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## The Evaluation of the Effect of a Newly Designed Computer Game on 7th Grade Students' Motivation Towards Science and Aggression

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### ABSTRACT

In this study, it is aimed to design a computer game for the 7th grade Science lesson and evaluate the effect of the computer game on students' motivation and aggression. The quasi-experimental method has been selected as a quantitative method of research. The study group of the research is comprised of 444 7th grade students in total studying in 7 different schools chosen from each region of Turkey. In this context, while there is no interference in one of the two 7th grade classrooms from each school, the other is sustained with a computer game as an additional material to the teaching process. The application proceeded through 2014-2015 academic year. Motivation towards Science and aggression scale have been applied to all groups three times; at the beginning of the first term, at the beginning of the second term and at the end of the second term. As a result of the research, the computer game is found to generate a meaningful difference on behalf of the experimental group and to have no effect on aggression. Computer games meet the deficiencies of a conventional educational system by promoting learning via games and creating an engaging atmosphere helping students increase their motivation.

**Keywords:** aggression, motivation, science education, computer game

### INTRODUCTION

Games have always maintained its importance among the scientists as an issue of concern to understand what they actually are, why they are that important and why people keep playing them, and that has led to a number of researches (Smith and Welliver, 1990). And, Piaget and Vygotsky are the leading scientist to have studied on games.

Piaget argued that there is a strong relation between the mind and the game and he based his theory of game on the cognitive enhancement. To him, an individual's learning depends on the process of assimilation and accomodation. That is, an individual locates the new input in his cognitive schema. Namely, he makes the new experiences clear by his own schemata. And this is called the assimilation. ccomodation, on the other hand, signifies someone's developing a new scehma or his changing the old one after experiencing a new phenomenon. When the existing schema is insufficient in explaining the new phenomenon, it is either changed or developed. And locating these information in one's schema is called the adaptation(Baykoc Donmez, 1992). Piaget believed that game is a phenomenon in which a child combines his experiences and knowledge and argued that there is a close relation between the games and the children's mental developement (Sevinc, 2003). "According to him, a game is an

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#### State of the literature

- Studies conducted on motivation and other elements affecting academic achievements have revealed that the increase in motivation affects students' achievements positively.
- Computer games, one of the leading materials that could affect learning positively, are thought to have adverse effects on students.
- From this point of view, educational computer games have been developed and are found to have favourable effects on students but, its influence on negative behaviour has been passed over.

#### Contribution of this paper to the literature

- While examining the students' motivation levels regarding Science, this study is unique in examining the effects of the computer games on students' aggressions.
- Addressing the significance of the interaction among students, the computer game has been developed accordingly to meet one of the essential requirements of education.
- This newly designed computer game is economic in adaptability to other fields and achievements by changing the questions and the graphics without changing its original software.

adaptation and it enables children to learn new subjects on their own that nobody else could teach them. (Yavuzer, 1984, s.199).

Vygotsky, on the other hand, based his theory of game on socio-cultural development. To him, a game is a new formation and involves discoveries. The player faces contradictions and conflicts that cannot be resolved at a time during the game and tries to find solutions to them. Vygotsky also supported the idea that the mental structures are formed via using tools and symbols and stated that games are significantly crucial for these symbols to be developed. According to him, social learning and language is vital in learning via games, for during the game children learn new things from the others who are better than them. Furthermore, he regarded games as tools to make inferences and to guide the learning (Sevinc, 2003). In computer games on the other hand individual learning gains importance rather than social learning.

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 favorite entertainments for people, especially for 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 Majevski; 2003). The computer games' becoming considerably popular among people has, increasingly, led to the development of the industry of the computer games. 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 the industry of computers have yielded the development of the industry of games correspondingly. And 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 research he has done, Yagız (2007) stated that the computer games take up the most of the time of today's children with the development of technology. In his same research again, he expressed that while children spent 4 hours on average playing computer games at home or in an arcade in 1980s, today, girls of the school-age spend 5,5 hours and boys of the same age 13 hours on average and added that the time they spare for computer games is increasing day by day (Yagız, 2007). As a consequence, the time students save for their education has decreased and accordingly 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 distress their parents (Özdemir, 2013).

"Sometimes, the games which are apparently perceived as mere fun but which actually include violence grow from a game in which two teenagers mutually play passionately into the one with a greed to kill or destroy

the other" (Healy, 1999, s.87). And as a result, children experience aggression. Cooper and Mackie (1986), indicated that there is a great amount of violence and aggression in most of the computer games. According to some researchers supporting the view of the social learning theory, people, especially children, learn the aggressive behaviours by modelling and imitation and consequently Tv's and video games bring about the problem of increasing aggressive behaviours around" (AKT, Bilgi, 2005). However, the games that do not include violence are found to have no effect on children's states of aggression (Bilgi, 2005; Ozdemir 2013).

Teachers as well have noticed this unfavourable situation and the computer games' being a considerable part of students' life day by day, 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 than a boring one (Dogusoy and Unal, 2006).

When the body of the literature is analyzed, the computer games have been 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, van 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 students 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; Papestrergiou, 2009).

Science can be defined as a pursuit of examining the nature and the natural phenomena systematically and to forecast unobserved events. In today's educational system, the main purpose must be to teach students how to reach the information rather than transmitting it directly to them. Students are expected to avoid from memorising, learn by comprehension, develop new point of views and consequently develop their skills in scientific process (Anagun and Yasar, 2009). Science is the leading subject that help students gain these high-level skills. Observing their environment thoroughly, correlating the cause and effect relationship among phenomena to get accurate results make their life easier. Therefore, students are guided to gain the habit of thinking objectively on the situations and events and to make correct decisions by examining their environment scientifically in Science lessons (Cepni, 2005).

Analyzing the Science Curriculum renovated in 2013, we have found that the learning domain is divided into four parts as knowledge, skill, perception and science-technology-society-environment. This way, Science curriculum has been designed to include not only the basic concepts and principles but also the skills, perceptions and correlations of Science, Technology, Society, Environment. ([MNE] Ministry of National Education, 2013). Affective skills which are identified to have little part in previous syllabuses are observed to be found more often in ones regulated after 2005. Because it is clearly understood that one cannot achieve the intended success unless he stops ignoring the affective features of the students (Seah and Bishop, 2000; Dede and Yaman, 2008; Yenice, Saydam and Telli, 2012). In many of the studies in this field, affective domain skills have also been claimed to have a positive effect on students' achievements (Alsop and Watts, 2000; Chen, 2001., Duit and Treagust, 2003; Cengiz, 2009; Yenice, Saydam and Telli, 2012).

Motivation, one of the affective domain skills in Science Curriculum of 2013, takes an important place in enhancing the students' achievements. Chen has taken the motivation as the most significant element affecting the learning and defined it as an essential prior condition in starting and accomplishing a task successfully (Chen, 2001). Lou et al., on the other hand, have defined the motivation as a key to a successful learning (Lou et al., 2010). Furthermore, other studies also demonstrate a meaningful relationship between the motivation and the learning. (Yilmaz, Cavas-Huyuguzel, 2007; Yenice, Saydam and Telli, 2012). For this reason, to maintain a meaningful and permanent learning in Science teaching, it is necessary to keep the students' motivation at a particular level.

Analyzing the literature, we have found out that the teachers do not necessarily make use of the computer games and the studies which are quite insufficient in number are observed to have focused only on individuals' academic achievements (Prensky, 2001; Squire, 2005; Kiili, 2005; Gungormus, 2007; Cosgun et al., 2012; Donmus, 2012). Moreover, the studies regarding the computer games use in Science lessons have also been found inadequate, and the studies that have been conducted in Turkey on the same subject have revealed that they are not genuine but rather the ones which are created abroad (Tuzun et al., 2006; Yigit, 2007; Sakhuseyinoglu, 2007; Bayirtepe and Tuzun, 2007; Bakar-Corez, Tuzun and Cagıtay, 2010). Also, there is not any study examining the effect of the computer games on students' aggression. In this context, this study is thought to fulfill the deficiencies determined in this field. In addition to this, a genuine computer game is to be created and its effect on students' motivation towards Science is also going to be proved. Besides, whether a computer game designed for educational purposes has an effect on students' aggression is going to be detected.

## METHOD

Quasi-experimental method is used in this study as a quantitative research model. Experimental method is the one which is easy in planning but difficult in implementing, and which also aims to find the cause and effect relations among variables (Cepni, 2005; Fraenkel, Wallen ve Hyun, 2012). One cannot determine the groups to be studied randomly in quasi-experimental method. Most of the educational researches are conducted in schools and it is quite difficult to choose samples randomly. Researchers mostly have to carry out their studies on the groups their methods allows them to. Therefore, they usually use the quasi-experimental method (Kaptan, 1998). The difference that distinguishes this method from the true experimental design is that the sample cannot be constituted by random assignment. In the study, while the experimental group is interfered the control group remains untouched. At the end of the study, one comes to a conclusion by comparing the data obtained from the groups (Christensen, 2004; Fraenkel, Wallen and Hyun, 2012; Christensen, Johnson and Turner, 2014/2015).

Choosing the schools with bias, determining the classrooms beforehand, teachers' deciding which classroom to conduct the study on, that is, being unable to form the experimental and the control groups randomly, comparing the groups which are deliberately interfered with the ones which are not can be specified as reasons why the quasi experimental method is preferred to be applied.

### The Study Group

The study group involves 7th graders from seven different schools chosen from each region of Turkey. To increase the validity and the reliability of the study a school is chosen from each region. But, every region is handled in itself with regard to the cultural and socio-economic differences. In choosing the schools to carry out the application it is considered that the schools must have computer labs and enough number of computers for students, the students who are to play computer games must know how to use computer and that they must have one in their house.

In this context, while there is no interference to the teaching process in one of the two classes in each school, the other is promoted by the newly designed computer game as an additional material. The teachers of the experimental and control groups have taught the lessons in accordance with their own plans, but the students in the experimental group have played the newly designed educational computer game twice a week after school for one hour additively.

This application proceeded during 2014 - 2015 academic year.

### Data Collection

Two basic data collection tools have been used in collecting the data one of which is the Motivation Scale Regarding Learning Science and the other is the Aggression Scale. These scales have been applied three times in total in 2014-2015 academic year, firstly at the beginning of the first semester, secondly at the beginning of the second semester and lastly at the end of the second semester.

**Table 1.** The Range of the Students in Study Group

Region	City	Group	N	Girl	Boy	Total
				N	N	
Marmara Region	Tekirdağ	Exp. Group	30	17	13	60
		Control Group	30	15	15	
Aegean Region	Afyon	Exp. Group	30	14	16	61
		Control Group	31	16	15	
Mediterranean Region	Rize	Exp. Group	33	16	17	67
		Control Group	34	17	17	
Central Anatolia Region	Kayseri	Exp. Group	31	15	16	63
		Control Group	32	15	17	
Blacksea Region	Mersin	Exp. Group	30	16	14	61
		Control Group	31	15	17	
Eastern Anatolia Region	Erzurum	Exp. Group	32	14	18	62
		Control Group	30	13	17	
South Eastern Anatolia Region	Mardin	Exp. Group	34	15	19	70
		Control Group	36	16	20	

### *The Motivation Scale Regarding Science*

A Motivation Scale regarding Science has been used in this study in order to measure the motivation level of the students and its change towards Science. The scale, developed by Tuan, Chin and Shieh in 2005, has been translated into Turkish and checked in terms of reliability and validity in 2007 by Yılmaz and HuyuguzelCavas. The scale developed by Tuan, Chin and Shieh consists of 35 items with five point likert scale. In adapting the scale into Turkish Yılmaz and Huyuguzel Cavas have implemented the scale on 659 students in total attending 6<sup>th</sup>, 7<sup>th</sup>, and 8<sup>th</sup> grades in six different elementary school. 2 items have been excluded from the scale and it has been found to be a valid and reliable scale in determining the students' motivation regarding science. One can get at least 33, and at most 165 points from the scale.

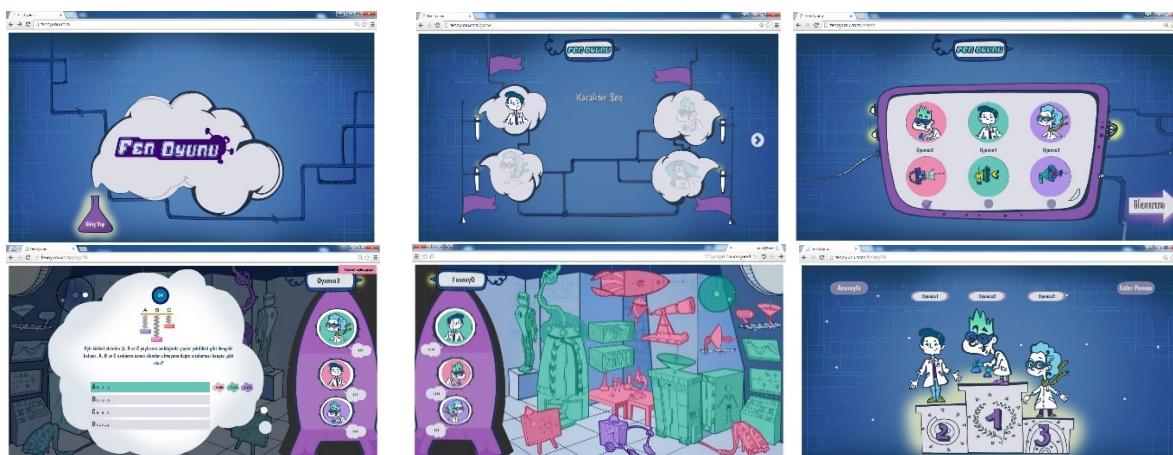
### *The Aggression Scale*

The Aggression Scale developed by Sahin (2004) has been used in the study to determine the aggression level and its change in students. 75 items have been prepared during the development process of the scale some of which were excluded later due to the fact that they have not been found compatible with the definition after reviewing the literature. To prevent children from perceiving themselves and the scale negatively, a scale with 31 items have been developed after adding neutral items which do not involve aggressiveness. 2 more items have been excluded from the scale after the expertise.

The scale with 29 items have been implemented on 450 elementary school students of 10-11 ages in total. The scale has been reduced to 13 items as a result of the analysis with the collected data and the coefficient of Cronbach Alpha has been found as .77. As a result of the study, the scale has been brought into use with 18 items in total, 13 of which involve aggression and the rest of which do not (neutral). One can get at least 13, and maximum 39 points from the scale.

### *The Process of the Game*

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 consisting 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



**Figure 1.** Sample Scenes from the Science Game

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 student to answer the question to the last one, 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 is to be conducted by the two most successful students. The success rating is determined by 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](#).

### Chosing the Questions for the Game

7th grade Science coursebooks on the market have been analysed for the selection of the questions to be used in the game, 4200 questions in total – each unit comprising of 600 questions- have been collected which are considered to be appropriate for the study. Sequence numbers were given to each of these questions starting from the unit 1.

1. Unit Questions (1) 1 - 600
2. Unit Questions (2) 1 - 600
3. Unit Questions (3) 1 - 600
4. Unit Questions (4) 1 - 600
5. Unit Questions (5) 1 - 600
6. Unit Questions (6) 1 - 600
7. Unit Questions (7) 1 - 600

Example; “(3)82” means eighty-second question of unit 3.

The questions have been asked in 15 8th grade classrooms comprising of 412 students in total as the questions of a unit every week. The number of the students in the classrooms, the sequence numbers of the questions and in which week they were applied are demonstrated in [Table 2](#).

**Table 2.** The Number of the Students in 8th Grade and the Sequence Numbers of the Questions Applied

	<b>N</b>	<b>1. Week (1)</b>	<b>2. Week (2)</b>	<b>3. Week (3)</b>	<b>4. Week (4)</b>	<b>5. Week (5)</b>	<b>6. Week (6)</b>	<b>7. Week (7)</b>
1. Group	28	1- 40	1- 40	1- 40	1- 40	1- 40	1- 40	1- 40
2. Group	28	41-80	41-80	41-80	41-80	41-80	41-80	41-80
3. Group	29	81-120	81-120	81-120	81-120	81-120	81-120	81-120
4. Group	30	121-160	121-160	121-160	121-160	121-160	121-160	121-160
5. Group	30	161-200	161-200	161-200	161-200	161-200	161-200	161-200
6. Group	30	201-240	201-240	201-240	201-240	201-240	201-240	201-240
7. Group	30	241-280	241-280	241-280	241-280	241-280	241-280	241-280
8. Group	31	281-320	281-320	281-320	281-320	281-320	281-320	281-320
9. Group	31	321-360	321-360	321-360	321-360	321-360	321-360	321-360
10. Group	31	361-400	361-400	361-400	361-400	361-400	361-400	361-400
11. Group	31	401-440	401-440	401-440	401-440	401-440	401-440	401-440
12. Group	32	441-480	441-480	441-480	441-480	441-480	441-480	441-480
13. Group	34	481-520	481-520	481-520	481-520	481-520	481-520	481-520
14. Group	34	521-560	521-560	521-560	521-560	521-560	521-560	521-560
15. Group	35	561-600	561-600	561-600	561-600	561-600	561-600	561-600

The questions have been analyzed to determine whether they are appropriate for the study. ITEMAN 4.1, a test and analysis program has been used for the analysis of the questions. Item difficulty (p) and biserial correlation coefficient which is used for item discrimination have been calculated via ITEMAN.

As a result of the analysis, the questions which are found to have a value between 0,20 and 0,80 in item difficulty index and the ones which are over 0,30 in item discrimination index have been included in the application, while the others have been excluded. In this context, 537 questions for unit 1, 544 for unit 2, 532 for unit 3, 551 for unit 4, 497 for unit 5, 511 for unit 6 and 485 questions for unit 6 have been uploaded to the game.

### Data Analysis

All groups' scores obtained from the motivation and aggression scales have been reviewed to decide which analysis technique to choose from the parametric and non-parametric ones. SPSS.23 software has been used in the analyzation of the data. And independed t-Test has been used in each region to determine if there is a meaningful difference among the scores the control and experimental groups got from the scales. Then each group, in its entirety, has used One Way Repeated ANOVA to determine whether there is a statistically meaningful difference among the pre-test, mid-test and post-test results.

### FINDINGS AND REVIEW

The findings of the study which has been conducted to examine the effects of the computer game developed for 7th grade Science lesson on students' aggression and motivation levels are presented and reviewed below. In this context, the scores obtained from the scales have been analysed to see whether they are homogenous or not and whether they have a normal distribution or not. F test for homogeneity and Shapiro-Wilk test (because the groups are smaller than 50) for normality have been used. As a result of the analysis, the groups have been found to have a normal distribution and to be homogenous and consequently, parametric techniques are found appropriate for the analyzation. Independed t-Test has been used to examine whether the groups' pre-test results for each scale are different or not, and One Way Repeated ANOVA is also used to examine the changes of the scores among the groups. In addition, the students' average scores are presented on the diagram.

It is clearly seen after the analysis that there is not any statistically difference between the pre-test results of motivation scales of both the control and the experimental groups from each (7) regions ( $t_{Marmara(58)}=0,104$ ,

**Table 3.** The Results of Independent t-test of Motivation Pre-test Scores

REGION	Group	N	$\bar{X}$	Ss	Sd	t	p
Marmara Region	Exp. Group	30	107,73	10,61	58	0,104	,918*
	Control Group	30	107,97	6,27			
Aegean Region	Exp. Group	30	101,67	6,41	59	0,615	,541*
	Control Group	31	102,90	9,02			
Mediterranean Region	Exp. Group	33	96,42	5,79	65	0,411	,683*
	Control Group	34	95,85	6,17			
Central Anatolia Region	Exp. Group	31	99,94	4,83	61	0,183	,856*
	Control Group	32	100,19	6,02			
Blacksea Region	Exp. Group	30	96,63	7,01	59	0,479	,634*
	Control Group	31	97,52	7,38			
Eastern Anatolia Region	Exp. Group	32	79,44	11,33	60	0,356	,723*
	Control Group	30	78,33	13,06			
South Eastern Anatolia Region	Exp. Group	34	79,24	9,66	68	0,644	,522*
	Control Group	36	80,78	10,35			

$t_{Aegean(59)}=0,615$ ,  $t_{Mediterranean(65)}=0,411$ ,  $t_{CentralAnatolia(61)}=0,183$ ,  $t_{Blacksea(59)}=0,479$ ,  $t_{EasternAnatolia(60)}=0,356$ ,  $t_{SouthEasternAnatolia(68)}=0,644$ ,  $p>,05$ ). The means of both the experimental and the control group in each region were observed to be close after the analysis of the pre-test results. In other words, there was no statistically meaningful difference among the motivation of students toward Science before the application.

As a result of the one way repeated anova analysis of the tests later on, it is revealed that  $X^2_{MarmaraExp.(2)}=4,78$ ,  $X^2_{AegeanExp.(2)}=4,25$ ,  $X^2_{AegeanCont.(2)}=0,32$ ,  $X^2_{MediterraneanExp.(2)}=3,64$ ,  $X^2_{MediterraneanCont.(2)}=0,24$ ,  $X^2_{CentralAnatoliaExp.(2)}=0,78$ ,  $X^2_{CentralAnatoliaCont.(2)}=4,79$ ,  $X^2_{BlackseaExp.(2)}=4,36$ ,  $X^2_{BlackseaCont.(2)}=3,97$ ,  $X^2_{EasternAnatoliaExp.(2)}=0,28$ ,  $X^2_{EasternAnatoliaCont.(2)}=3,07$ ,  $X^2_{SouthEasternAnatoliaExp.(2)}=0,22$ ,  $X^2_{SouthEasternAnatoliaCont.(2)}=3,04$  ( $p>0,05$ ) meet the requirement of Sphericity to be able to use the one way repeated anova according to the Manckley's test results and,  $X^2_{MarmaraCont.(2)}=1,22$ , ( $p<0,05$ ) doesn't. Because the Marmara control group, which doesn't meet the requirements, has a value of more than 0,75 in Epsilon, the degree of freedom of the tests has been changed in accordance with the Huynh-Felt's suggestions.

When examined, the results of the analysis have shown a statistically meaningful difference among the experimental groups' results of the pre-test, mid-test and the post-test whereas the scores of the six control groups are found to have no difference. Only the Central Anatolian students scores are found to have meaningful difference among the results of the pre-test, mid-test and the post-test. The related findings are demonstrated in **Table 4**.

After a detailed analyzation of **Table 3** and **4** and **Diagram 1**, one can clearly see that the experimental group students have increased their scores in the mid-test compared to the pre-test, and that they scored approximately the same points as in mid-test, in the post-test. However, there is not a considerable increase or decrease in control group students scores. As a result, the computer game has enhanced the motivation of the students towards Science to a particular level, and also kept it at that particular level.

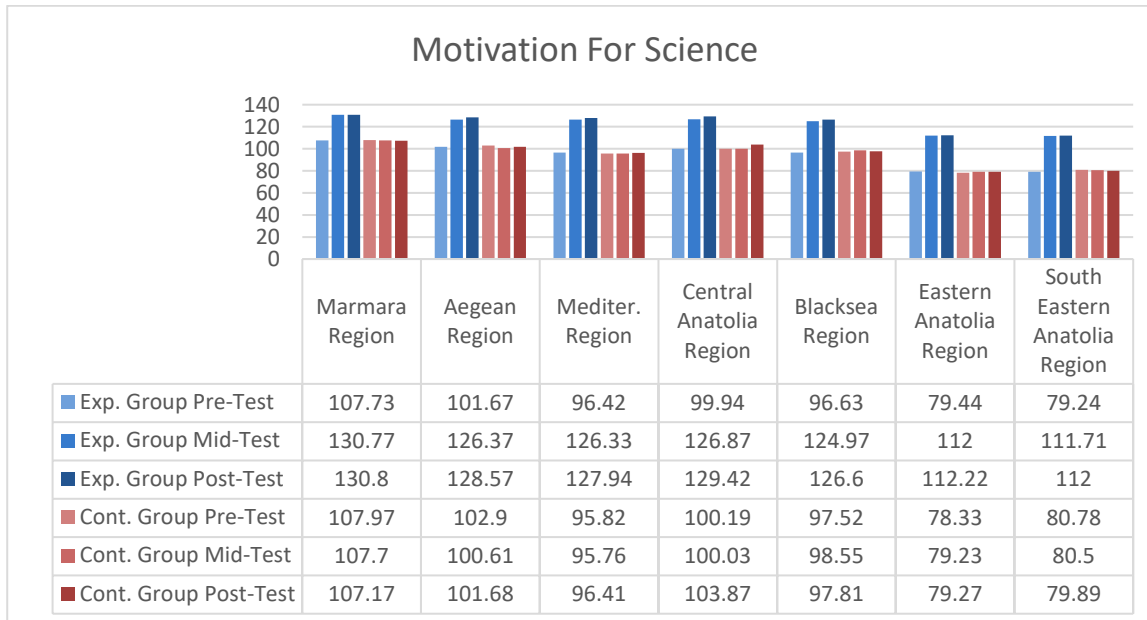
After examining the pre-test results of the experimental and the control groups, we have found no meaningful difference among them. However, after observing the results of the tests that have been done later on, we have observed an increase in the experimental groups scores where there is a statistically meaningful difference between the mid-test and the pre-test results of the experimental groups students which is on behalf of the mid-test. In other words, the experimental groups students' mid-test motivation scores towards Science have shown an increase in comprasion to the pre-test results. After observing the post-test results, we can still say there is an increase, but this is not a statistically meaningful one.



**Table 4.** One-Way Repeated ANOVA Analysis of the Motivation Scores For Science

REGION	Group	Source	Sum of Squares	Sd	Mean Square	F	p	Diff.
Marmara Region	Exp. Group	Between Means	3674,90	29	126,69	79,097	0,00	3-1, 2-1
		Measure	10626,07	2	5313,03			
		Error	3895,93	58	67,17			
	Control Group	Between Means	2127,39	29	73,36	0,395	0,639	-
		Measure	35,29	2	17,64			
		Error	2592,04	58	44,69			
			Total	89	5506,89			
			Total	89	135,69			
Aegean Region	Exp. Group	Between Means	2105,73	29	72,61	133,244	0,00	3-1, 2-1
		Measure	13385,40	2	6692,70			
		Error	2913,27	58	50,23			
	Control Group	Between Means	3491,61	30	116,39	0,898	0,413	-
		Measure	81,44	2	40,72			
		Error	2721,23	60	45,35			
			Total	92	202,46			
			Total	92	202,46			
Mediterranean Region	Exp. Group	Between Means	973,66	32	30,42	164,963	0,00	3-1, 2-1
		Measure	20793,71	2	10396,86			
		Error	4033,62	64	63,03			
	Control Group	Between Means	2202,67	33	66,75	0,075	0,928	-
		Measure	8,71	2	4,35			
		Error	3834,63	66	58,10			
			Total	101	129,20			
			Total	101	129,20			
Central Anatolia Region	Exp. Group	Between Means	1009,81	30	33,66	227,595	0,00	3-1, 2-1
		Measure	16546,90	2	8273,45			
		Error	2181,10	60	36,35			
	Control Group	Between Means	19737,81	92	8343,46	4,180	0,020	3-2
		Measure	1302,91	31	42,03			
		Error	302,90	2	151,45			
			Total	62	36,23			
			Total	95	229,71			
Blacksea Region	Exp. Group	Between Means	1085,60	29	37,43	171,91	0,00	3-1, 2-1
		Measure	17034,47	2	8517,23			
		Error	2873,53	58	49,54			
	Control Group	Between Means	20993,60	89	8604,20	0,134	0,875	-
		Measure	1135,16	30	37,84			
		Error	17,57	2	8,79			
			Total	60	65,72			
			Total	92	112,35			
Eastern Anatolia Region	Exp. Group	Between Means	2492,41	31	80,40	87,949	0,00	3-1, 2-1
		Measure	22773,06	2	11386,53			
		Error	8026,94	62	129,47			
	Control Group	Between Means	33292,41	95	11556,40	0,67	0,935	-
		Measure	2580,72	29	88,99			
		Error	16,82	2	8,41			
			Total	58	125,68			
			Total	89	223,08			
South Eastern Anatolia Region	Exp. Group	Between Means	3091,29	33	93,68	116,662	0,00	3-1, 2-1
		Measure	24116,78	2	12058,39			
		Error	6821,88	66	103,36			
	Control Group	Between Means	34029,95	101	12255,43	0,089	0,244	-
		Measure	3410,33	35	97,44			
		Error	14,59	2	7,44			
			Total	70	83,55			
			Total	107	188,43			

**Diagram 1.** The Means of Motivation Scores



When it comes to the control groups, the scores of 6 regions have been analysed but the pre-test- mid-test, post-test results are not found to have a statistically meaningful difference. Speaking of the Central Anatolian control group, we observe a statistically meaningful difference between the mid-test and the post-tests results. While the motivation scores of the control group students in this region hasn't shown an increase in mid-test, we can see an ongoing increase until the end of the second term. Although to a lesser extent, this increase may count a statistically meaningful one. This increase is thought to result from different factors affecting the teaching environment. These factors are assumed to have an impact on the experimental group as well, as they are in the same environment and they have the same teacher. However, when compared to the control group, one can say the increase in experimental group is much more. The desire to be successful in the game and to come first on the leader board have attracted the students' attention for the game. And one can infer from this fact that the computer game is considerably effective on the motivation towards Science. Being fun and enjoyable, the game has prevented students from getting bored, and it has also kept their motivation at a particular level while reinforcing their knowledge via questions. Furthermore, after the examination of other experimental group, one can observe a meaningful increase in students' scores. In this context, one can say that the computer game has a positive effect on students' motivation towards Science.

Considering the increase in sub-factors scores of the experimental groups' students, it is observed that the highest increase is on the 6th factor, in other words, on the promotive part of the learning environment. This fact is believed to stem from the fun they have while playing the game. Because, when students feel confident while they are playing computer games, they aspire a more confident and enjoyable learning environment rather than a classical one. Moreover, students' being interactive and being in a mild competition makes the computer games, in other words, the learning environment become the ideal atmosphere. In this context, the computer game can be said to increase the motivation level towards Science.

To determine the level of aggression of students, an aggression scale has been applied to the students at the beginning, in the middle and at the end of the application. As a result of the one way repeated anova analysis, it has been found out that none of the groups  $X^2_{MarmaraExp.}(2)=30,84$ ,  $X^2_{AegeanExp.}(2)=15,78$ ,  $X^2_{MediterraneanExp.}(2)=25,08$ ,  $X^2_{CentralAnatoliaExp.}(2)=23,58$ ,  $X^2_{BlackseaExp.}(2)=16,84$ ,  $X^2_{EasternAnatoliaExp.}(2)=42,44$ ,  $X^2_{SouthEasternAnatoliaExp.}(2)=32,83$ , ( $p < 0,05$ ) provide the Sphericity feature which is the prior-condition for using the repeated analysis of variance after that these groups' epsilon values have been reviewed. After finding out that the epsilon values of the groups were less

**Table 5.** One-Way Repeated ANOVA Analysis of the Aggression Scores

REGION	Group	Source	Sum of Squares	Sd	Mean Square	F	p	Diff.
Marmara Region	Exp. Group	Between Means	143,73	29	4,41	0,31	,899	-
		Measure	0,267	2	0,13			
		Error	248,40	58	4,28			
		Total		89				
Aegean Region	Exp. Group	Between Means	190,00	29	6,55	0,087	,849	-
		Measure	0,47	2	0,23			
		Error	155,53	58	2,68			
		Total		89				
Mediterranean Region	Exp. Group	Between Means	290,24	32	9,07	0,065	,589	-
		Measure	0,42	2	0,21			
		Error	208,24	64	3,25			
		Total		98				
Central Anatolia Region	Exp. Group	Between Means	493,91	30	16,46	0,241	,686	-
		Measure	2,86	2	1,43			
		Error	356,47	60	5,94			
		Total		92				
Blacksea Region	Exp. Group	Between Means	596,46	29	20,57	0,013	,958	-
		Measure	0,29	2	0,14			
		Error	655,04	58	11,29			
		Total		89				
Eastern Anatolia Region	Exp. Group	Between Means	849,32	31	27,40	0,120	,764	-
		Measure	1,75	2	0,88			
		Error	453,58	62	7,31			
		Total		95				
South Eastern Anatolia Region	Exp. Group	Between Means	1189,37	33	36,04	0,311	,625	-
		Measure	9,20	2	4,60			
		Error	976,80	66	14,80			
		Total		101				

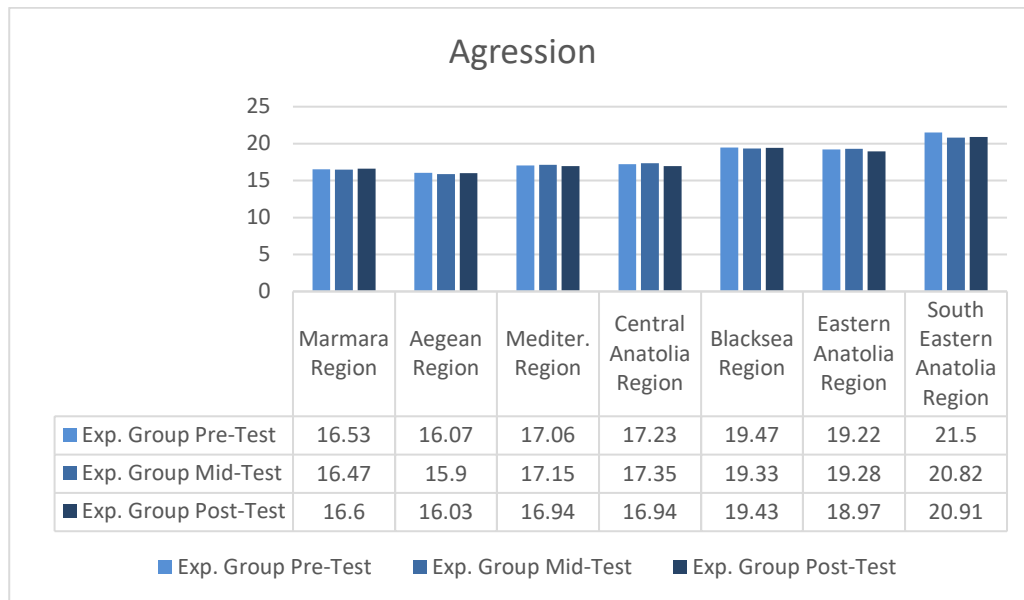
then 0,75; their degree of freedom was reformed through Greenhouse-Geisser's suggestions. The findings are demonstrated on **Table 5** and **Diagram 2**.

After examining the **Table 5** and **Diagram 2** in detail, one can infer that the results of the pre-test, mid-test and the post-test scores of the experimental groups have shown no statistically meaningful difference. One can also say that the computer game has neither a positive nor a negative impact on students' aggression levels. And it is believed that this is because of the fact that this computer game does not include any scenes or moves that could trigger the aggression. So, without violence and aggression, the game doesn't pose the problem of increase in aggression levels.

## DISCUSSION AND CONCLUSION

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'

**Diagram 2.** Expreimental Groups' Means of Agression Scores



self-sufficiency has been examined to see if there is a meaningful difference between the scores of the students who play the game and who do not.

Initially, pre-test results are reviewed for the evaluation of the motivation levels of the students and it is determined that there isn't any statistically meaningful difference between the experimental and the control groups. Then, after reviewing the mid-test and the post-test results, we see a statistically meaningful increase in experimental groups while we do not observe any meaningful change in control groups. This difference can be interpreted as the computer game, which is an additional material for the teaching process of Science, has had a positive effect on students' motivation levels. This shows a parallelism with the other studies in the literature on computer games and motivation. (Avcı et al., 2009; Kebritchi, Hirumi and Bai; 2010; Donmus, 2012).

Reviewing the studies on the effect of the computer games on motivation in the literature, we find that Avcı et al. (2009) has determined that the lessons which are promoted by the educational computer games have been adored by the students and the teachers participating in the application and that it has been effective on their learning. Tuzun et al. (2008), in researches they have conducted to see the effectiveness of learning Math and concepts and contents related to it in a 3D, multi-player game and the points in its application, stated that the educational game context can be used as an effective tool in learning the functions and variables, and that the significant factors in this effectiveness are inquiry-based activities which are also based on experience, the high motivation level of students during the activities, students' having the opportunity to learn at their own pace, and the atmosphere that encourages the students to cooperate.

Donmus (2012), Kebritchi, Hirumi and Bai (2010) and Papestrergiou (2009) have studied the effects of the educational computer games on motivation. As a result of the studies, they stated that the computer games have positive effects on increasing students' success, motivation and memorability. In addition, it is stated that the computer games are regarded as tools enhancing learning in secondary schools and that they must be extended. The prior studies regarding the effects of computer games on motivation support this study. Because it is also determined in this study that the computer games have a positive effect on motivation.

When considering the effect of computer games on students' aggression, we came to a conclusion that this game doesn't have an effect on aggression levels. Additionally, after reviewing the similar studies in the literature, we understand that not all but only the games with violent scenes or moves trigger students' aggressions (Bilgi,

2005; Ozdemir 2013). And in this study it has been tried not to include a situation that could trigger aggression and consequently this newly designed computer game is determined to have no effect on aggression. As a result, we can say if a computer game does not include violence, it doesn't increase students' aggression. And this is also supported by the studies in literature.

As a result, in the increasingly developing technology today, trying to extract the computer games that students adore playing from education means ignoring a teaching material which is thought to be a considerably effective one. The future of the computer games where learning with fun is given a particular importance has been widely accepted all over the World. The computer games now take place near the top among the effective materials that can be used for students to make use of their own experiences, to learn with fun, and to be motivated for the lesson.

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