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THE EFFECT OF VIRTUAL REALITY ENHANCED LEARNING ENVIRONMENT ON THE 7TH-GRADE STUDENTS' READING AND WRITING SKILLS IN ENGLISH

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ABSTRACT

The aim of this study is to investigate the effect of virtual reality (VR) enhanced learning environment on the 7th-grade students' academic achievements in reading and writing in English. Within the scope of the experimental application of the research, the "planets" unit topic was selected from the 7th-grade syllabus of the 2018 Turkish English Language Teaching (ELT) curriculum for primary and secondary schools and a VR application about planets was developed for the research. In this study, a quasi-experimental research design was used. The achievement test, which was developed by the researchers before the experiment, was applied to both 15 experimental group and 11 control group students, who were volunteers and who were selected randomly in the seventh grade of a public secondary school in İzmir, Turkey. Before the study, the students in the experimental group were informed how to use VR headset and components. After a total of 3 weeks of implementation, the achievement test was applied to the students in the experimental and control groups. It is found that the experimental implementation has a positive effect on the academic achievement of the experimental group students regarding the reading and writing in English. In addition, the findings reveal that immersive VR is superior to frontal teaching by teachers and all other classical materials especially textbooks by delivering students sensory information in three dimensions. This study is based on quantitative research. For that reason, further studies based on qualitative research design can provide extra insights to get more educational evidence on the use of VR-Applications in English teaching.

Keywords: *Virtual reality, immersive VR, English language teaching with VR, reading and writing skills*

INTRODUCTION

Virtual reality has recently gained importance as an innovation to enhance English language learning environments. Alternative words used for virtual reality are virtual environment, artificial reality, and cyberspace (Schwienhorst, 2002). It provides learners with a first-person experience by enabling them to be present virtually in the events and environments related to the topics that they study. VR, thus, provides the students with an interactive and immersive language learning environment. There are different virtual reality systems like HTC vive, Google Cardboard, Samsung Gear VR, Oculus Rift, Oculus Go and Oculus Quest, which can provide immersive language learning.

Virtual Reality is a three-dimensional simulation environment into which participants immerse themselves through various hardware and software devices. The hardware devices include smartphones, computers, and head-mounted displays (HMD), the use of which depends on the type of VR system. The software may include 360 VR videos, which do not allow for interaction or VR

applications, which enable the user to interact with the virtual world. Different HDMs are available on the market like Oculus Rift, Samsung Gear VR, Google Cardboard, PlayStation VR and HTC Vive. There are mainly three types of virtual reality experienced by the participants (Bamodu & Ye, 2013): 1. Non-immersive VR (Desktop VR); 2. Semi-immersive VR; 3. Immersive VR.

Non-immersive VR (Desktop VR)

Non-immersive VR (Desktop VR) is an interactive 3D computer simulation environment where participants can interact with the virtual world through devices such as a computer mouse and keyboard. In this system, HDM is not used. A desktop computer mouse allows interaction with the virtual World and there is no need for any expensive software or hardware (Martín-Gutiérrez, Mora, Díaz, Marrero, 2017). In non-immersive VR, participants do not fully immerse themselves into the virtual environment, thus, it does not provide the user with an immersive experience in the virtual environment, in other words, in this system, the user is aware of the real world (Vince, 1995).

Semi-immersive VR

Semi immersive VR is an interactive 3D simulation environment where participants immerse partly but not fully into the virtual world. Like non-immersive VR, Semi-immersive VR system does not allow the user to have a sense of being there (Martín-Gutiérrez et al., 2017). Bamodu and Ye (2013) argue that this system provides the user with a high level of immersion and that the Cave Automatic Virtual Environment (CAVE) is an example of this system. Semi-immersive VR, like non-immersive VR, does not make use of an HDM. The other example of semi-immersive virtual reality is a flight simulator, which is a system to train pilots to equip them with flying skills (Vince, 1995).

Immersive VR

Immersive VR is an interactive 3D simulation environment where participants get a feeling of presence in the virtual world. Vince (1995) describes immersive VR as a system which isolates the user from the real world. In immersive VR, participants immerse fully into the 3D virtual world, which provides the users with the first-person experience in the virtual environment. The system makes use of HMD, data gloves, tracking devices, and others to allow the user to have a feeling of being part of the virtual world (Bamodu & Ye, 2013). The immersive VR system is mostly used with an HDM. It must be accompanied by a smartphone in the Samsung Gear VR system, but a computer is necessary for Oculus Rift. Some new versions like Oculus Go and Oculus Quest need neither a smartphone nor a separate computer.

As can be seen from all three types of VR, it is clear that these rich learning and teaching environments will not only increase students' academic development but also increase their interest and motivation for the lessons. In the following section, information about the studies in the field of VR and the results obtained from these studies are given.

Virtual reality systems have many benefits for teaching and learning. Teaching and learning require effective interaction. Interaction is an important component of a VR system. The user can interact virtually with the objects in the virtual world through various hardware devices such as a joystick or interactive glove. Martín-Gutiérrez et. al., (2017) argue that virtual reality systems allow learners to be active learners since they are involved in decision taking while they interact with the virtual world and understand complex concepts.

In this respect, virtual reality also enhances experiential learning. Çavaş, Çavaş, and Can (2004) argue that the learners experience the events in the virtual world through interaction with the objects in the virtual reality environment. Learning by doing which is provided by VR systems is based on constructivist learning theory. Bronack, Sanders, Cheney, Riedl, Tashner, and Matzen (2008) argue that in such a learning theory, the feeling of presence and community of practice enhance collaboration for reflective learning. Learning occurs as a result of the mind's structuring process, thus, individuals construct the

items that they learn by establishing relations with the previously learned ones in their minds (Önen, Altundağ, & Musafaoğlu, 2017).

In short, VR technology provides a high degree of interaction for the students. Bricken (1991) summarises it as the learners talk, reach out their hands to move an object or to pick it up, hear what is going on around them and look around.

Immersive VR system appeals to the senses of touch, sight, and hearing. Even if the touching experience is not as real as real-life, it is still possible to activate it in an immersive VR system. Vince (1995) argues that tactile gloves, which provide touching sensation, are helpful in this respect. VR technology also allows students to visualize abstract concepts in school subjects, to observe events at atomic or planetary scales. The users are fully immersed in a 3D visual environment where they can see the virtual environment in 360 degrees. Back and forth as well as up and down head movements allow the users to see what is going on in their virtual environment. Immersive VR, thus, strongly appeals to vision. Alongside vision, it also appeals to the users' sense of hearing. Vince (1995) mentions such examples as scraping noises, collision noises, thunder, and water being poured.

Virtual reality also has a fun factor. It provides students with interesting and entertaining learning environments, which increases students' motivation. Thus, VR provides students with a stress-free environment by making boring language classes more enjoyable. Harris and Reid (2005) investigate the degree of motivation children show during virtual reality play sessions and indicate that VR play is a motivating activity. Cho et al. (2002) investigated the virtual reality (VR) for attention enhancement in a cognitive training program and found that immersive VR with cognitive training gave positive results for attention enhancement.

Dalgarno and Lee (2010) investigated the learning benefits of three-dimensional virtual learning environments and state that VR is rather beneficial since it provides opportunities for experiential learning, collaborative and contextualized learning.

The most important benefit of VR technology for language teaching is perhaps immersion. VR directly immerses students into the environments of topics and provides students with a rich 3D interactive environment in language learning. Thus, virtual reality provides the learners with a first-person experience by enabling them to be present virtually in the events and environments related to the topics that they will read and write in learning English.

Stuart and Thomas (1991) list seven roles for VR in education,

1. Explore existing places and things that students would not otherwise have access to.
2. Explore real things that, without alterations of scale in size and time, could not otherwise be effectively examined.
3. Create places and things with altered qualities.
4. Interact with people who are in remote locations through global clubs with a common interest or collaborations on projects between students from different parts of the world.
5. Interact with real people in non-realistic ways.
6. Create and manipulate abstract conceptual representatives, like data structures and mathematical functions.
7. Interact with virtual beings, such as representations of historical figures and agents who are representatives of different philosophies and viewpoints participating in simulated negotiations (in Pantelidis, 1993, p.25).

The aim of this study is to investigate the effect of virtual reality enhanced learning environment on the 7th-grade students' academic achievements on reading and writing in English. Samsung Gear VR was used as a virtual reality system. As a software, a special application about planets was developed for this research. Nine planets were simulated in the application with reading passages below them. The application was designed to be interactive in such a way that the students could click on the planet they

would choose to explore and read the information about the planet. Besides, the application allowed the students to feel themselves in a spacecraft and also to zoom in and zoom out the planet they would like to explore.

METHODOLOGY

Research Problem

What is the effect of virtual reality (VR) enhanced learning environment on the 7th-grade students' academic achievements in reading and writing in English?

Sub-Problems

The sub-problems of the research were determined as follow:

Is there a statistically significant difference between the pre-test academic achievement scores of the control and experimental group students?

Is there a statistically significant difference between the pre-test and post-test academic achievement scores of the control group students?

Is there a statistically significant difference between the pre-test and post-test academic achievement scores of the experimental group students?

Is there a statistically significant difference between the post-test academic achievement scores of the control and experimental group students?

Participants

This study consists of 15 students in the experimental group and 15 students in the control group from the seventh grade of a public secondary school in İzmir, Turkey. Both groups were selected randomly among the students in the same class where the same teacher taught the class. In the process of advanced analysis made during the process, it was decided to extract the data of 4 of the control group students. Therefore, the control group, which did not include the data of 4 students, was accepted as 11 students. These 4 students dropped out of the course. All of the students were at an average age of 12. In each group, half of the students were males and the other females.

Data Analysis and Data Collection Tool

The statistical analyses were carried out using the SPSS software program. Frequency analysis, normality analysis, homogeneity analysis between groups, paired sample t-test, and Ancova tests were used for data analysis.

To investigate the effect of a virtual reality enhanced learning environment on the 7th-grade students' reading and writing skills in English, an achievement test was developed by the researchers. The achievement test has been prepared by making use of previous researches and postgraduate studies in the field. Validity and reliability tests were done and found as acceptable tools for data collection.

Research Design

In this study, a quasi-experimental design was used. With this model, the data that are desired to be examined in order to reveal cause-effect relationships between variables are produced in the collection of quantitative data (Büyüköztürk, 2001; Karasar, 2004). This study includes one experimental group and one control group, and the pre-test / post-test model with a control group was used. In this model, the effect of the experimental process is tested with a study applied to a single group. The dependent

variables of the students participating in the study are obtained with the same measurement tools before the application with the help of pre-test and after the application with the post-test. In this process, pre-test and post-tests' participants do not change. Besides, the significance level of the difference between pre-test and post-test values (D1 - D2) belonging only the experimental or control group is also tested (Büyüköztürk et al., 2008). Accordingly, the experimental design of the research on academic achievement is given in Table 1.

Table 1
The experimental design of the research on academic achievement

Groups	Pre-test	Process	Post-test
Experimental group	D_1	X	D_2
Control Group	D_1		D_2

In the table, D1, pre-measurement (pre-test) taken from the groups; X, experimental process; D2 shows the last measurement (post-test) taken from the groups.

The control group implementation

In the control group, the students carried out the activities in the English language curriculum. The activities in this group included gap-filling exercises in official textbooks, smart board exercise, listening to the teacher and answering the questions.

The experimental group implementation

In addition to the explanations defined at the control group, students in this group used immersive VR headsets and software to follow the English course curriculum. These activities included introducing a virtual reality environment with VR headsets and components. For three weeks, the students watched the planets and read the short reading passages about the planets in the immersive VR environment. In the VR activity developed by the researchers, students find themselves in a spacecraft when they wear the VR glasses. Students have a remote control that works with VR glasses. With this remote control, students interact with the objects they see on the VR screen. Students have the chance to go to different planets in space. Two planets are targeted each week and students are asked to read the short reading passages of these planets as they travel the planets in a 3D environment. The students were asked to fill in the worksheets they were given after obtaining information about the planets in the VR environment. Due to health and safety reasons, each student's stay in the VR environment is planned to be 15 minutes at most in this study. All activities have been successfully completed during 3 weeks. The following screen images are examples from VR environments developed by the researchers.

Screen Image 1 and 2. Screen images of Virtual Reality Environments.

FINDINGS

Firstly, descriptive analysis results of the pre-test and post-test achievement scores of the experimental and control group students are given in Table 2.

Table 2
Experimental and Control Group Descriptive Analysis Results

		Pre-Test				Post-Test			
Group	N	X	Sd	Skewness	Kurtiosis	X	Sd	Skewness	Kurtiosis
Experimental group	15	43.40	19.34	-0.05	0.77	67.07	21.74	-0.19	-0.32
Control group	11	27.91	10.95	0.53	0.40	29.27	13.12	-0.71	0.65

Table 2 shows the achievement scores of the experimental and control group students, it is seen that the pre-test scores are for the control group (X = 27.91; Sd = 10.95) and for the experimental group (X = 43.40; Sd = 19.34). It is seen that there is a difference between the experimental (X = 67.07; Sd = 21.74) and control (X = 29.27; Sd = 13.12) groups in the post-test achievement scores of the students. The values of kurtosis and skewness between -1.5 and +1.5 indicate that the data are normally distributed.

Findings for the First Sub-Problem

In the first sub-problem of the study, it was investigated whether there was a statistically significant difference between the pre-test academic achievement scores of the experimental and control group students. Firstly, "Shapiro-Wilk" and "Kolmogorov-Smirnov" analyses were performed on the data in order to investigate whether the data show the normal distribution. The data obtained are presented in Table 3.

Table 3
Normality analysis results for pre-test control and experimental groups

		Kolmogorov-Smirnov			Shapiro-Wilk		
		Statistic	df	p	Statistic	df	p
Pre-Test	Control	0.13	11	0.20	0.97	11	0.92
	Experimental	0.16	15	0.20	0.94	15	0.32

As seen in Table 3, the p-value was greater than 0.05 in both normality tests. In this case, it can be said that the data are distributed normally. After the normal distribution of the data, the homogeneity of the variance between the groups was examined. According to the analysis results presented in Table 4, it can be said that the variances of the groups were homogeneous (p>0,05).

Table 4
Test of homogeneity of variances (Levene's test)

	Levene's test	
	f	p
Pre-Test	3.01	0.10

The t-test analysis results for the independent groups regarding the pre-test achievement scores of the experimental and control group students are given in Table 5.

Table 5
Results of t-test Analysis of Experimental and Control Group Pre-Test Achievement Scores

		N	X	Sd	t	p
Pre-Test	Experimental Group	15	43.40	19.34	-2.38	0.03
	Control Group	11	27.91	10.95		

When Table 5 was examined, a statistically significant difference was found between the pre-test achievement scores of experimental (X=43.40; Sd=19.34) and control (X=27.91; Sd=10.95) group students (t= .-2.38; p<0.05).

Findings for the Second Sub-Problem

In the second sub-problem of the study, it was investigated whether there was a statistically significant difference between the pre-test and post-test academic achievement scores of the control group students. For this purpose, the t-test was performed for the dependent groups regarding the pre-test and post-test achievement scores of the control group students. First of all, the assumption of normality which was necessary to carry out this test was tested. Firstly, "Shapiro-Wilk" and "Kolmogorov-Smirnov" analyses were performed on the data in order to investigate whether the data show the normal distribution. The data obtained are presented in Table 6.

Table 6
Normality analysis results for the control group pre-test post-test scores

	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	df	p	Statistic	df	p
Pre-Test	0.13	11	0.20	0.97	11	0.92
Post-Test	0.17	11	0.20	0.95	11	0.70

As seen in Table 6, the p-value was greater than 0.05 in both normality tests. In this case, it can be said that the data are distributed normally. Table 7 shows the t-test results for the dependent groups.

Table 7

Pre-test and post-test scores of the control group students' t-test analysis results for dependent groups

		N	X	Sd	t	p
Control Group	Pre-Test	11	27.91	10.95	-0.37	0.723
	Post-Test	11	29.27	13.12		

As shown in Table 7, there was no significant difference between the pre-test and post-test achievement scores of the control group students (t=-0.37; p>0.05).

Findings for the Third Sub-Problem

In the third sub-problem of the study, it was investigated whether there was a statistically significant difference between the pre-test and post-test academic achievement scores of the experimental group students. For this purpose, the t-test was performed for the dependent groups regarding the pre-test and post-test achievement scores of the control group students. However, first of all, the assumption of normality, which is necessary for performing this test, was tested.

Firstly, "Shapiro-Wilk" and "Kolmogorov-Smirnov" analyses were performed on the data to determine whether the data show the normal distribution. The data obtained are presented in Table 8.

Table 8
Normality analysis results for experimental group pre-test post-test scores

	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	df	p	Statistic	df	p
Pre-Test	0.16	15	0.20	0.94	15	0.32
Post-test	0.19	15	0.16	0.89	15	0.06

As a result of both normality tests, p>0,05 was found. This indicates that the data are normally distributed. After the normal distribution of the data, a t-test was performed for dependent groups in order to find a response to the sub-problem and the results are given in Table 9.

Table 9
Results of t-test analysis for dependent groups regarding pre-test and post-test scores of experimental group students

		N	X	Sd	t	p	Cohen's d
Experimental Group	Pre-Test	15	43.40	19.34	-3.08	0.01	0.79
	Post-Test	15	67.07	21.74			

As seen in Table 9, there is a statistically significant difference between the pre-test (X=43.40; Sd=19.34) and post-test (X=67.07; Sd=21.74) points of the students in the experimental group (t: -3.08; p<0.05). Accordingly, the post-test scores of the experimental group students were significantly higher than the pre-test scores. In other words, after the experimental procedure, student achievement increased. Learning activities using virtual reality environments had a positive effect on students' learning. Cohen d value was calculated to determine the magnitude of this effect. It is seen that the calculated effect size (d=0.79) is large.

Findings for the Fourth Sub-Problem

In the last sub-problem of the study, it was examined whether there was a statistically significant difference between the post-test academic achievement scores of the control and experimental group students.

Since there was a significant difference between the pre-tests of the control and experimental groups, in other words, since the control and experimental groups were not identical, the Ancova test was used to find a response to this sub-problem. In the Ancova test, the pre-test scores were used as a covariate. The results of analysis to determine whether the data show normal distribution before the Ancova analysis are presented in Table 10.

Table 10
Normality analysis results for post-test control and experimental groups

		Kolmogorov-Smirnov			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Post-Test	Control	0.17	11	0.20	0.95	11	0.69
	Experimental	0.19	15	0.16	0.89	15	0.06

When the results of the normality analysis were examined, it was found that the data were distributed normally ($p>0.05$). In the next step, homogeneity of variance between groups was tested and the results are presented in Table 11.

Table 11
Test of homogeneity of variances (Levene's test)

	Levene's test	
	f	p
Post-Test	2.99	0.10

As shown in Table 11, it was observed that the variances between the groups were homogeneous. The results of the Ancova test to find a response to the sub-problem are presented in Table 12.

Table 12
Ancova Test Analysis Results of Experimental and Control Group Post-test Success Scores

		N	X	Sd	F	P	Eta square
Post-Test	Experimental Group	15	67.07	21.74	19.18	0.000	0.46
	Control Group	11	29.27	13.12			

As is seen in Table 12, there is a significant difference between the post-test scores of the experimental and control groups by taking into consideration the statistically significant difference in the pre-test scores of the experimental and control groups ($p<0.05$). This difference was realized in favour of the experimental group. In other words, the success of the students in the experimental group was higher than that of the control group. This can be interpreted as the activities designed on virtual reality have a positive effect on student achievement.

DISCUSSION

The aim of this study is to investigate the effect of virtual reality enhanced learning environment on the 7th-grade students' academic achievements on reading and writing in English. Within the scope of the experimental application of the research, the "planets" unit topic was selected from the 7th-grade syllabus of the 2018 Turkish ELT curriculum for primary and secondary schools and a VR application about planets was developed for the research.

After the analysis of the data obtained in the study, a statistically significant difference was found between the pre-tests of the control and experimental groups (p=.03, t=-2.38). From this perspective, it can be said that the control and experimental groups are about equivalent groups at the beginning. There was no statistically significant difference between the pre-test and post-test of the control group (p=.723, t=-0.37). There is a significant difference between the pre-test and post-tests of the experimental group (p=.01 t=-3.08). Similarly, using the Ancova test, a statistically significant difference was found between the post-tests of the experimental and control groups (p=.00, Eta Square=0.46, F=19.18). From this perspective, it can be concluded that the experimental process has a positive effect on students' academic achievement.

It is obvious that problems in English language education are known in all countries where English is taught as a foreign language. Especially in Turkey, it is problematic for almost all primary and secondary students to learn English (Acar, 2019). Accordingly, it is a fact that radical changes need to be made in order to improve the standards of English teaching. In the study carried out by Orakçı (2019), he stated that different teaching methods should be handled in English teaching and that students should improve their English experience by comparing it with their life situations.

Findings obtained from this study revealed that VR-Based English teaching had positive effects on the students' academic achievement. The results showed that the students' cognitive skills improved especially at high levels. In the virtual reality environment, students were responsible for their own English learning. The English texts that appear on the VR screens especially during their visits to the planets in an environment close to the real images contributed to the students' improvement of reading and writing skills.

The positive results obtained from this study can be considered as an example of using English for different grade levels or even for different courses. Since this study is a research supported by quantitative data, English education can be developed through new data by using qualitative research methods in future research. The Ministry of National Education can enrich the English curriculum through VR-based activities and put activities in digital textbooks in this context.

CONCLUSION

Research on the use of immersive VR systems in English language teaching is very rare and no research was found in the literature investigating the effect of immersive VR on English students' academic achievements on reading and writing in English. A literature review has been conducted by Freina and Ott (2015) about the use of immersive VR and HMD in education, and in their literature review, no research study was found about the use of immersive VR with HDM in English teaching. They argue that "the most common subject is Computer Science, and a significant number of papers referring to the medical subjects has been found" (p.4). Most of the VR studies in English teaching focus on non-immersive VR (desktop VR) employing graphics workstation using a monitor, a keyboard, and a mouse (e.g. Chung, 2012; Kristi, 2009). One study which uses immersive VR in language teaching is presented by Cheng, Yang and Andersen (2017), which employs an immersive virtual reality technology (Oculus Rift) to teach embodied cultural interaction, such as bowing in Japanese greetings.

This study, which aims to fill in this gap by investigating the effect of virtual reality enhanced learning environment on the 7th-grade students' academic achievements on reading and writing in English, reveals that immersive VR outperforms all other classical materials, especially textbooks, by providing

students with sensory information in three dimensions. It also points out that immersive VR involves students as first-person in their classroom activities, creating positive changes in their reading and writing skills. In this respect, it is recommended that English learning environments, which aim to improve students' reading and writing skills, include immersive VR systems. Since the study does not focus on the effect of virtual reality enhanced learning environment on the ELT students' academic achievements on listening and speaking in English, it is suggested that further studies should focus on these aspects of the application of immersive VR systems on English language teaching. Further research on these aspects of the use of VR in English teaching may confront the problem of the development of interactive listening and speaking applications in the use of VR in English teaching since such interactive applications where the students can listen to and speak with the virtual interlocutors are not common.

It is hoped that this study will shed light on the effect of virtual reality enhanced learning environment on the English language students' academic achievements on reading and writing in English and on the realization of further research on other aspects of English language learning.

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