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The Effect of Augmented Reality Applications on the Attitudes of Middle School Students towards Astronomy

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Abstract: In this study, the effect of augmented reality applications on students ' attitudes towards astronomy was investigated. In this study, seventh grade students studying in two different classes in a public school were used. One of the classes was determined as a control group and the other class was determined as an experimental group. Astronomy Attitude Scale was used as data collection tools. For 4 weeks, the Solar System and Beyond Unit were processed in the control group in accordance with the curriculum, while the experimental group was supported with augmented reality applications. The Astronomy Attitude Scale was applied as a pre-test to both groups before the application started. After the application, the same test was applied as a post-test to both groups. The obtained data were analyzed with SPSS 22 statistical package program and t-test was used in the evaluation of the obtained data. According to the results of the post-test scores of Astronomy Attitude Scale, a statistically significant relationship was found in favor of the experimental group. Accordingly, it has been shown that augmented reality applications improve the attitudes of middle school students towards astronomy.

Keywords: Agumented reality, Astronomy education, Attitude, Solar system unit

Introduction

The age in which we live is a time when computers and the internet have become completely central and digital applications occupy more space in everyday life and the communication styles of the masses are changing (Arslan and Elibol, 2015). The way students' access and present information in educational and instructional environments is influenced by technological changes in this digital age. One of the possibilities that arise in the direction of these technological changes is the Augmented Reality (AR) applications.

AR is used for education in the fields of environment, construction, electrical engineering and architecture with courses such as geometry, mathematics, geography, anatomy and visual arts. It is not limited to the field of education but also in many fields such as military, design, sports and health. For example, the medical industry can operate using virtual reality glasses; the location and color of the objects can be changed by using barcode readers in the field of construction and architecture; the objects can be touched and even heard by the help of gloves and glasses in the field of advertising. Many applications have been designed to be used in Science Education recently on the dissemination of the idea that AR can be used in educational environments (Kırıkkaya and Şentürk, 2018).

Examples of these applications include Anatomy 4D, which provides learning of human anatomy in the interactive 4D experience, Quiver 3D, which enables the study of objects, organelles in cells, Animal 4D+, which allows the introduction of animals, Elements 4D, which allow the four-dimensional representation of elements ' symbols, atomic numbers, and physical states, Octaland 4D, which enables the promotion of professions. The first of the AR applications used in the study is Space 4D, which allows the study of planets in the solar system in a four-dimensional way. The other is the Spacecraft 3D developed by NASA, which promises a fun experience, allowing you to have a portable, realistic experience on the table of many spacecraft, including curiosity. Another is Star Tracker, an application to study celestial objects such as stars, comets, and constellations (Kırıkkaya and Şentürk, 2018).

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Research Problem

What is the impact of Augmented Reality (AR) applications on students ' attitude towards the astronomy in science lesson?

Sub-problems

Answer to the following sub-problems related to the problem sentence of the research:

1. Do the astronomy attitude scores of the experimental and control groups differ in the pre-test?
2. Do the astronomy attitude scores of the control group differ from pre-test and post-test?
3. Do the astronomy attitude scores of the experimental group differ from pre-test and post-test?
4. Do the astronomy attitude scores of the experiment and control groups differ in the post-test?

Method

In this study, the effect of augmented reality applications on students ' attitudes towards astronomy was investigated. In the research, quasi-experimental design with pretest-posttest control group has been used. In this quasi-experimental study, the experiment and control group were determined as neutral but the subjects in the groups were not identified as neutral. Because the study was carried out on formal students and the assignment of students to experimental and control groups was not created artificially, as it would cause disruption of the educational process that is currently underway. The research consists of 56 students studying in the seventh grade of a middle school affiliated to MoNE in Hadim District of Konya Province.

Table 1. Number of students in groups

Group	Male	Female	N
Experimental	16	12	28
Control	13	15	28
Total	29	27	56

In order to measure the students ' attitudes towards astronomy, The Astronomy Attitude Scale was used. The scale refers to 15 expressions with 10 negative and 5 positive expressions in five Likert type. Each expression is numbered from 1 to 5, from the students' negative attitudes towards astronomy to their positive attitudes. The applied astronomical scale has been evaluated over 75 points.

It was developed by Zeilik, Schau and Mattern (1999) and adapted to Turkish by Bilici, Kılıçan, Çakır and Yürük (2012). The internal consistency and sub-factors of the scale were determined in the study. Reliability coefficient was found to be $\alpha = .80$. It is important to note that the reliability coefficient is more than .70, so it is assumed that the measurement tool has sufficient reliability and is used to collect data (Büyüköztürk, 2011).

"Solar System and Beyond " unit topics were lectured in both groups for 4 weeks. The subjects were explained to both groups by the researcher. In this way, individual differences in teaching skills of the teacher were eliminated and the teaching was made more effective. The subjects were explained to the experimental group using Augmented Reality applications. The control group was told by using the experiments and activities in the textbook according to the Science Curriculum.

The Astronomy Attitude Scale was applied to the experiment and control group as both pre-test and post-test. Data obtained from the study were analyzed by SPSS 22 statistical program. The level of significance was determined as 0.05.

Before starting the study, "independent t-test" was used to compare two independent groups, whether there was a significant correlation between the experimental group and control group's test results of the Astronomy Attitude Scale applied to both group. The Control and Experimental Group's Astronomy Attitude Scale was determined by applying the "dependent t-test" used to compare two measurements from a single group to determine whether there is a significant relationship between pre-test and post-test results. The "independent t-test" was used to compare two independent groups to determine whether there was a significant correlation between the post-test results applied to the experimental and control groups.

Findings

Sub-Problem 1: Do the astronomy attitude scores of the experimental and control groups differ in the pre-test?

Astronomy Attitude Scale applied to control and experiment groups after analysis of pre-test results, pre-test score averages, standard deviations (SD), degree of freedom (df) and p values were given in Table 2. The Astronomy attitude test applied as a pre-test is close to each other ($\overline{X}_{control}$=30, 21; $\overline{X}_{experimental}$=30, 60).

Table 2. Astronomy attitude scale control and experimental groups Pre-test data

Group	N	$\overline{X}$	SD	df	t	p
Control group pre-test	28	30,21	10,06	54	0,14	,886
Experimental group pre-test	28	30,60	10,40			

As shown in Table 2, there is no significant difference between the groups (t=0, 14, p=, 886; p>, 05). This result shows that the pre-study Astronomy attitudes between the experimental group and the control group are close to each other. According to this, the scores of both groups ($\overline{X}_{control}$=30, 21; $\overline{X}_{experimental}$=30, 60) are close to each other and since there is no significant difference between them, it can be said that the purpose of the research is appropriate.

Sub-Problem 2: Do the astronomy attitude scores of the control group differ from pre-test and post-test?

After the analysis of pre-test and post-test scores applied to the control group, the mean scores, standard deviations (SD), degree of freedom (df) and p value were given in Table 3. The mean of pre-test scores of the control group students was $\overline{X}_{control}$=30, 21; the post-test scores were $\overline{X}_{control}$=36, 35.

Table3. Astronomy attitude scale control group Pre-test and Post-test data

Group	N	$\overline{X}$	SD	df	t	p
Control group pre-test	28	30,21	10,06	27	8,96	,000
Control group post-test	28	36,35	11,59			

As shown in Table 3, there is a significant difference between the groups (t = 8, 96, p =, 000; p <, 05). It is understood from these results that the Science Curriculum produced a statistically significant difference in the students' attitudes toward the astronomy at the end of the control group.

Sub-Problem 3: Do the astronomy attitude scores of the experimental group differ from pre-test and post-test?

After the analysis of pre-test and post-test scores applied to the experimental group, the mean scores, standard deviations (SD), degree of freedom (df) and p value values were given in Table 4. Students in the experimental group pre-test average score on the $\overline{X}_{experimental}$=30, 60; post-test average score on the $\overline{X}_{experimental}$=40, 21 as were found.

Table 4: Astronomy attitude scale experimental group Pre-test and Post-test data

Group	N	$\overline{X}$	SD	df	t	p
Experimental group pre-test	28	30,60	10,40	27	6,16	,000
Experimental group post-test	28	40,21	13,30			

As shown in Table 4, there is a significant difference between the groups (t = 6.16, p = .000; p <. 05). It is understood from these results that there was a statistically significant difference in the attitudes of the students towards the astronomy in the experimental group in which Augmented Reality applications were applied.

Sub-Problem 4: Do the astronomy attitude scores of the experiment and control groups differ in the post-test?

Astronomy Attitude Scale are applied to the experimental and control groups' post-test scores of "independent groups t-test after analysis, the mean score, standard deviations (SD), degree of freedom (df), and p value are given in Table 5.

Table 5. Astronomy attitude scale control and experimental groups Post-test data

Group	N	$\overline{X}$	SD	df	t	p
Control group post-test	28	36,35	11,59	27	3,98	,000
Experimental group post-test	28	40,21	13,30			

Students in the control group post-test average score of $\overline{X}_{control}$ =36, 35; students in the experimental group post-test average score on the $\overline{X}_{experimental}$ =40, 21 as were found. There was a statistically significant difference between the scores of the two groups (t=3, 98, p=, 000; p<, 05).

Results

The study found that the use of augmented reality applications improved students ' attitudes toward astronomy. In addition, in the renewed science curriculum, it was observed that the students ' attitudes towards astronomy are at an adequate level.

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