

The Effect Of The Computer Game Developed For The 7th Grade Science Lesson, On Student's Self-Efficacy Toward Science

Serkan Say

*Faculty of Education, Pamukkale University, Denizli, Turkey.
serkansay13@hotmail.com*

Hüseyin Bağ

*Faculty of Education, Pamukkale University, Denizli, Turkey.
huseyinbag@gmail.com*

ABSTRACT

Human being starts learning about life via games. Therefore games have always maintained their importance and have always been interesting since the beginning of the human life. Games are being moved from streets to virtual platforms today as information Technologies are considerably progressing. And because of that, computer games are one of the entertainments for people today, especially for the children of school age. Analysing the literature, we find the computer games to have many positive effects on children's performance at school.

In this research, the effect of the computer game developed for the 7th grade science lesson, on student's self-efficacy toward science is studied. Quasi-experimental design is used as the quantitative research method. The study group consists of 444 7th grade students in total attending to 7 different schools chosen from 7 different regions in Turkey. In this context, while there has not been any interference to the students attending to one of the 7th grade classrooms chosen from each school, the other students are provided with the computer game which is developed in the context of the application as an additional exercise. Seven experimental groups and seven control groups were chosen from each region in total one of which is the control group and the other is experimental group. "Science Self- Efficacy Scale" was drawn on as the data collection tool. The scale was applied two times in total, the first of which was before the application and the second after the application.

As the result of the study, the developed computer game is determined to be an effective material in increasing the students' self-efficacy toward Science. In addition, It is concluded that there are regional differences regarding the students' self efficacy.

Keywords: Computer Game, Science Education, Self-Efficacy

INTRODUCTION

Human beings start learning about life via games. For this reason, games have always been interesting and maintained their importance throughout the history. In addition to being entertaining, games, at the same time, allow the player to learn new things (Gungormus, 2007)

Accomplishing productive results in education is closely related to the teaching's being planned and carried out in a way to get the maximum performance from the students. J. Locke lays emphasis on making use of the games for a more productive lesson teaching. And Fenelon states that promoting the teaching with games spirits away the boring, monotonic and theoretical form of teaching while making it become an entertaining and amusing process (Ergun, 1980). Furthermore, taking the games with the purpose of teaching makes it possible to have a productive lesson and gives the students the opportunity to engage actively and construct the knowledge by themselves in the teaching process (Hagbood, Ainsworth and Benford; 2005).

In today's world where the information technologies have considerably developed, games have been moved from streets to virtual platform and have become one of the entertainments of people, especially of the children of school-age. And the reason of this lies behind the real-like virtual platforms with audio, image and the ascribed roles for the players (Brand, Knight and Majeovski; 2003). The computer games' becoming considerably popular among people has increasingly led to the development of computer games sector. The effect of computer games and its popularity have extremely increased with the applications enabling tens of thousands of people simultaneously to play games at the same virtual platform (Tuzun et. al, 2009)

Since 1970's when the first computers games were designed, the developments in computer sector have yielded the development of the game sector correspondingly. Since 2000's multi – user (online) computer games have become highly popular. Sharing the same game's enthusiasm at the same virtual platform with the users from the different parts of the world has drawn the attention of computer users (Emekli, 2002; Akkemik, 2007). In a reasearch he has done, Yagız (2007) stated that the computer games took up the most of the time of today's

children with the development of technology. In his same research again, he expressed that while in 1980's children spent 4 hours in average at home or in an arcade, today, as the children of school – age, girls spend 5,5 hours and boys 13 hours in average and that this time was increasing day by day (Yagiz, 2007). As a consequence of that, the time students saved for their education has decreased and they do not have enough time for their homework. Students' acting this way causes a decline in their achievements at school and their declining achievements and interests in the lessons distresses their parents.

That unfavourable situation and the computer games' being a considerable part of students' life day by day were noticed by the teachers as well, and they came up with the idea of integrating the highly welcomed computer games with the teaching. And thanks to that idea, the computer games, today, are being used for various purposes in almost all fields, from social to historical, health to military. This way, it is thought that the deficiencies of the traditional learning environment can be perfected by educational computer games, making it become more entertaining and interesting but boring (Dogusoy and Unal, 2006).

Garris, Ahlers and Driskell explain how to use computer games in teaching as follows:

- Today, we move from traditional teaching method of presentation to student-centered teaching method where the learner is more active. Consequently, the students must be provided with a learning environment where they can learn by experience, not only by listening to the lessons.
- Some of the experimental studies in literature indicated that the computer games could be used as an effective tool when teaching the complicated subjects.
- According to the educators, this voluntary active engagement could be drawn on as a motivation tool to accomplish educational goals considering the great number of students playing computer games and the interest people have in playing games (Garris et al., 2002, p.441-442).

And Papestrerghiou (2009) attributes the computer games' being effective learning environments to those;

- Games make learning become a multi-sensory, active, experimental and problem-focused one.
- And the obligation of the students to use the prior knowledge to proceed in the game supports the effective memorability of the rudiments.
- Games ensure that the learning is organised, and offer instantenous feedbacks that help learning.
- The scores and the different levels in games offer self-assessments for students.
- Games are increasingly becoming social environments with the community of players they involve.

When the body of literature is analyzed, the computer games were found to have many positive effects on children's performance. The computer games which are played just for fun can make children obtain the information necessary for them during the game (Pillay, 2002; Prensky, 2001; Tuzun et al., 2009; Ural, 2009; Vos, var der Meijden and Denessen, 2011). Moreover the experts underline the fact that computer games can create a new type of learning culture and that it can meet the demands of the stuedents all the better. This way, it would be possible to turn the disadvantages resulting from the harmful effects of the computer games that parents and educators complain about into advantages (Gros, 2007). Considering the potential that the computer games have, today's experts recommend using the computer games in the classrooms on the intent of providing students a better learning environment and promoting their learning capacities (Prensky, 2001; Gros, 2007; Papestrerghiou, 2009).

Prensky (2001), attributed the computer games' being that interesting to those 12 reasons;

A computer game;

1. is in the form of entertainment and gives us pleasure.
2. is a format of playing and enables interest and attendance.
3. has rules and that ensures we make a plan.
4. 's targets motivate us.
5. requires us to do something because it is interactive.
6. is in a flow and can be adapted.
7. provides an opportunity to learn by the outputs and feedbacks.
8. achievements facilitates the ego satisfaction.
9. brings us adrenalin because it has conflict, difficulty, competition and contrast.
10. developes creativity because it requires problem solving.
11. makes it possible to establish social groups because it is interactive.
12. brings us emotions because it has demonstraton and story.

The 6 of those (rules, targets, outputs and feedabcks, conflict/difficulty/competition/contrast, interaction and story) are named as the items that make it a game (Prensky, 2001).

Science teaching must bring in required customs and understandings to make students think about their own purposes and have responsibilities and challenge with problems in the future. In addition science teaching must contribute students to grow up as citizens constituting open society which, among the developed World countries, has an important place (Koseoglu, et al., 2003). The skills the students gain by the science teaching are aimed to be used throughout their life. The level the students could reach the determined goals is affected by many factors. The features of the learning environment, the characteristics of the teacher and the students affect the students achievements. The students' confidence in science affects their performance and engagements in activities. And one of the qualities affecting the performance in science lesson is the students' self – sufficiency.

Bandura (1986) defined the confidence as “the judgements people make about their organizing the actions and performing their skills that could help them accomplish a certain performance”(As cited in Kotaman, 2008). According to this definition, the self – sufficiency is one's belief in doing any skill or performing any behaviour. The idea that emerges in mind before doing an activity causes a positive or a negative attitude towards the activity that is to be done in accordance with one's prior knowledge. Bandura's theory states that the human behaviour is directed by a type of self – control mechanism that derives its source from one's beliefs regarding himself and his environment, and brings a perspective that makes an individual both a producer and a product in their environment and social system (Senemoglu, 2004). According to the social learning theory there is an ego system in individuals enabling them to control their emotions, thoughts, motivations and actions. This system provides an individual a self – regulatory mechanism to understand, regulate and assess his/her behaviour. The results of the individual's actions, levels of achievements and the judgements regarding the environment have a determinant effect on his/her subsequent behaviours (Henson, 2001 – As cited in Ozerkan, 2007).

The sense of self-sufficiency is the basic determinant of the individual's motivation for an activity. The self-sufficiency is one's judgement on his abilities during a period of accomplishing a specific goal (Aydiner, 2011). These judgements are significant especially when they have negative aspects. When this is the case, the people who have a sense of high self-sufficiency will probably achieve their goal by working with will and patience and with confidence on a certain target. On the other hand, people who doubt they have enough capacity or skill are quite likely to fail. In Social Learning Theory, the sense of self-sufficiency is also addressed when explaining the concepts of teaching and learning and human behaviour. The self-sufficiency of an individual can clearly be observed from his/her behaviour. Because a person with a high sense of self-sufficiency does something with an intrinsic motivation without a need of extrinsic motivation (Erden, 2007).

It is analyzed from the literature that the computer games are not employed sufficiently (Prensky, 2001; Squire, 2005; Kiili, 2005; Gungormus 2007) and new methods are needed to increase students' self – sufficiency in Science. Therefore, a computer game for the 7th grade is designed to be employed in science lesson and its effect on students' self-sufficiency towards science is examined in this study. In this context, it is thought that this study could meet the shortages determined in literature and could also reveal the effect of using computer games on learning.

METHOD

We drew on quasi – experimental method in this study. This method involves an experimental and a control group but the groups are not assigned randomly. If there is not a meaningful difference in groups' pre-test results, then we can talk about the equality of the groups. The changing scores of both groups from pre-test to post-test are compared and analyzed to see if there is a meaningful difference between the groups (Christensen, 2004).

According to Sonmez (2005), the population and sample must not be an option in experimental researches. Therefore the population generalizability is ignored, and then the study group is determined accordingly. The study group involves 7th graders from seven different schools chosen from each region of Turkey. In this content, while there is no interference to the teaching process in one of the two classes in each school, the other is promoted by the new designed computer game as an additional material. This application proceeded during 2014 – 2015 academic year.

Within the context of the study, the current teaching process was not intervened. The control group's and the experimental group's lessons in each school, are conducted by the same teacher. The computer game designed in parallel with the teaching process was additionally played by the experimental group students. The game is played by three players on-line. 3 players are randomly matched up in login. The game takes place in a laboratory. The main goal of the game is to hunt down the stuffs in the lab. The stuff choice questions come first in the interface of the lab and those consist of multiple-choice questions. The game involves 6 circuits in total. One of the multiple choice questions in active categories in each circuit is chosen by the system randomly and

shown to the players simultaneously. The question is to be answered in a limited time. When all the players answer the questions or the time is up, the “interface of the answer” is shown to the players. Here, the question, options, the right answer, players’ answers and the time of answering the question is displayed. The ones who give the right answer will be able to choose a stuff, from the fastest to give the answer to the last, respectively. The ones that cannot give the right answer will not be able to make a choice, but will be the watchers. They can only see that the player(s) made their choice. Each circuit is completed this way. When the circuits are all completed but there is still a stuff that is not chosen, then comes another step “additional stuff choice” and that will be conducted by the two most successful students. The success rating is determined with the players scores. The actual game starts in this phase. The players make moves one by one to take possession of another’s stuff. 3 questions are asked to the two players, one of whom is the attacker and the other is the owner of the stuff. Here, there may be multiple – choice questions or answers to be guessed by the players. Each question directed in this pace is answered in a limited time. When the questions are answered or the time is up the interface of the answers is displayed to all the players. After answering each question in this way, if the winner (the one to get more points than the other) is the attacker, he/she gets hold of the opponent’s stuff. If the winner is the one who is attacked, his/her stuff stays with him/her and another player takes turn. The game is over when one of the three players captures all the stuffs. The sample scenes from the game are shown in figure 1.

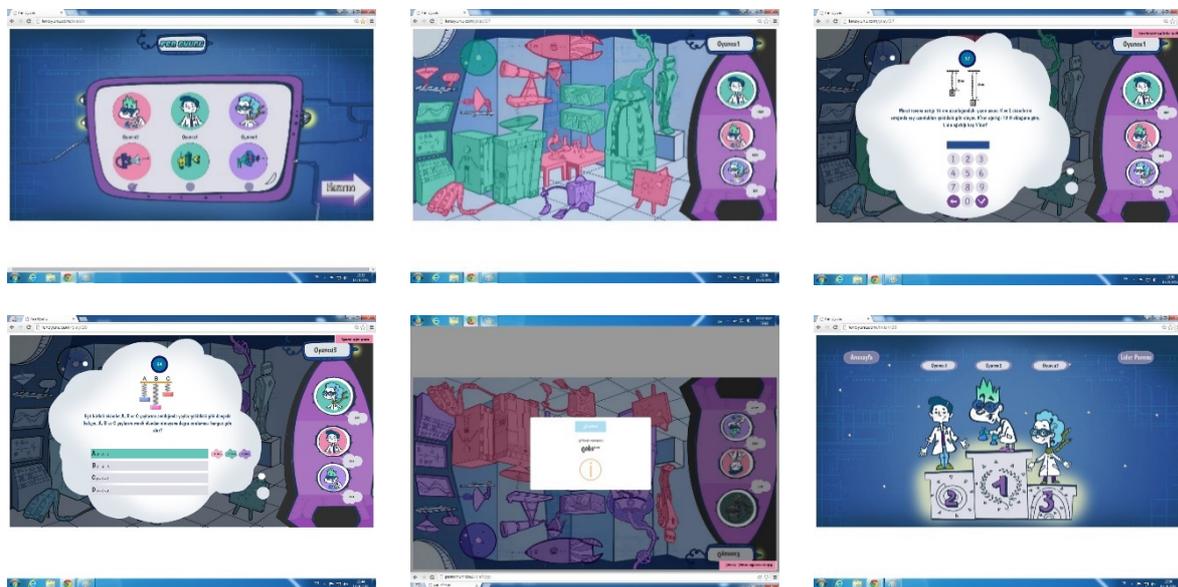


Figure 1. Sample scenes from the science game.

Science lesson self-sufficiency scale developed by Tatar et al. (2009) is used in this study to determine the students’ levels of self-sufficiency in Science and the changes in these levels. The scale is applied to the students two times in total, at the beginning of the first term as a pre-test and at the end of the second term as a post-test. 36 questions in total are prepared in five point likert form in the process of developing the scale. And these questions are asked to 400 students of the 6th, 7th and the 8th grades in 10 primary schools. The scale is dropped to 27 questions as a result of analyzing the data obtained from this investigation and the coefficient of the Croanbach alpha is determined as .93.

FINDINGS

The self-sufficiency scale is applied to all of the groups as a pre-test before and as a post-test after the application and it is checked with the independent t-test if there is a statistically meaningful difference between the groups pre-test and post-test results. The result of the application is demonstrated below;

Table 1: The statistical pre-test and post-test results between the control and the experimental groups of each region

Regions	Application	Group	N	\bar{X}	ss	Sd	t	p
Marmara	Ön Test	Experimental	30	89,87	6,48	58	,391	,698*
		Control	30	90,50	6,07			
	Son Test	Experimental	30	115,07	6,77	58	12,076	,000**
		Control	30	92,47	7,70			
Aegean	Ön Test	Experimental	30	87,83	8,56	59	,487	,628*
		Control	31	86,81	7,90			
	Son Test	Experimental	30	114,80	4,66	59	19,910	,000**
		Control	31	86,32	6,35			
Mediterranean	Ön Test	Experimental	33	84,39	10,81	65	,648	,519*
		Control	34	85,91	8,21			
	Son Test	Experimental	33	113,97	7,48	65	15,750	,000**
		Control	34	84,88	7,63			
Central Anatolia	Ön Test	Experimental	31	86,74	8,54	61	,142	,888*
		Control	32	86,44	8,48			
	Son Test	Experimental	31	116,03	5,42	61	17,935	,000**
		Control	32	85,59	7,80			
Black Sea	Ön Test	Experimental	30	87,13	7,21	59	,476	,636*
		Control	31	88,03	7,52			
	Son Test	Experimental	30	117,40	4,81	59	24,252	,000**
		Control	31	85,84	5,32			
Eastern Anatolia	Ön Test	Experimental	32	75,03	7,57	60	,052	,959*
		Control	30	74,93	7,21			
	Son Test	Experimental	32	103,50	6,39	60	14,593	,000**
		Control	30	76,63	8,06			
Southeastern Anatolia	Ön Test	Experimental	34	71,82	6,62	68	,960	,341*
		Control	36	73,19	5,30			
	Son Test	Experimental	34	105,12	5,59	68	22,737	,000**
		Control	36	75,03	5,49			

*p>.05; **p<.01

When the analysis results are examined, the experimental and the control groups' - chosen from seven regions - pre-test scores of the self-sufficiency scale regarding Science are found to have no meaningful difference. $t_{\text{Marmara}}(58) = 0,391$, $t_{\text{Aegean}}(59) = 0,487$, $t_{\text{Mediterranean}}(65) = 0,648$, $t_{\text{Central Anatolia}}(61) = 0,142$, $t_{\text{Black Sea}}(59) = 0,476$, $t_{\text{Eastern Anatolia}}(60) = 0,052$, $t_{\text{Southeastern Anatolia}}(68) = 0,960$, $p > ,05$). When we examine the average scores of pre-tests on the basis of regions, it can clearly be seen that the average scores of the experimental and control groups students in each region are close to each other. That is, we can say that the the levels of the control and the experimental groups' students' self – sufficiency in Science before the application is quite close to each other.

And, when we examine the post-test results after the application, we can talk about a meaningful difference between the experimental and the control groups' students' average scores of self- sufficiency scale regarding Science. ($t_{\text{Marmara}}(58) = 12,076$, $t_{\text{Aegean}}(59) = 19,910$, $t_{\text{Mediterranean}}(65) = 15,750$, $t_{\text{Central Anatolia}}(61) = 17,935$, $t_{\text{Blacksea}}(59) = 24,252$, $t_{\text{Eastern Anatolia}}(60) = 14,593$, $t_{\text{Southeastern Anatolia}}(68) = 22,737$, $p < ,05$). Once again, we see a considerable difference between the experimental and the control group students when we examine the post-test results on the basis of the regions. The experimental groups' students' scores are determined to be higher in comparison to the other groups. In this context, we come to the conclusion that a computer game designed for Science lesson increased the students' levels of self-sufficiency.

DISCUSSION

The recent researches have shown that the primary and the secondary school students have increased the time they spare for the computer games and that the computer games take place on the top among the purposes of using computers (Christakis et al., 2004; Inal and Cagiltay, 2005; Chen et al., 2010). The disadvantageous conditions of the students who are interested in computer games and spend too much time playing computer games can be turned into an advantage by the educational computer games. In this context, the effect of the computer game designed for the 7th grade Science lesson as an additional material for the current teaching

process on students' self-sufficiency was examined to see if there was a meaningful difference between the scores of the students who play the game and who do not.

The post-test results are based on to evaluate the students' self-sufficiency levels regarding Science. We see a meaningful difference between the post-tests of the control and the experimental groups in the same region. That difference can be interpreted in a way that the computer game designed for Science lesson and used as an additional material in experimental groups affects the students' self-sufficiency level in a positive way.

Offering an opportunity to learn by experience, computer games are tools that students can fool around with and carry on their activities individually. They also offer feedbacks directly and make evaluations of right and the wrong answers and make it possible for the students to see their mistakes immediately visually, audibly etc.

When we examine the literature, we find out that the researches in which the computer games have been applied in different ways have come to good results:

The study conducted by Avcı et al. (2009) has shown that the teachers and the students who attended the study liked the computer game promoted lessons very much and that it contributed a lot on students' learning. Tuzun et al.(2009) conducted a research to observe effectiveness of learning some concepts and contents of Math in a 3D multiple-player computer game setting, and came to a conclusion that the newly designed educational computer game could be used as an effective tool in learning the subject "function" and its varieties. They also stated that the significant factors in that effectiveness are the setting's including experimental and inquiry based activities, the high motivation of the students during the application, their having the opportunity to learn at their own speed and the atmosphere that encourages student cooperation.

Donmus (2002) and Kebritchi, Hirumi and Bai (2010) examined the effect of educational computer games on students' motivation in their research. As a result of their study, the computer games are found to have a positive effect on students' motivation, memorability of the subjects and promoting students' achievements. They additionally stated that the computer games must be popularized because they are regarded as tools enriching the teaching in Primary school level.

Many similar researches in literature have shown that the educational computer games have many positive effects on the teaching process of different disciplines. This study which is carried out on students' self-sufficiency towards science share similarity with other studies in the literature. The study fills a gap about the effect of educational computer games on students' self-sufficiency towards science in the literature and shows that along with the other favourable effects, the educational computer game has a positive influence on students' self-sufficiency toward science. Considering the potential of them, computer games are recommended in teaching process to increase the learning capacity of the students and to offer them a better learning environment.

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