The Effect of Instruction With Augmented Reality Astronomy Cards On 7th Grade Students' Attitudes Towards Astronomy and Academic Achievement

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ABSTRACT
In this study, it was tried to investigate the effect of the augmented reality cards on teaching. For this purpose, the effect of the reality cards designed for astronomy subjects on students' attitudes towards astronomy, the effect on academic achievement and the opinions of students about reality cards were evaluated. Mixed method was used as research method in the study which quantitative and qualitative data were collected together. The study group consisted of 53 students studying in the seventh grade of a state school located in Erdemli district of Mersin province. Within this scope, a branch in the school was defined as experimental group including 26 students, and another branch as control group including 27 students. During the "Solar System and Beyond" unit, the subject was taught with augmented reality cards in the experimental group, while the control group was not intervened. The implementation continued throughout the unit. Attitudes towards astronomy scale and achievement test were applied as pre-test and post-test before and after implementation. In addition, open-ended interviews were held with two lower, middle and upper level students in the experimental group in terms of academic achievement. As a result of the analyzes, it was seen that both groups showed a positive change in their attitudes towards astronomy and an increase in the academic achievement on astronomy when the groups were examined within themselves. When the groups were compared, statistically significant difference was found in favor of the experimental group in both attitude and academic achievement. As a result of the interviews conducted with the students, the results revealed that they liked the augmented reality cards very much, could not really distinguish the images from the real objects, as if the planets were indeed in their classes and they learned much more easily.

Key words: Augmented Reality, Astronomy, Science Teaching, Attitude

INTRODUCTION

Today, technology is manifested in every aspect of our life. The technology that started in the early ages has been constantly changed and developed with imparting and fund of knowledge (Rıza, 2003). In recent years, information technologies have rapidly developed, service production has increased and globalization has accelerated. These developments have also affected the perception of education. Therefore, educational tools and equipment required to be changed in order to respond to today's needs. Societies that cannot catch up with the technology that develops in the field of education are behind in the educational standards (Karasar, 2002).

The increase in information resources, desire to reach and share information quickly and the 21st century skills to be technology-oriented has made it necessary for technology to be used in education, and it has also directed the studies carried out in the field of education in recent years (Wang and Hannafin, 2005; Sonyürek, 2014). As a result of these developments, the organizations that determine the qualifications to be reached in education set out serious policies in order to ensure the integration of information technologies into the teaching process and implement comprehensive projects in this direction (European Parliament and the Council, 2006; UNESCO, 2008; FATIH, 2012). Moreover, the integration of the technology into existing curriculum has become a necessity in responding to the diverse expectations of today's youth, nowadays known as Digital generation or Z generation. It is quite normal to need technology in this kind of learning environment that is intertwined with technology at every moment of their lives (Prensky, 2001; Oblinger and Oblinger, 2005; Kennedy et al., 2008; Sonyürek, 2014). For this reason, it is thought that traditional learning methods and environments are not enough to attract their attention as they were in previous generations. On the one hand, different technological developments have to be transferred to the educational environment in order to attract Z generation's attention and provide an efficient training (Bennett, Maton and Kervin, 2008; Somyürek and Karabulut-Koskun, 2013). A real learning experience is always necessary. Involving more senses into learning makes it easier, effective, stronger and permanent. In this context, augmented reality emerges as a developing technology for education (Walczak, Wojciechowski and Cellary, 2006; Lai and Hsu, 2011; Luckin and Fraser, 2011). Augmented reality (AR), which can be defined as a computer enrichment of the real world, has the potential to be more accessible in recent years with the development of

technology. AR is defined as a blended technology of real world and virtual images, and provided a real-time interaction with the virtual environment (Azuma, 1997). Technology of Augmented reality emerged in the 1970s after Ivan Sutherland and his students began working on computer graphics at Harvard and Utah universities in the1960s. Officially, the US Air Force and NASA have been able to use this technology for the first time since 1990 (Feiner, 2002).

This technology can easily interact the user with events and objects in natural ways using with a variety of tools such as desktop computers, laptop computers, portable devices, and smartphones (Kirner, Reis and Kirner, 2012; Wojciechowski and Cellary, 2013). The new opportunities for learning and teaching provided by augmented reality have been recognized by the educators over time and coexistence of virtual objects and real environments have been found to help students to understand the complex and abstract concepts (Arvanitis et al., 2007; Wojciechowski and Cellary, 2013). In addition, AR combines learning environments with the real world in which students live, allowing the seamless implementation of knowledge and skill (Lave and Wenger, 1991).

Communication between users and both real and virtual objects allows them to learn through experience and increase their motivation (Singhal, et al., 2012). While AR technology embodies abstract objects and makes invisible events visible, it also removes potentially dangerous situations. For these reasons, it is emphasized that the use of AR technology in education will increase the effect of education on the student (Walczak, Wojciechowski and Cellary, 2006). Moreover, AR applications attract children's interest because they can move and intervene, and make learning fun and permanent (Billinghurst, Kato and Poupyrev, 2001; Bujak et al., 2013; Oh and Woo, 2008; Wojciechowski and Cellary, 2013; Zhou, Cheok and Pan, 2004).

As implied in the literature, it is seen that AR applications provide an important contribution to the education process, but new application examples are also needed (Martin et al., 2011; Wu et al., 2013). In addition, the internal decision-making mechanism, ie, the reaction of learners, is very important in the process of integrating new technologies into the educational process (Venkatesh, et al, 2003). For this reason, students' attitudes towards the topics they learn with the help of AR will give clues about the effectiveness of AR. However, the impact of AR on the success of students needs to be examined (Clark, Nguyen and Sweller, 2005), since it is thought that it is an important variable in determining the effectiveness of the learning of change in students' achievement.

From all these, the study tried to investigate the impact of the AR on the attitudes and success of the students. In this context, the astronomy was chosen as the topic and the "Solar System and Beyond" unit of the seventh classes was chosen as the base. The fact that the subject which is being tried to teach at various stages contains extremely large objects, the concepts that planned to impart cannot be experimented by touching or feeling make it difficult for the students to learn the astronomy. In addition, observes and images remain in 2D, makes difficult to shape concepts in mind for students (Şener, Demirhan and Kalyoncu, 2005). The issue of astronomy has been chosen since AR thought to overcome these difficulties.

METHOD

In the study, the mixed method sequential explanatory research design was used. In sequential explanatory patterns, the researcher first collects and analyzes quantitative data, then collects and analyzes qualitative data to better explain quantitative data (Creswell, 2003).

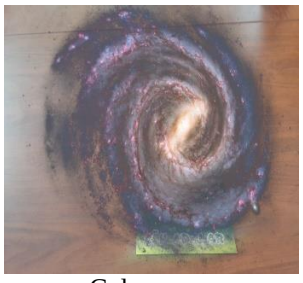
According to Sönmez (2005); universe and sample should not be selected in the experimental research. For this reason, generalization of the universe was ignored and the study group was chosen. The study group consisted of 53 students studying in the seventh grade of a state school located in Erdemli district of Mersin province. Within this scope, a branch in the school was defined as experimental group including 26 students, and another branch as control group including 27 students. During the "Solar System and Beyond" unit, the subject was taught with augmented reality cards in the experimental group, while the control group was not intervened.

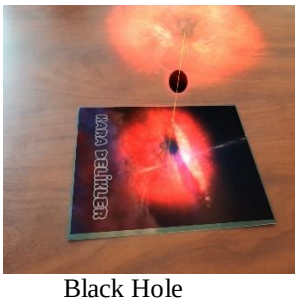
The "Astronomy Attitude Scale" developed by Zeilik et al. (1999) and adapted to Turkish by Canbazoğlu-Bilici et al. (2012) was used in the study to determine the astronomical attitudes and the effect of AR on the astronomy attitudes of the students. As a result of the analyzes, data revealed that original scale was different from the adapted scale which had two subscales and and consist of 15 items. The Cronbach alpha internal consistency coefficient of the scale was .80. The Cronbach alpha internal consistency coefficient of the two factors of the scale is .71 and .77.

The "Astronomy Achievement Test" developed by Arıcı (2013) was also used to determine the students' astronomic success levels and the effect of AR on astronomical achievements. In the first phase, after the test consisting of 50 questions with 4 options in multiple choice and 20 questions were given and the reliability coefficient was found .76 .

In addition, open-ended interviews were held with two lower, middle and upper level students in the experimental group in terms of academic achievement. In the interviews, questions were asked to the students about how they found the practice and what the application made them feel.

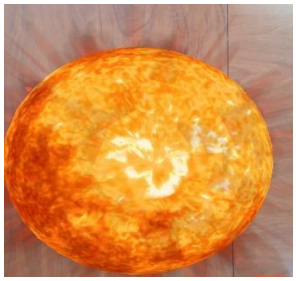
The AR cards used in the study are; developed by ATF studios. On one side there is the object or the visual of the concept, on the other side there are the texts that are voiced when it is opened by the program. The sample images that are opened with the program are as follows:


Galaxy

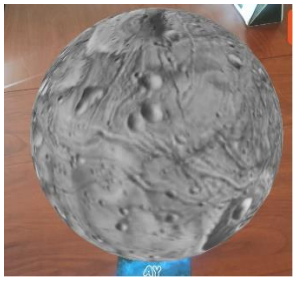


Black Hole


Solar system


Sun

Earth



Moon

FINDINGS

The findings of this study which aims to examine the effects of augmented reality cards on student attitudes and academic achievements are presented and interpreted below. In this context, it was examined whether the scores obtained from the scales were homogeneous and assumptions of normal distribution were checked. The F-test for homogeneity and the Shapiro-Wilk test for normality were used since the groups were smaller than 50. As a result of the analyzes, it was determined that the scores of the groups were homogeneous but not normal. Therefore, non-parametric tests were used for other analyzes.

The analysis of the students' Astronomy Achievement Test scores are given in Table 1 and Table 2:

Table 1. U test Results of the Groups on Astronomical Achievement pre-test

Group	N	mean rank	sum of ranks	U	p
experimental	26	23,87	620,50	269,50	,141
Control	27	30,02	810,50		

The Mann Whitney U-test results of the pre-intervention experimental and control group students' scores on the astronomy achievement test are given in table 1. Accordingly, before the "Solar System and Beyond" unit, there was no statistically significant difference between the astronomical achievement scores of the experimental and control group students, U = 269,50, p>, 05.

Table 2. U test Results of the Groups on Astronomical Achievement post-test

Group	N	mean rank	sum of ranks	U	p
experimental	26	38,54	1002,00	51,00	,000
Control	27	15,89	429,00		

Mann Whitney U-test results on the astronomical achievement scores of the groups were given in Table 2 after the "Solar System and Beyond" unit was lectured in experimental and control groups. Accordingly, there appears to be a statistical difference between the scores of the experimental and control groups after the astronomical

achievement test was given, U = 51.00, p <, 05. The difference in favor of the experimental group can be interpreted as the use of the augmented reality cards become more effective when the "Solar System and Beyond" unit is being processed. It is also believed that seeing the concepts in three dimensions rather than two dimensions make it easier for students to learn.

The analysis of the students' scores on the Astronomy Attitude Scale is given in Table 3 and Table 4:

Table 3. U test Results of the Groups on Astronomy Attitude Scale pre-test

Group	N	mean rank	sum of ranks	U	p
experimental	26	26,12	679,00	328,00	,680
Control	27	27,85	752,00		

Mann Whitney U-test results on the astronomy attitude scale pre-test scores of the students in experimental and control groups were given in Table 3. According to this, before the "Solar System and Beyond" unit, there was no statistically significant difference between astronomical attitude levels of experimental and control group students, U = 328.00, p>, 05.

Tablo 4. Grupların Astronomi Tutum Ölçeği Son-testlerinden Aldıkları Puanlarının U-Testi Sonuçları

Group	N	mean rank	sum of ranks	U	p
experimental	26	36,02	936,50	116,50	,000
Control	27	18,31	494,50		

Mann Whitney U-test results on the astronomy attitude scale scores of the groups were given in Table 2 after the "Solar System and Beyond" unit was lectured in experimental and control groups. Accordingly, there appears to be a statistical difference between the scores of the experimental and control groups after the astronomical achievement test was given, U=116,50, p<,05. The difference in favor of the experimental group can be interpreted as the use of the augmented reality cards increase the positive attitude towards astronomy when the "Solar System and Beyond" unit is being processed. It is also believed that seeing the concepts in three dimensions rather than two dimensions make an positive effect onattitudes towards astronomy.,

As a result of the open-ended interviews made with the students; in general, the results revealed that they liked the augmented reality cards very much, could not really distinguish the images from the real objects, as if the planets were indeed in their classes and they learned much more easily. They also stated that the information they learn is more permanent, appealing to more senses, much fun and very advantageous. Some of the views of the students about the AR are as follows:

> *"I love it. It was very fun listening to the lesson. I also did not have any interest in these subjects, but after the lessons I made searches about the planets from the web and read new things. "*
>
> *"Very beautiful lessons. Let's work always this way. I learned very easily and got a high score on the exam. It was so beautiful both telling the subject and showing as if it was real and made me understand easy "*
>
> *"In this way, our class was a lot of fun. I like these cards very much. Because they were as good as real, we are able to intervene like we want, and we can examine the part we want more easily. "*
>
> *"These cards were very beautiful. I wish there were more for other lessons too. It was very easy to learn by seeing the planets. It was also very nice to talk about the planet while watching the planet. "*
>
> *"It seems as if the planets were in our class. They were like real. At first, I was tough, but then I started to enjoy it as I learned. While our teacher was talking about it, I learned quickly because we saw it all the time. "*
>
> *"The fact that it was three-dimensional affected me very much. I guess it was real. If I were a teacher, I would always use them in my classes. It makes easy to teach and give my lecture. I liked the lesson because it was explained in this way. "*
>
> *"Everything we see visually provides more permanent instruction. So, this course was very good. It was also very good to use tablets in lessons "*

"When our teacher first showed us, I was very interested. I think should be used in every lesson. I would use them if I were a teacher. Because technology is remarkable, which is unusual. "

"We both heard and intervened. That's why it appealed many of our senses. Since it was three-dimensional, we have seen and understood better. And everyone participated in the class. I think these issues were difficult but we understood it easily. "

CONCLUSIONS

Experts who focus on how advanced technologies can be used to add value in teaching today are treating technology of augmented reality as an effective environment / method (Dunleavy, Dede and Mitchell, 2009; Clarkeand Dede, 2007; Kozmaandanderson, 2002). Augmented reality technology, which enables the real world to be supported and enriched with information created in the virtual environment, provides opportunities for digital generation who was surrounded by computers, video cameras, smart devices in order to supply entertaining and participatory learning experiences (Somyürek, 2014).

In this study, the impact of the AR on the attitudes and academic achievements of the students was examined. In this context, AR cards developed by ATF studios were used. The implementation lasted for one month during the process of unit. At the end of the research, the changes in attitude and achievement levels of AR cards were examined.

When the attitudes of the students were examined, it was seen that there was a statistically significant difference between the students' pre-test and post-test attitude scores. In other words, the attitudes of the students were positively affected by AR. In addition, results indicate that, students who used AR cards were very happy to use these applications, wanted to use even in other lessons, and had fun while using AR. This can be expressed as an attentive learning environment for the students, and a positive attitude of the students. In addition, the students' first encounter with the application and their interaction with the application also positively affected their attitudes. This situation is also supported by some other researches in the literature (Klopfer and Squire, 2008; WeiandElias; 2011; Vate-U-Lan, 2012; MahadzirandPhung 2013; Wu, et al., 2013).

When the success levels of the students are examined, they show similar results with attitude levels. It has been found that the students' academic achievemnt levels increases more with the education provided by AR cards. The fact that the students have more fun, the interaction with the application in the teaching process, the visualization with the three dimensions and intervention, providing the individual learning have positively affected the success of the students. Since the AR cards attractive lead to an increase in the motivation of the students. This result is similar to some other studies in the literature (Bradford, 2011, Wojciechowski and Cellary, 2013, Bujak et al., 2013, Küçük, Yılmaz and Göktaş, 2014).

As a result; It was noticed that secondary school students were satisfied with AR cards and they had a lot of fun while learning astronomy. Also, students stated that AR cards should be used in other subjects and lessons. The students' progress in fun, easy learning, interactively participating in lessons and enabling individual learning have improved positive attitudes, which has reduced the anxiety level of the students, and increased their success. From all these, it is thought that AR is an effective material in teaching and should be used.

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