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The Effect of Technology Supported Education on the Academic Achievement of Middle School Students in Science Lessons and Their Interest in Science Topics[1]

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Abstract

The aim of this study is to examine the effects of technology-supported science education on the academic achievement and interest in science subjects of 6th grade students. A pre-test-post-test matched control group model, one of the quasi-experimental designs, was used in the study. The sample of the study consisted of 52 students studying in the 6th grade of a middle school in Karaman in the 2022-2023 academic year. Data were collected through the Academic Achievement Test for the Solar System Unit and the Interest Scale for Science Subjects. The application was carried out for 5 weeks. While the lessons were taught according to the current program in the control group, the lessons were taught with technology-supported science education in the experimental group. As a result of the research, it was found that technology-supported science education had a significant effect on academic achievement and this effect was in favor of the experimental group. However, despite the increase in the scores of the experimental group in terms of interest in science subjects, no significant difference was found between the two groups. According to the results of the research, suggestions were made such as increasing the use of technology in science classes, using technology not only in the Solar System and Eclipses unit but also in other units, and providing schools with the necessary technology infrastructure and materials.

INTRODUCTION

Education is a phenomenon that is given importance throughout human life and constantly thought about how it can be done better. It constantly develops by being affected by the developments that shape human life. Rapid technological changes that continue for years cause the emergence of new technological tools every day. These technological developments inevitably affect educational activities, as in every area of life (Meriçelli and Uluyol, 2016). The use of technology in education is also important in terms of students' adaptation to rapid changes in science and technology, getting used to using technology effectively, and creating the basic infrastructure of the education-teaching process (Kenar and Balcı, 2013). For this reason, individuals who try to learn only by reading books or only with methods where the

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teacher is at the center cannot usually be effective in technology-supported education. On the other hand, education through both audio and visual media channels affects students' attitudes and success more positively in science lessons (Asan and Haliloğlu, 2005; Demirci Güler and Irmak, 2018; Ortaakarsu and Sülün, 2025; Özmen and Kolomuç, 2004).

Science lessons include abstract concepts, but they gain more meaning when connections are made between concrete experiences and daily life. In cases where abstract concepts are dominant in explaining nature and natural events, science lessons need to be strengthened with technological support. Activating technology in the learning process increases students' interest and motivation in the lessons at school and the subjects they are trying to learn, while also helping them remember their previous knowledge. The information presented with technology is simplified and students can grasp the subject with original learning methods (İşman et al., 2002). Activating technology during science lessons helps to increase the quality of science lessons, develop students' reasoning skills, access information, advance their problem-solving skills, and convey situations that are rare or dangerous to observe in our lives (Karamustafaoğlu et al., 2012). Using technology in effective and efficient science teaching is very important, and this shows us that technology-supported science teaching is important (Şahin, 2016).

The Purpose of Study

This study aimed to measure the effect of the technology-supported lesson plans prepared for the "Solar System" subject of the Science course "Solar System and Eclipses" on the academic success of 6th grade students and their interest in science subjects. The reason for including this unit in the study was that there were abstract events and situations regarding space and the universe and that technology would be better utilized in this unit and subject.

The problem statement of this study was determined as; ''Does the technology-supported teaching used in the Science course affect the academic success and interest in science subjects of 6th grade students?''

The sub-problems are listed as follows;

1. The experimental group in which the Science course was conducted with technology support and the control group in which the 2018 Science Course Curriculum was used in the subject of "6th Grade Solar System and Eclipses Section, Solar System";
    - Is there a statistically significant difference between the academic success pre-test scores?
    - Is there a statistically significant difference between the academic success post-test scores?
2. The students in the experimental group and the control group;
    - Is there a statistically significant difference between the pre-test scores of interest in science subjects?
    - Is there a statistically significant difference between the post-test scores of interest in science subjects?

METHOD

Study Design

In this study, the pre-test-post-test matched control group model, one of the experimental methods, was used to determine the cause-effect relationship. In this model, there are two groups assigned impartially. Measurements are made in these two groups both before and after the application (Karasar, 2015). Before the application phase, students at the relevant

grade level were divided into two groups as experimental and control groups with an unbiased assignment. In the first phase, previously prepared scales were applied to both groups as pre-tests. The Academic Achievement Test developed by Yeşiltepe (2019) and the Science Interest Scale developed by Şimşek and Nuhoğlu (2009) were applied to all students as pre-tests.

Table 1. Research design

Group	Pre-Test	Teaching according to the current program	Technology-Assisted Teaching	Post-Test
Experimental group	X		X	X
Control group	X	X		X

During the implementation, the "Current Program" was applied to the control group, and the "Technology-Supported Instruction", the effectiveness of which was investigated, was applied to the experimental group. When the implementation was completed, the scales applied as pre-tests were repeated as post-tests, and the effectiveness of the methods applied to both groups on their academic success and interest in science subjects was examined. The implementation took five weeks in total.

Study Group/Partipicants

The study group consisted of 52 students studying in the 6th grade of a secondary school in Karaman province in the 2022-2023 academic year. The experimental and control groups were determined by the convenience sampling method, which is a non-random sampling method. The reason for determining the experimental and control groups by the convenience sampling method is that this method provides the opportunity to prevent loss of money, labor and time (Büyüköztürk et al., 2014). The two branches closest in terms of academic success according to their 5th grade grade point averages were randomly selected as the experimental and control groups, and the study groups were determined in this way.

Data Collection

First, the students were informed about the research. After obtaining permission from the parents, the Academic Achievement Test for the Solar System Unit (Yeşiltepe, 2019) and the Interest Scale for Science Subjects (Şimşek and Nuhoğlu, 2009) were applied to the students as a pre-test. The lessons were taught to the control group without any changes in the current curriculum. In the experimental group, lesson plans for technology-supported science education were prepared and lessons were taught according to these lesson plans. Technologies such as augmented reality, virtual reality, QR codes, educational computer games, holograms and interactive concept maps were used in the experimental group. The application lasted 5 weeks and at the end of the lesson process, an achievement test and an interest scale for science subjects were applied to each group regarding the determined outcomes.

Data Anaysis

The data were analyzed with the SPSS 21 program. Before the analysis, a normality test was applied and skewness and kurtosis values were reviewed. The results of the normality test are given in Table 2.

Table 2. Normality test results

Scales	N	x̄	ss	Skewness	Kurtosis
Academic achievement test (pre)	52	13.42	3.72	-.694	.189
Academic achievement test (post)	52	17.23	4.84	-.807	.330
Interest scale for science subjects (pre)	52	62.13	14.58	.307	-.739
interest scale for science subjects (post)	52	63.23	15.00	.262	.029

As indicated in Table 2, the Skewness value was found to be between -.807 and .307, and the Kurtosis value was found to be between .330 and -.739. According to Tabachnick and Fidell (2013), Kurtosis and Skewness values between -1.5 and +1.5 indicate normal distribution. When the results of the normality test were examined, it was determined that parametric tests were appropriate for this study.

FINDINGS

In this section, the data collected with the scales specified in the method section were analyzed using appropriate statistical methods and the results obtained were presented.

Is There a Statistically Significant Difference Between Academic Achievement Pre-Test Scores? Findings Regarding the Research Question

Independent t-test was conducted to compare the academic achievement pre-test scores of the application and comparison groups. The data obtained as a result of the analysis are given in Table 3.

Table 3. Independent t-test results of academic achievement pre-test scores of the experimental and control groups.

	Groups	N	x̄	ss	Min.	Maks.	t test		
							t	sd	p
Academic achievement test (pre)	Experimental group	26	13.03	4.33	22	44	-.742	50	.462
	Control group	26	13.80	3.03					

When Table 3 is examined, it is understood that there is no statistically significant difference between the academic achievement pre-test scores of the experimental and control groups ($t[50]= -0.742$; $p>0.05$).

Is There a Statistically Significant Difference Between the Academic Achievement Post-Test Scores? Findings Regarding the Research Question

Independent t-test was performed on the experimental and control groups to examine the academic achievement post-test scores. The results obtained from this test are shown in Table 4.

Table 4. Independent t-test results of the academic achievement post-test scores of the experimental and control groups.

	Groups	N	x̄	ss	t test			
					t	sd	p	Cohen'd
Academic achievement test (post)	Experimental group	26	18.80	4.56	2.463	50	.017*	0.68
	Control group	26	15.65	4.67				

According to Table 4, it was determined that there was a significant difference between the academic performance post-tests of the application and comparison groups (t[50]= 2.463; p<0.05). It was found that the academic success average of the experimental group (X=18.80) was significantly higher than the control group (X=15.65). When the effect size was examined, Cohen's d value was calculated as 0.68 and according to Cohen's (1988) classification, this value indicates a medium-level effect.

Is There a Statistically Significant Difference Between the Pre-Test Scores of Interest in Science Subjects? Findings Regarding the Research Question

Independent t-test was applied to the experimental and control groups to examine the pre-test scores of the interest scale for science subjects. The analysis results are presented in Table 5.

Table 5. Independent t-test results of the pre-test scores of the interest scale for science subjects of the experimental and control groups.

	Groups	N	x̄	ss	Min.	Maks.	t test		
							t	sd	p
The interest scale for science subjects (pre)	Experimental group	26	59.46	13.21	27	135	-1.332	50	.189
	Control group	26	64.80	15.62					

When Table 5 was examined, it was seen that there was no statistically significant difference between the pre-test scores of the experimental and control groups regarding science subjects (t[50]= -1.332; p>0.05).

Is There a Statistically Significant Difference Between the Post-Test Scores of Interest in Science Subjects? Findings Regarding the Research Question

An independent t-test was performed on the experimental and control groups to examine the post-test scores of the Interest Scale for Science Subjects. The findings obtained from this test are given in Table 6.

Table 6. Independent t-test results of the post-test scores of the Interest Scale for Science Subjects of the groups participating in the study.

	Groups	N	x̄	ss	t test			
					t	sd	p	Cohen'd
The interest scale for science subjects (pre)	Experimental group	26	61.34	17.49	- .904	50	.370	0.25
	Control group	26	65.11	12.06				

When Table 6 is examined, there is no statistically significant difference between the post-test scores of the experimental and control groups regarding science subjects (t[50]=-0.904; p>0.05). However, when the pre-test and post-test means of the interest in science subjects of the application group are compared, it is seen that the mean increased more in the application group compared to the comparison group. The effect size was determined to be low at d=0.25 (Cohen, 1988).

CONCLUSION, DISCUSSION AND SUGGESTIONS

In light of the research findings, no significant difference was found between the academic achievement pre-test score averages of both groups. This finding showed that the academic achievement levels of the groups were equal before the application. At the end of the study, the academic achievement test was applied to both groups as a post-test. When the academic achievement post-test scores of the experimental and control group students were examined, the academic achievement test scores of the experimental group students were found to be significantly higher than the academic achievement test scores of the control group students. These data show that technology-supported science education has a positive effect on academic performance. There are similar studies in literature. In the studies conducted, it was found that there were significant differences in favor of the experimental groups between the experimental groups applied computer, simulation and technology-supported learning and the control groups receiving education with existing programs (Akçay et al., 2007; Bell and Trundle, 2008; Carlsen and Andre, 1992; Doğan, 2025; Emrahoğlu and Bülbül, 2010; Güvercin, 2010; Jimoyiannis and Komis, 2001; Karamustafaoğlu et al., 2005; Kıyıcı and Yumuşak, 2005; Ortaakarsu and Sülün, 2025; Saka and Yılmaz, 2005; Tokur, 2011). Studies in which approaches that confirm traditional knowledge are used in technology-supported education show that technology has positive effects on academic achievement by Azar and Şengüleç (2011), Bozkurt and Sarıkoç (2008), Çinici et al. (2013), Kıyıcı and Yumuşak (2005). The study conducted by Güven and Sülün (2012) and the study conducted by Çetin and Günay (2010) reached similar results in terms of academic success and student attitudes. Both studies reveal that computer-aided and web-based teaching methods have positive effects on students' academic performance and interest in lessons. The study by Güven and Sülün (2012) showed that computer-aided education increased students' success in science and technology lessons and that they had a more positive attitude towards lessons. Similarly, the study by Çetin and Günay (2010) showed that students achieved success in science lessons and gained a positive approach towards the lesson thanks to web-based education. These compatible results show that computer and web-aided education methods are important tools in innovative teaching and contribute to students' learning processes. In line with the findings obtained, it was concluded that the role of technology in modern education is increasing, supporting students' natural motivation and has the potential to increase academic success. Kerdvibulvech (2022) developed some virtual reality and digital game applications in his research and applied them as distance

education during the pandemic period and looked at the results. He saw that it was as effective as face-to-face education and predicted that it could be used in normal education periods and that interest and success in lessons could increase. Hwang and Chien (2022) made an application by integrating virtual reality glasses and augmented reality situations into education with existing applications in their research and achieved successful results in permanent learning in students. It even concluded that virtual reality applications are better in terms of permanence and success. They revealed that virtual reality-based education will contribute to future generations becoming scientifically literate individuals by developing artificial intelligence technology. Kramarski and Feldman (2000) concluded in their research that although the technology-supported education environment increased students' motivation and interest in the lesson, there was no difference in metacognitive awareness levels in the technology-supported environment compared to the control group. Regardless of the learning approach, students can develop the skills necessary to manage their own cognitive processes. Alexander et al. (2006) stated that with the effect of the education students receive throughout their school years and the equipping of this education with technology, metacognitive skills also develop in parallel with the development of mental abilities, and academic success in lessons also increases. In their research, Lockee (2021) supported each other with the positive effect on students' academic success and attitudes as a result of the permanent and traceable interaction between students and teachers who teach technology-supported lessons. Virtual reality glasses, in other words, head-mounted displays, allow users to experience a high degree of immersion (Kim et al., 2020; Radianti et al., 2020). High-quality graphics and immersive content presented using head-mounted displays allow students to explore complex subjects in ways that traditional teaching methods cannot (Hamilton et al., 2021). Similarly, in a trend study conducted by Jensen and Konradsen (2018) on the effects of the use of head-mounted virtual reality devices on immersion and presence, they found that the use of virtual reality glasses in designed virtual reality environments had a more positive effect on students. At the beginning of the study, no statistically significant difference was found between the pre-test scores obtained from the interest scale for science subjects applied to both groups. This showed that the initial levels of the experimental and control groups were equal. At the end of the study, the Interest Scale for Science Subjects was applied to both groups as a post-test. Although there was no statistically significant difference between the post-test scores of the experimental and control groups, the experimental group showed a greater increase in average scores compared to the control group. Contrary to other studies investigating the level of interest in science subjects, it was concluded that there was no significant difference in students' interest in science subjects in this study (Gibson and Chase, 2002; Yaman and Öner, 2006). It is thought that the short period of time that the study was conducted may be effective in the findings obtained in the study. A longer period is needed for affective characteristics such as interest and attitude to change significantly. (Güven and Sülün, 2012). Moreover, since the pre-test scores of the experimental group students were already high, although their interest scores for science courses increased, it did not create a significant difference. It was concluded that a longer period of application should be carried out to increase students' interest in science subjects.

According to the results of the research, the following suggestions are presented;

- Since technology-supported science teaching increases students' academic success, it is recommended that science courses be taught with technological support.
- Based on the results of the study, it is recommended that teachers implement Technology-Supported Science Teaching at different levels and in various subjects.
- It is recommended that technology support be used in science classes for a long time to meaningfully increase students' interest in science subjects.
- Technology-supported teaching is recommended to be used especially in units where abstract concepts are intense, such as the "Solar System" unit.

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