

THE IMPACT OF COMPUTER GAMES ON CRITICAL THINKING AND ENVIRONMENTAL EDUCATIONAL RESPONSIBILITY IN HIGH STUDENTS

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Abstract: *The article was conducted to examine whether computer games influence students' critical thinking dispositions and Environmental Educational Responsibility. Many studies indicate that knowledge acquisition in computer games has a significant impact on critical thinking and environmental educational responsibility. Through this article, it explains the insights gathered while teaching cognitive knowledge, engaging students emotionally through the illustration of computer games on students' educational achievement in environmental education. This study has been examined among 120 students in an Eco-school in Jaffa-Tel Aviv. A questionnaire was used to test critical thinking and to test computer games. T-test and one-way ANOVA were necessary to the data analysis. A significant effect of playing computer games on students' educational achievement was found despite computer games not having any significant effect on critical thinking ($P < 0.05$).*

Keywords: *Computer games, critical thinking, Environmental Educational Responsibility.*

1. Introduction

The computer games have seen a rapid growth in recent years due to the growing competition in modern culture and industry. Despite the possibilities presented by technological advancements, people have had to adjust to some undesirable and desired changes in their daily lives. We have been influenced by this cultural arm as an effective and quiet media throughout our lives. These games are fascinating to children and teenagers, so they spend a lot of time playing them. They end up spending a lot of mental and physical energy on these games, leaving their eyes and minds exhausted and their minds drained. [8].

The most important concern in this case is that playing computer games takes up (wastes) time that could be spent on schoolwork, free study, or exercise. Furthermore, games promote scientific problem solving that is intrinsically motivating, hence being suitable for

environmental studies. Yet, the use of educational games in previous studies has shown that collaborative efforts (between groups) are more beneficial for learning than individual efforts. [3].

Since the computer games have a lot of fans among children and teenagers, there are two factors that contribute to these anxieties, which are linked to the amount of time children spend playing computer games and the nature of the game. The first factor is related to the amount of time children spend playing these games, while the second is related to their nature. [11].

In other words, when children and teenagers spend their free time playing these games instead of participating in other educational and social activities,

they may be considered injurious charms. In this case the most important concern is that doing computer games take (waste) the time of other activities such as school activities, free study or exercise [14]. Teenagers who were exposed to various features of digital eco-games had a tendency to be intrinsically motivated by these eco-games. Even so, digital games play a crucial role in enhancing motivation and immersion in gameplay, especially when they are carefully designed to meet the interests and needs of learners. One of the big concerns of parents and educators is the positive or negative effects of educational games on educational achievement. While some studies (Yang & Chang, 2013) show the positive effect of computer games on the educational achievement, the findings of other studies report the contrary results [11]. However, there are some studies which do not report any significant difference between the mean score of sample and control groups' educational achievement. In a study conducted by *Yee et al (2009)*, the relationship between computer games and students' educational achievement was examined and it was concluded that there is no significant difference between computer games and students' educational achievement.

The study examined how one student engages with computer games and its effect on his or the educational achievement. Students' educational achievement was affected primarily by the type of games according to the research findings. However, plying games duration hasn't been associated with educational achievement, so that it was not statistically significant. [13] [14].

Therefore, researchers believe that the type of games make children probe and it causes to improve the level of their memory and their concentration. Using these games as a tool for

education and learning involves both interacting in the game and learning simultaneously. Despite the imagination that computer games are entertainment and don't offer any mental and educational activity, most of the games that are entertainment in nature create a thought in the mind of the student.

As a result of playing games, players learn many things in virtual environments and their mental activities are increased due to the fact that they solve problems in these games. Ultimately, these activities will be implemented to the real world which exposed the students in environmental education to a powerful cognitive learning source where they can develop different skills such as critical thinking and eco -problem solving (*Hosseni, 2012, Gunter, 2008*).

Learning and interacting in these games are both simultaneous elements of using these games for education. This is the reason that critical thinking disposition is defined as “consistent internal motivation to engage problems and make decisions through the use of critical thinking” [6].

Review of literature (*Bell & Loon, 2015*) indicates that critical thinking disposition is attitudinal and can be developed. In educational games, there is less evidence to suggest that critical thinking dispositions can be developed. [2]. In order to win, players must recognize and prepare for the possible challenges in computer games in order to win and achieve desired results [4] [5].

For example, *Saberi (2013)* organized research on the effects of computer games on students' creativity in guidance school. The results revealed that there was a significant difference ($P < 0.05$) between experimental and control groups. [11].

The findings showed that there was a significant difference between creativity and educational achievement regarding the experience and the time spent on computer games in environmental education field. This is the reason why critical thinking can be defined as a kind of intellectual and reflective thinking that focuses on doing eco activities.

In critical education, one of the most important goals is the preparation of critical citizens to participate actively in society.

For this reason, games have become one of the most effective ways to create critical thinking. As part of a critical thinking research study conducted by *Ru-Song (2008)*, online

group games were investigated in order to find out if they affected writing ability and critical thinking abilities. [10].

Due to the fact that many people are eco-aware, but cannot control pro-environmental behaviors, intentions have not been translated into actions. Teaching pro-environmental behavior in the classroom through digital games can serve as a powerful tool for encouraging environmentally conscious behavior among youngsters. Games foster players' knowledge of sustainability issues and make them think and highly motivated about sustainable development strategies, which enable students to develop positive effect of these types of games on critical thinking. Critical thinking is the ultimate goal of higher education and the basis of environmental issues dilemma reasoning. By strengthening this type of thinking, the participants acquire the skills to investigate their environment and to make intelligent, informed decisions about how they can help take care of. Experts emphasize on critical thinking skills to promote the quality of the environmental education. [10] [12].

On the other hand, researchers have found that digital games-based learning (DGBL) are more effective at attitudinal learning than traditional methods because learners are enabling to test their behaviors and see the consequences of non-environmental behavior immediately through the game environment.

Therefore, the purpose of the current study was to investigate the effects of using computer games on the disposition to critical thinking and environmental educational achievement of high school students in Tel-Aviv Jaffa. Based on the main purpose, the main objectives are:

1. To examine the effect of computer games on students' critical thinking disposition.
2. To examine the effect of computer games on students' environmental activities achievement.
3. To determine effects of different computer games on students' critical thinking.

Here are the following hypotheses according the following criteria:

Computer games significantly affect students' critical thinking disposition.

Computer games significantly affect students' environmental achievement.

Different types of computer games have significantly different effects on students' critical thinking disposition.

Methodology

This research is descriptive in nature and its type is comparative.

The data were collected from first grade eco-high school students (n = 120) in 2019, who were selected randomly to fill the questionnaire.

Respondents were asked to state what extent they carry out 25 environmentally related activities by using different digital games with a Likert response scale from 1 (never) to 5 (almost always).

The reliability coefficient of this research subscales was reported as follows: The creativity subscales=85%, the boast subscale= 52% and the commitment subscale=88% [1]. The internal reliability coefficient of the instrument in the present study was 0.85.

Spearman correlations have been determined to test the relationship between students' critical thinking disposition and to test students' environmental achievement by different type of digital games in the two kinds of items, Likert questions (Part 1) and multiple-choice questions (Part 2). [4]

The questionnaires were distributed among the selected students in class and after a preliminary explanation. They answered the questions in the questionnaire. After collecting and coding the questionnaires, the data were analyzed using SPSS. Both descriptive and inferential statistics were applied at descriptive statistics level the frequency, mean and standard deviation was reported. At the inferential statistics level the one-way ANOVA and T-test were used for independent groups.

Findings

Before reporting the results of testing the hypotheses, some useful descriptive information is presented in this section.

Table 1 presents the frequency and percentage of students who had computer games at home:

Table 1. Descriptive statistics results of students who had computer games at home.

Response	N	Percentage (%)
YES	80	72
NO	40	28
TOTAL	120	100

As it can noticed in Table 1 most of the subjects (72%) stated that they had computer games at home.

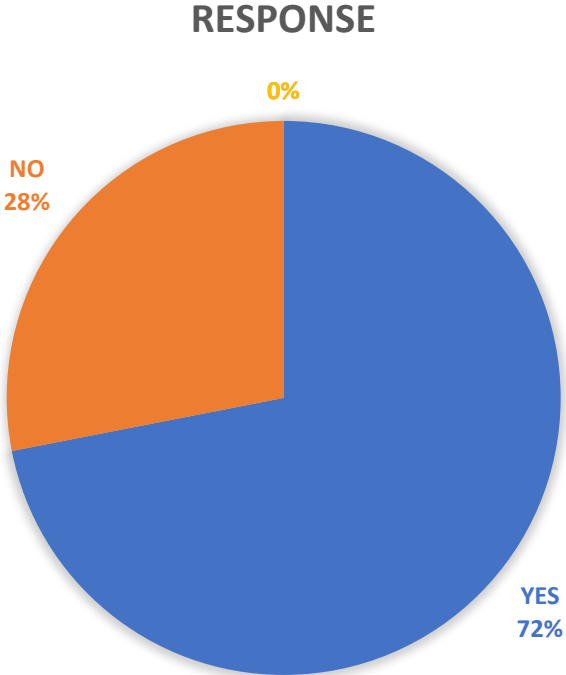
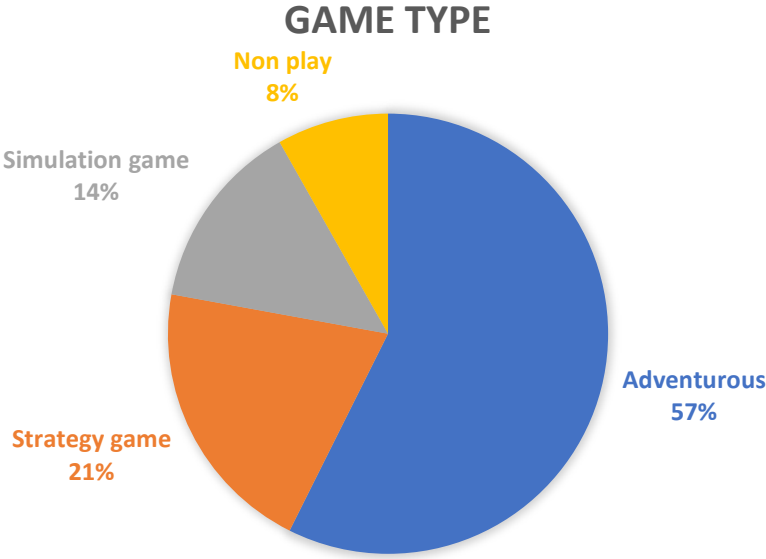


Table 2. Descriptive statistics results of the type of computer games

Game type	N	%
Adventurous (Plot and puzzle solving environmental issues)	70	58.33
Strategy game (Use of strategy as opposed to fast action)	25	20.67
Simulation game (Management simulation to use limited resource of a specific environment).	17	14
Non play	10	7
Total	120	100

Table 2 presents the frequency of computer games used by students.

The percentage was: adventurous 58.33%, strategy game (intellectual-instructional) 20.67%, simulation game 14 % comparing to non -play 7%.



3.1 Hypothesis testing (H1): The first null hypothesis of this study was Computer games do not significantly affect students’ critical thinking disposition.

Table 3. Effect of playing computer games on students' critical thinking disposition.

Variable	N	Mean	t	df	Sig.(2-tailed)
Critical thinking-Play game	110	50	1.7	210	.062
Non play game	10	10	1.7	210	.062

The independent t-test was used, to calculate the students' critical thinking disposition in playing and non-playing groups. The results indicate that the hypothesis was not rejected ($t(110) = 1.7, p = 0.05$). Therefore, playing computer games does not have any effect on students' critical thinking disposition.

Hypothesis testing(H2): The second null hypothesis of this study was Computer games do not significantly affect students' environmental achievement.

CRITICAL THINKING DISPOSITION

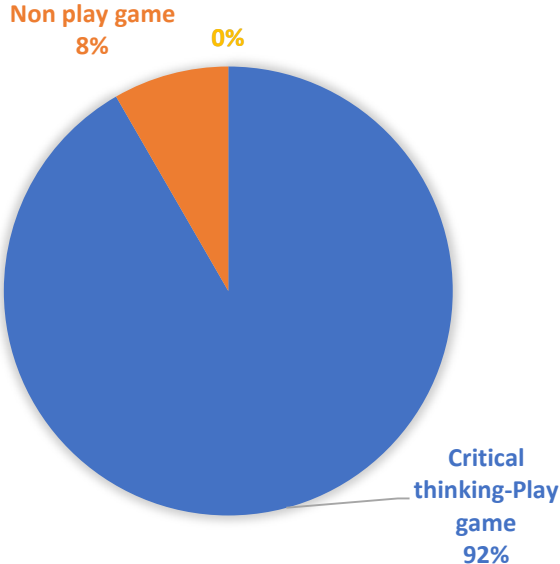


Table 4. Effect of playing computer games on students’ environmental achievement.

Variable	N	Mean	t	df	Sig.(2-tailed)
Environmental achievement. -Play game	110	16.7	3.5	210	0.01
Non play game	10	12.5	3.5	210	0.01

The independent t-test was used, to calculate the students’ environmental achievement in playing and non-playing groups.

Hypothesis 2 is rejected ($t(110) = 3.5, p=0.01$).

Therefore, playing computer games have a significant effect on student achievement.

Hypothesis testing (H3): The third null hypothesis of this study was:

Different type of computer games has no significantly different effects on student's critical thinking disposition.

STUDENTS’ ENVIRONMENTAL ACHIEVEMENT

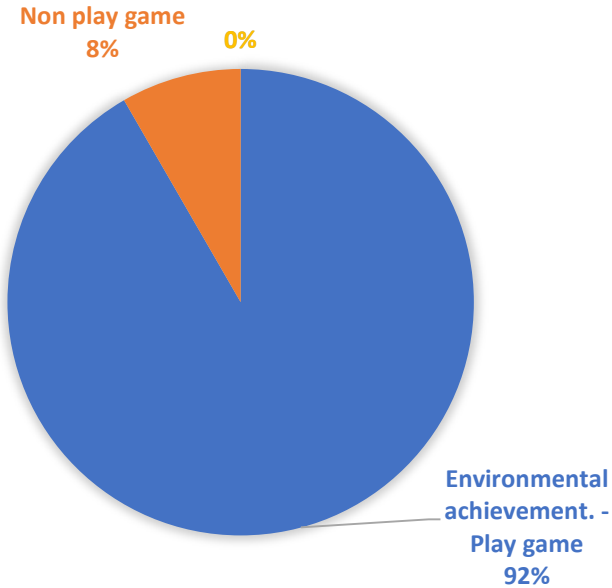


Table 5. One-way ANOVA results of the effect of game types on students’ critical thinking disposition.

Variable	SS	df	MS	F	Sig.(2-tailed)
Between Groups	130.512	5	45.6	---	-----
Within Groups	120.321	40	20.2	0.12	0.3
Total	250.833	29.2			

Based on the summary of the results in Table 5, the null hypothesis is confirmed and the research hypothesis is rejected ($F(5, 40) = 0.12, p=0.3$).

So, it can be concluded that regarding the type of the game, there is no significant difference between students’ critical thinking disposition mean.

The final hypothesis was ‘Different type of computer games have significantly different effects on students’ critical thinking disposition.

Table 6. One-way ANOVA results of the effect of game types on students’ environmental achievement.

Variable	SS	df	MS	F	Sig.(2-tailed)
Between Groups	130.512	5	45.6	---	-----
Within Groups	120.321	40	20.2	0.12	0.3
Total	250.833	29.2			

Based on the summary of the results in Table 6, the null hypothesis is confirmed and the research hypothesis is not rejected ($F(5, 40) = 0.12, p=0.3$).

So, it can be concluded that different types of computer games do not result in significant differences between students’ environmental achievement means.

Discussion and Conclusion

This study emphasizes that different types of digital games on environmental topics was shown to be a more effective way to influence pro-environmental behaviors by students' environmental achievement. Within a game, action can be taken visually, decisions can be made, actions can be performed virtually, and results can be seen and understood. Furthermore, this research was designed to examine the effects of using computer games on critical thinking dispositions and educational achievement among high school students. The finding of the research showed that playing computer games has a positive significant effect on students' environmental achievement, but has no significant effect on critical thinking disposition. However, the results of the current study were not in line with some other studies[14] [10].

Likewise, the results showed that different types of computers games were no significant effects on students' critical thinking and their environmental achievement. It is important to mention that games improve people's critical thinking skills in the face of ambiguous situations, resulting in enhanced cognitive abilities and creativity to take care of their near environment. Furthermore, it has been determined that the effective factors for critical thinking vary from society to society.

While designing a game intentionally can help educators incorporate meaningful lessons into one game, all of them experienced attitudinal learning from the game covering different aspects, showing that it is possible to combine meaningful lessons into a game in an intentional manner.

Several studies concluded that "climate change and pollution in our environment" games enhanced players' eco-awareness and immersed them in a real-world plot that allowed them to see the implications of their actions immediately. [7] .Therefore, it would be interesting to determine if games are effective in producing durable behaviors, longitudinal studies were needed that observed the behaviors of participants rather than relying on self-reports.

In light of the increasing popularity of computer games, the use of these games as a pedagogical tool for teaching proper behavior toward the environment makes sense, and their effect on students' critical thinking disposition. Several factors controlled the content and quality of the games, so it is expected to produce different results.

According to the results of this study, the games had no impact on the critical thinking of students, as compared to the results of some studies, possibly because participants were from different cultures and were exposed to different training factors.

Finally, the use of games in ESE (Environmental Sustainability Education) provides a transformative pedagogy that makes them more persuasive than traditional instructional methods.

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