



## The Effect of Educational Computer Games on Students' Accuracy and Concentration

Akbar Jadidi Mohammadabadi <sup>1</sup> | Parvin Salari Chineh <sup>2</sup>

1. Assistant Professor, Department of Education Sciences, Payame Noor University, Tehran, Iran. E-mail: [a.jadidi@pnu.ac.ir](mailto:a.jadidi@pnu.ac.ir)

2. Corresponding Author, Assistant Professor, Department of Educational Sciences, Farhangian University, Kerman, Iran.

E-mail: [p.salari@cfu.ac.ir](mailto:p.salari@cfu.ac.ir).

Article Info	ABSTRACT
<b>Article type:</b> Research Article	It should be noted that the effect of educational computer games on the accuracy and concentration of students depends on several factors, including the type of game, content, design, and duration of use. This research was conducted to investigate the effect of educational computer games on the accuracy and concentration of eighth-grade female students in Kerman. Quasi-experimental research method and pre-test-post-test design with a control group were used. The statistical population of the research was all female students in the eighth grade of secondary school in Kerman City in the academic year 2022-2023 and a sample of 80 people was selected in the form of two classes of 40 people from the society by multi-stage cluster sampling method. Two Toulouse and Pieron accuracy questionnaires (1911) and Savary & Oraki concentration questionnaires (2015) were used to collect pre-test-post-test information and computer game software was used as an experimental practice. Data analysis was also done with the statistical method of analysis of covariance and using SPSS19 software. The results showed that computer educational games have been effective in improving the accuracy and concentration of students in the experimental group compared to the control group.  Therefore, due to the flexibility of the structure of educational computer games and their non-linear organization, the motivational features of computer games and the benefit of learning rules and principles such as immediate reinforcement, they can contribute to increasing concentration and accuracy.
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## Introduction

Although in recent decades we have witnessed the emergence and development of new technologies and the subsequent change in the way of life of today's people, the educational systems have kept their traditional education methods and adapted themselves to the characteristics of today's people. have not changed ([Mozelius, 2016](#)). Today, traditional and old methods of teaching and learning have lost their effectiveness with the advent of new technologies and methods. To keep pace with the constantly changing environment around them, learners must look for new ways and procedures to transfer knowledge and increase learning ([Saeid & Jadidi mohammadabadi, 2022](#)). In order for education not to be boring for today's students, educational methods must be changed and the preferences of the digital generation should be taken into account, otherwise they will not be interested in school and lessons ([Sevalnev & Tsirin, 2022](#)). The lack of interest and lack of motivation of learners can lead to their dropping out ([Perrotta et al, 2013](#)). Now there is a quantitative and qualitative drop in education in educational centers, the qualitative drop in education refers to incomplete learning and academic weakness and the quantitative drop in education is manifested in the forms of dismissal, dropping out of school, withdrawal, and probation, which are the effects and consequences. It has social, economic and cultural benefits for the individual, educational system and society ([Dehghanzadeh, 2015](#)). For years, there has been talk about the need to review teaching and learning methods and turn to active methods ([Lai & Chen, 2021](#)).

Today, the need for new teaching methods is more felt due to the increasing progress of science and technology, and one of the methods of active learning is the use of games ([Yarmohamadi Vasel et al, 2014](#)). The game is one of the facilities that can be used to educate and motivate students ([Dortaj, 2014](#)). Educational computer games, which in turn are one of the manifestations of technological progress in the contemporary era, will occupy an important part of education in the future ([Moradi & Norozi, 2016](#)). For this purpose, the educational systems decided to change their educational methods and thought about what teaching and learning methods and how to prepare the learners of the digital generation to live in this culture ([Moffat et al, 2017](#)). To improve and make education more effective for today's digital learners, according to the features and capabilities of educational computer games, one of these methods seems to be the use of educational computer games as an educational strategy in educational systems ([Toda et al, 2019](#)). Today, computer games are one of the most effective media among different educational media.

Playing a game can be used as an educational method during education, but according to many researchers, making a game by the students themselves can have deeper effects and is one of the most informative and enjoyable experiences for people, especially students ([Roshanian Ramin et al, 2020](#)). In computer game development, due to the person's involvement with multifaceted activities, will lead to the growth of thinking and creativity ([Van Roy & Zaman, 2018](#)). Even though the pillars of the civilization of any society are based on its education system and structure, without a doubt the health, comprehensiveness and efficiency of the education system of that society depends on the breadth, scope, variety and quality of comprehensive educational programs and effective educational services. is offered to students in regular schools or special classes ([Wu & Chiang, 2021](#)). However one of the major problems is the lack of educational games related to academic lessons ([Asadi et al, 2023](#)). According to the research conducted by Ranjbarfard and Zandvakili, game-based education has shown a significant difference compared to other evaluated methods ([Ranjbarfard & Zandvakili, 2021](#)). These results show that educational institutions, teachers and developers of computer games should pay more attention to game-based education and use games for education ([Jafarkhani et al, 2022](#)). In addition, the use of integrated methods such as training through working with specialized software and especially game-based training, along with the traditional method, can lead to an increase in students' satisfaction, learning, motivation, ability, interaction and enjoyment ([Fathi et al, 2020](#)). Also, in the research with the name "Effect of online multi-user educational computer games on students' social skills and cognitive abilities", it was shown that the use of online multi-

user educational computer games on social skills and cognitive ability Students are significantly effective ([esmaeeli gojar & poorrostaeei ardakani, 2019](#)).

Regarding increasing concentration through today's technologies, research was conducted by Saeid & Jadidi Mohammadabadi and showed that education through mobile phones is a suitable method for teaching various subjects due to its accessibility, portability, and easy use ([Saeid & Jadidi mohammadabadi, 2022](#)). This method provides access to content at any time and place. Also, the flexibility of this type of education allows students to learn according to the conditions and mental preparation and reduces the interfering factors in concentration ([Sliwinski et al, 2017](#)). Concentration means maintaining and maintaining attention and Concentration on a certain subject. Without concentration, learning will not be fruitful ([moradi & maleki, 2015](#)). The skill of concentration is considered one of the essential skills in learning and it is mentioned as one of the most important factors of learning success ([Savary & Oraki, 2015](#)). Concentration is essential for information processing ([Lin & Chiou, 2017](#)). The meaning of concentration is the ability of a person to pay attention to educational activities, which facilitates the speed and accuracy of a person's performance in performing duties and tasks ([Roohani & Heidari Vincheh, 2021](#)). Environmental, biological, psychological, social and cultural factors also play an effective role in the accuracy category. When a person chooses a certain stimulus and prepares himself to create a certain reaction in front of it, in this case, it is said that his attention is drawn to a certain matter. Accuracy precedes perception, learning and thinking ([Hooshmand Hamedani, 2022](#)). Using skills that can increase our productivity from this information is also very important. Many students try hard, and study a lot, but due to their inability to concentrate, they cannot achieve the desired result while studying ([Zahed et al, 2012](#)).

[Bayanfar and Tabatabaee \(2019\)](#) in research investigated the effectiveness of brain exercises on symptoms of attention and concentration deficits, and academic self-efficacy in students, and the results showed that brain exercise exercises reduce the symptoms of attention and concentration deficits and increase academic self-efficacy and academic performance in It becomes students.

falahatgar ushibi et al ([Falahaatgar Ushibi et al, 2022](#)) in research investigated the moderating role model of electronic sports on the impact of emotional ataxia and aggression in students. The findings showed that due to their age and the special sensitivities of adolescence, students often face many psychological problems such as uncontrolled anger and excitement caused by lessons and school, and the possibility of experiencing unpleasant things such as social aggression is high among them. Therefore, it is suggested to facilitate the reduction of aggressive behaviors with the correct and planned use of the potential of electronic sports.

Conducting research on educational computer games and their effect on students' accuracy and concentration can be useful and necessary for the following reasons: 1. Brain stimulation and strengthening 2. Practicing cognitive skills 3. Improving morale and motivation 4. Optimum use of technology and, in general, conducting research on the effect of educational computer games on the accuracy and concentration of students can help us to see a significant improvement in this field and use this solution to improve the teaching and learning process. Based on the above studies, the following questions are raised.

1. Do educational computer games affect the accuracy of eighth-grade female students in Kerman?
2. Do educational computer games affect the concentration of eighth-grade female students in Kerman?

## Method

### Sample and Sampling Method

In this research, a quasi-experimental method and a pre-test-post-test design with a control group were used. The statistical population of the research was all eighth-grade female students of Kerman secondary school in the academic year of 1402-1401, of which 80 students were selected as a sample in two classrooms of

40 students through multi-stage cluster sampling. For this purpose, at first, 2 schools were selected, and 1 eighth-grade class was selected from each school. In this way, they were included in the control group (40 people) and the people of the other class were included in the experimental group (40 people). The age range of the sample was between 12-13 years.

### **Tools Used**

The tools of the present research are computer game software and two questionnaires, and to measure each variable, a separate questionnaire was tested as follows.

#### **Concentration questionnaire**

This questionnaire was created by [Savary and Oraki \(2015\)](#) to measure concentration skills, which includes 13 items and 2 components of voluntary concentration and involuntary concentration. In Savary and Oraki's research, Cronbach's alpha coefficients of the components of voluntary concentration, involuntary concentration, and the whole scale were obtained as 0.72, 0.70, and 0.74, respectively, and the validity of the questionnaire was also reported as favorable.

#### **Accuracy test (Toulouse & Piéron drawing)**

The general principle of the line drawing test is that the examinee can quickly identify the desired symptoms among several symptoms and draw a line on each of them. The underlining test can also be done by taking a newspaper page and deciding to underline some of its letters, for example (M), (V) and (N). The first person who proposed this test was the French psychologist Bourdon. In 1911, Toulouse & Piéron, two other French psychologists, inspired by Bourdon's initiative, suggested using symbols instead of letters to eliminate cultural interference. The use of Toulouse & Piéron are those that are still used ([Toulouse & Piéron, 1911](#)). Later, its use became stable and uniform. In its classic formula, there are a thousand symbols that are mixed completely randomly and printed on a large page. At the top of the screen, three signs are considered models. The subject must cross out all the signs similar to the three signs on the top of the screen as quickly as possible. The duration of the test is 10 minutes. The main criteria are: the number of correctly crossed signs (speed) and the percentage of incorrectly crossed out or forgotten signs (accuracy). In this questionnaire, symbolic or formal validity was used to determine the validity of the data collection tool. Cronbach's alpha test was used to test the reliability of the questionnaire using SPSS statistical software, and the reliability rate was 0.855.

#### **Introducing the intervention program: educational computer games**

The method of educational computer games uses the basic principles of cognitive theories based on neurobiological processes, which include the ability to improve cognitive processes through structured opportunities to practice different aspects of attention, planning, memory, etc. Also, in the computer games method, unlike the neurofeedback method, which uses the child's mind and brain, the child's hand works. In this therapeutic protocol, the child learns with his hand movements what he should do to achieve the result, which will lead to the improvement of his ability to sustain attention and active memory. In the method of educational computer games, software and educational games were first introduced for students. Then they would choose their favorite game from among the 15 available games in each session and then start playing. In these games, recognizing game cues and combining them within a strategy to facilitate performance caused selective attention. Also, these games caused internal motivation, ability to control, fun, challenge and curiosity, and the students were asked to comment after the game on a variety of educational goals, game features, and strategies they used during the game. These games are designed so that children experience a pleasant level of failure. That is, in case of failure in the game, the continuation of the game starts from the same stage and it is possible to prevent the occurrence of unfortunate events with the right of choice and control that children have in these games. These games showed children's goals for the game, their understanding of signs and strategies, or attention patterns and committing them to memory in the game. Also, game theory can be used in the online environment, which allows for

simultaneous and non-simultaneous interaction of players and helps to better understand different concepts ([Noorani et al., 2023](#)). In the following, we will introduce some online games:

**Minecraft Education Edition:** is a game-based learning platform that promotes creativity, collaboration and problem-solving in an immersive digital environment. Educators around the world use Minecraft Edition to engage students and bring abstract concepts to life.

**GeoGuessr:** is a web-based geographical exploration game started by Anton Wallén, a Swedish IT consultant, and launched on May 9, 2013. The Geoguessr website is designed in the style of a game where you get to know new sites in different locations around the world. The goal of the game is for players to guess their geographic location in the world using only visible clues. You will see a lovely place on the planet and you have to locate that area on the map based on the information and signs there. The game allows players to be transported into a realistic, usually ambiguous environment and guess their approximate location using 360-degree images of real locations around the world.

**Haft Khan Esfandiar game:** This game has an interesting story of Persian mythology and includes 7 main stages, each stage contains several sub-stages. Going through the game path depends on the open player being able to complete the first stage successfully and get the necessary points to unlock the second stage for him. The educational design of the game was based on the opinion of language teachers, who emphasized teaching words first and then practice and repetition, and in some stages of the game, only review and repetition of previous lessons are discussed ([Salimei & Zangeneh, 2022](#)).

**Stackelberg game:** Stackelberg is the name of one of the game theory games that are used in the field of economics and strategic decision-making. This game is known as two-player, where two players take turns making decisions. The first player, also known as the leader, decides the second player (the follower) plays. It means that the leader acts and then the follower acts in response to the leader's decision. These games are studied and modeled based on game theory and different algorithms.

### Procedure

First, a briefing session was held for parents so that their children could participate in the research with written parental consent. Then, before the application of the test in the pre-test, the attention and concentration of all the subjects of both groups were measured and the scores of the subjects were recorded. In the next step, after the initial investigations on the content of computer games, the experimental subjects were asked to play the games that were selected based on the content classification of computer games, for three weeks and every week in three one-hour sessions in a laboratory environment (room in school) to do. The control group was also asked not to play any kind of computer games during this period. After that, both groups were measured in attention and concentration. The data was analyzed using SPSS19 software in two descriptive and inferential sections. In the descriptive part, variance, standard deviation and mean scales were used, and in the inferential part, the covariance test was used to measure the impact of computer games.

### Results

Descriptive information on accuracy and concentration is presented in Table 1, separated by pre-test and post-test in the experimental and control groups:

**Table 1. Descriptive information on the level of accuracy and Concentration by measurement stage in groups**

		factors	pre-test	post-test	
Statistical index					
accuracy	Control	Number	40	40	
		Average	15.70	57.57	
		Standard deviation	12.63	35.33	
	Experiment	Number	40	40	
		Average	33.33	92.68	
		Standard deviation	79.95	34.26	
	Concentration	Control	Number	40	40
			Average	3.05	7.87
			Standard deviation	7.46	2.34
Experiment		Number	40	20	
		Average	5.91	14.97	
		Standard deviation	4.42	8.59	

Being independent means that each person's score in the associated and dependent variable is independent of the scores of all other subjects. This condition was established because the subjects' answers to the questions were not influenced by other subjects. Kolmogorov Smirnov test (data normality test).

**Table 2. Data normality test (Kolmogorov-Smirnov test)**

Indicators	accuracy	Concentration
Z	1.01	0.61
P	0.26	0.84
Sig	0.05	0.05

According to the results of Table 2 and the level of significance obtained for each of the research variables, which is greater than 0.05, the null hypothesis is confirmed and the data of all variables are normal, and parametric tests can be used to test each of the variables.

#### Homogeneity of regression slopes

This assumption means that the regression coefficient of the dependent variable on the covariance variables is the same in the groups. According to the output of the covariance analysis to check the homogeneity of the regression coefficients, it was observed that the interaction between the test variable and the companion (pre-test) is not significant, so the slope of the regression line is the same for the experimental and control groups.

**Table 3. Tests of effects between subjects (checking the homogeneity of regression slopes)**

Indicators	Source	sum of squares	df	mean square	F	level of freedom
accuracy	Group interaction * Pre-test	8.31	1	8.31	8.37	0.15
Concentration	Group interaction * Pre-test	8.23	1	8.23	3.89	0.31

#### Homogeneity of variances

According to the prerequisites of the covariance analysis test, the homogeneity of the regression slopes has been investigated first, and the results are shown in the table below.

**Table 4. Lon's test for equality of error variance**

Indicators	Test statistics	df between groups	intragroup df	level of freedom
accuracy	0.214	1	78	0.64
Concentration	3.01	1	78	0.071

The results of Table 4 show that according to the statistics observed at the alpha level of 5./ The assumption of equality of error variances has not been questioned.

#### Examination of research questions

Do educational computer games have an effect on accuracy among eighth-grade female students in Kerman?

**Table 5. Tests between subjects' effects**

Component	group	sum of squares	DF	mean square	F	Sig	Eta Squared
accuracy	pre-test	8.31	1	8.31	3.37	0.005	0.098
	post-test	8.99	1	8.99	9.05	0.004	0.105

The results of Table 5 showed that the experiment was effective in improving students' accuracy. Test Question 2: Do educational computer games have an effect on concentration among eighth-grade female students in Kerman?

**Table 6. Tests between subjects' effects**

Component	group	sum of squares	DF	mean square	F	Sig	Eta Squared
Concentration	pre-test	8.12	1	8.12	3.89	0.001	0.078
	post-test	9.32	1	9.32	9.12	0.001	0.12

The results of Table 6 showed that the experiment was effective in improving students' concentration.

### **Discussion & Conclusion**

The present study was conducted to investigate the effect of educational computer games on the accuracy and concentration of eighth-grade female students in Kerman. In the first question, according to the findings, it can be said that educational computer games have been effective in improving the accuracy of eighth-grade female students in Kerman. The findings of this question are in line with [Dortaj's research \(2014\)](#). In these findings, the use of computer games regulates cognitive emotion and increases accuracy and attention to programs. The results showed that the effect of educational computer games on students' accuracy depends on the planning and design of the game, how to use it, the content and the level of interaction with the game. If these games are chosen correctly and implemented using effective teaching methods, they can have positive and significant effects on improving students' accuracy. Educational games are effective tools in the learning process. These games encourage students to practice and repeat educational materials with high attractiveness and the ability to appeal to the audience. The brain challenges provided by these games enhance students' executive abilities and improve their motivation. In other words, educational games can be used to make the learning process more attractive and effective.

The results showed that educational computer games were effective in improving the concentration of eighth-grade female students in Kerman. These findings are consistent with the research of [Dortaj \(2014\)](#), [Ranjbarfard and Zandvakili \(2021\)](#), and the research of [Saeid and Jadidi Mohammadabadi \(2014\)](#). The conclusions obtained from these studies show us that computer games increase concentration and decrease distractions and create motivation. Educational computer game concentration depends on various factors such as the type of game, content, duration of the game, teaching method and attention to several other related factors. Educational games are usually designed to keep students Concentration on the subject and engage them in specific mental activities. There are effective strategies to strengthen students' concentration in educational computer games. The first solution is charm and challenge. Educational games should have interesting and challenging content to challenge students and increase their motivation for continuous

activity. The second solution is related content. The content of the game should be related to the curriculum to encourage students to concentrate on the educational topics. The third solution is the appropriate difficulty level. Games should have an appropriate level of difficulty so that their challenges and topics attract students but are accessible and understandable for them. The fourth solution is the right time. The duration of the games should be adjusted in such a way that the students' concentration is maintained and they are not tired at the same time and the last solution is a suitable educational environment. Students should play in a quiet environment without external distractions to maintain their concentration and attention. By implementing these solutions, educational games can be used as an effective tool in strengthening students' concentration and abilities in the learning process. Considering the above, it can be said that educational computer games, with appropriate conditions and attention to educational aspects, can facilitate the improvement of concentration and attention of eighth-grade female students.

The games you choose must be aligned with your learning needs and the skills you want to develop. In addition, encouraging students to think critically, ask comprehensive questions, and carefully examine the content of games can help increase their accuracy and concentration. Therefore, educational computer games can have a significant impact on students' accuracy and concentration. Educational computer games are usually designed to help students experience educational skills and concepts in an engaging and interactive environment. In general, these games can be effective in the following way:

1. Increase accuracy: Educational computer games can help improve students' accuracy by providing repetitive exercises and activities that require accuracy. For example, math games can encourage students to perform calculations faster and more accurately.

2. Enhancing concentration: Educational computer games are usually interesting and varied, which can play an important role in motivating students to concentrate and actively participate. These games usually include challenges and immediate rewards, which can attract students' attention and concentration.

However, it should be noted that the effect of educational computer games on the accuracy and concentration of students depends on several factors, including the type of game, content, design, and duration of use. Also, it should not be forgotten that the balanced and regular use of educational computer games along with other educational activities can facilitate the improvement of students' performance and concentration.

The limitation of the research was being limited to eighth-grade female students in Kerman, as well as the lack of follow-up and being limited to examining accuracy and concentration, which are influential factors for generalizing the results. Therefore, it is suggested to check other cities and bases in the case of boys. In addition, follow-ups with short-term and long-term intervals should be used. To check the effectiveness of the results more precisely. Also, conducting research comparing these methods with pharmaceutical, behavioral, cognitive, metacognitive, etc. methods can be effective.

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