was concluded that augmented reality applications are an effective tool to increase the motivation of primary school students towards the lesson and provide students with the opportunity to learn while having fun. In the study conducted by Farias, Dantas, and Burlamaqui (2011) it was concluded that the use of augmented reality applications in education contributes positively to the learning process, making the learning process remarkable and more effective.

During the implementation process, augmented reality applications were supported by educational films. In the literature, there are study results showing that educational films, which are the other components of the study, increase student motivation, similar to the results of this study. It is thought that the reason for this situation is that educational films eliminate the ordinary of the lesson and provide a different learning environment to the students. This helps them to be motivated to watch the lesson. Similarly, Weinstein (2001) states that the use of educational films as teaching materials eliminates the ordinariness and monotony of the lessons, and also increases student motivation towards the subjects being taught. In the research conducted by Topal, Guven Yildirim and Onder (2019), the views of teacher candidates on the use of educational films in science lessons were examined. As a result of the study, it was seen that while pre-service teachers talked about the benefits of

using educational films in science lessons, they stated that educational films made learning the subject easier and increased motivation and interest in the lesson. As a result of Oztaş (2008)'s study, it was concluded that with the use of educational films in the lesson, the interest and motivation of the students towards the subjects of history increased and the films directed the students to research. In addition, Watts (2007) states in his study that movies motivate individuals to learn by providing learning opportunity. In another study, Akridge and Balkanski (1990) emphasize that the active use of educational films in the learning environment will contribute to the students' having a good time in the learning process and to increase their attitudes and motivation towards the lesson. It is stated by other researchers that educational films and videos are important learning objects that create enjoyable teaching environments, increase interest and motivation towards the lesson, and form the basis for effective and permanent learning (Hébert & Peretz, 1997; Stoddard, 2009; Wagner, 1954).

The results obtained from the research and the results of previous studies on the subject reveal the benefits of the teaching process carried out with both educational films and augmented reality applications. The result of this research reveals that educational film supported augmented reality applications both contribute to the success of science course and increase the motivation for learning science. However, this research was limited to the effect of educational film supported augmented reality applications on student achievement and motivation only in the Solar System and Eclipses Unit. In addition, the study group and the duration of the application stand out as a limitation of the research. In this context, in the light of the findings of this study, the effects of educational film supported augmented reality applications on different variables can be examined in different units and subjects, in different sample groups and for a longer period of time.

## Scientific Ethics Declaration

The authors declare that the scientific ethical and legal responsibility of this article published in JESEH journal belongs to the authors.

The purposes and procedures of the current study were granted approval from the ethical committee of the Gazi University (26.04.2021 / 80287700-302.08.01- 71328).

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