



## Investigating the Impact of Strategy in Educational Computer Games in the Management of the Creative Thinking in Children Using Interactive Approaches: A Randomized Controlled Clinical Trial Study

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### Original Article

#### Abstract

**Introduction:** The main purpose of the present study was to investigate the effect of educational computer games on the management of the creative thinking in children using interactive approaches.

**Materials and Methods:** In this randomized controlled clinical trial study, the statistical population consisted of all first-grade students in Shiraz City, Iran, in the academic year of 2019-2020. 60 children were selected using cluster random sampling method. Data were collected using a questionnaire that measured the subjects' abilities in interactive performance and creative thinking skills. Children were randomly assigned to experimental and control groups. The experimental group was exposed to computer games training, and the control group continued traditional training. The results were analyzed using covariance method.

**Results:** Educational computer game strategy had a significant effect on creative thinking management with the impact intensity of 17.8%. The f statistic was 9.83 for social skills ( $P = 0.003$ ), and the impact intensity was 49.9%.

**Conclusion:** Probably educational computer games may enhance creativity and social interactions in children, which in turn has a great impact on individual life, as well as social and personal skills.

**Keywords:** Computer games strategy, Creative thinking management, Interactive approaches, Educational games, Therapeutic games

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#### Introduction

In today's digital world, with the proliferation of smartphones as well as the hardware advancement of gaming consoles and personal computers, the computer game industry has become one of the inseparable hobbies of human beings; In such a way that every individual, even after getting a few minutes of free time between his daily tasks, quickly goes to his smartphone and starts to play. The development of computer games in Iran is very new, and one can talk more about the shortcomings than the progress in this case (1).

Creativity, ideas, or new and useful solutions and in fact, divergent thinking in solving problems are measured using tests made in this regard (2). Today, psychologists believe that creativity can be acquired and taught (3). Having creative thinking leads to discovery, problem solving, innovation, and success in individual and social life, and ultimately, it will play a significant role in the satisfaction of personal and social life of individuals (4). Creative thinking skills are skills that a person acquires by combining problem-solving skills and decision-making with new ideas or

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relationships, and finds the ability to discover and choose new solutions (5). Educational computer games have a great impact on the creativity of human beings, especially children and adolescents (6) and are one of the important sources for the development of their creativity (7). Numerous investigations have been accomplished on the impact of computer games on the dimensions of creativity among children and adolescents (6,8,9). Since playing is part of a student's thinking in the elementary school, educational games can be one of the best methods to improve his learning to transmit many skills, values, and attitudes (10). Therefore, providing the ground to use them in the classroom is of remarkable importance.

The study of computer games is important because of their emergence and the position they have found among different age groups today, and since they are one of the first gateways for children and adolescents to enter the world of information and communication technology and computer skills (1,11-14). Computer games are no longer the only means of entertainment and have found several scientific and educational applications. This industry has largely educational outcomes and has significant effects due to its characteristics such as having relative interests, competitiveness, degrees of complexity, testability, and challenge (15,16).

At present, most studies conducted on computer games in the field of sociology and communication look at this phenomenon as a common social phenomenon in adolescents rather than an educational resource, but in the field of education and training, these games are considered in educational terms (7). Therefore, in the Iranian education system, it is necessary to pay special attention to the impact of educational computer game strategy on the management of creative thinking in children and the level of student interaction in learning. The present study is performed with the aim to investigate the strategy of educational computer games in managing creative thinking in children using interactive strategies.

### Materials and Methods

This study was a randomized controlled clinical trial conducted on students aged 7-7.5 years old in Shiraz, Iran, in the school year of 2019-2020. All stages of the study were approved by the ethics committee and its design was registered in the Iranian Registry of Clinical Trials (IRCT) system.

First, using the cluster random sampling method, Region 7 was selected from nine regions of Shiraz, and District 4 from four districts of this city. Then, among the primary schools of the afore-mentioned

district, 6 schools were randomly selected and from each class, given the existing first grades of this school, 5 students were randomly selected using online computer software. Therefore, out of 70 first grade students in these schools and based on the Morgan table and the availability of male students, 60 primary school students were randomly selected as the samples who were educating in District 4 Education Department of Shiraz in the school year of 2019-2020. In other words, the selection of male students was not based on specific inclusion criteria such as gender. After calculating the sample size, all stages of the study were discussed with the children's parents, and those who were willing to have their child participate in the study signed a conscious consent form before starting the project.

After conducting a pre-test of the Creative Thinking Questionnaire and Social Skills Rating System (SSRS), the samples were divided into two groups of test and control each with 30 subjects using a simple randomized lottery method. In the first stage, educational computer games available in the market were identified, and then from among them, the ones that best matched with the study variables were selected. The implementation method was such that after the necessary coordination with the selected schools and persuading the principal and teachers in applying the research project, first a pretest of the SSRS and Creative Thinking Questionnaire was performed on the subjects of the experimental and control groups. Then, the students of the experimental group performed educational computer games in ten 1-hour sessions for one month. During this period, the participants in the control group received the training information in the usual way. In the end, all members of both groups were re-evaluated in the post-test stage. All ethical and clinical criteria were fully observed and controlled in all stages of the study.

In order to measure the level of interactive strategies among the students, the standard teacher form of SSRS (17) and to measure creative thinking, the creative thinking questionnaire (18) were used which were completed with the help of the teacher and his assistant and collected.

**SSRS:** This questionnaire is addressed to teachers and educators and has been developed to assess students' social skills. This scale includes three special forms of assessment by parents, teachers, and students. Each of the scale forms can be used alone or in combination. The teacher form was used in the present study. The teachers completed the questionnaire for all students, which consisted of

47 three-point items (with options never, sometimes, and often). The content of this scale includes two main parts: social skills and behavioral problems. The reliability of the Persian version of this questionnaire was reported to be 0.74 to 0.95 (17). SSRS as one of the best scales for measuring social skills and problematic behaviors (19), has desirable construct and concurrent validity (20). After the experimental implementation and analysis of the items and calculation of their correlation with the whole test, 27 items were selected as the final social interaction questionnaire.

**Creative Thinking Questionnaire:** In order to measure the level of creative thinking in students, the Creative Thinking Skills Assessment Questionnaire (18) was employed, with a reliability value of 0.80 based on Cronbach's alpha coefficient. This questionnaire consists of 20 items with a five-point Likert measurement scale; the reliability of the Persian version of this questionnaire was calculated during the present study.

**Game:** Among the educational computer games available in the market, the educational game of Happiness School, version 1.2.5, which had the highest association with the study variables, was selected. This collection includes 26 educational games with the aim of teaching the basic concepts of the Science, Mathematics, and Persian courses. The main goals of this game are to teach the alphabet, to get acquainted with the social environment, to get acquainted with the concepts of planets and numerical and mathematical concepts, to make sentences, to find words, and so on. The game has a section to choose the selected individuals according to the highest score, which motivates children to earn more points and practice and try harder. The students of the experimental group were subjected to the educational computer game by the teacher for one month in 10 useful sessions (1 hour per session). During this period, the students of the control group received the educational information of the science course in the usual manner. At last, all members of both groups were re-evaluated in the post-test stage.

After collecting the data, the normal data distribution was investigated using the Shapiro-Wilk test. Comparison between the two groups was made

using the analysis of covariance (ANCOVA) test and changes within each group were also examined using Paired t-test. In each questionnaire, using Cronbach's alpha coefficient, some questions were removed if the item was removed. The reliability of the questionnaires was determined using Cronbach's alpha coefficient. Finally, the data were analyzed in SPSS software (version 22, IBM Corporation, Armonk, NY, USA).

## Results

All students in the two groups completed the study process. Due to the lack of drop of participants during the study, the intention to treat (ITT) analysis was not performed. The results of the Shapiro-Wilk test indicated that all the variables under study followed the normal distribution, and therefore, parametric tests were used to examine the study hypotheses. The demographic characteristics of the groups studied are presented in table 1.

There was no significant difference between the two groups in terms of demographic characteristics. The Cronbach's alpha coefficient was 0.92 and 0.90 for SSRS and the Creative Thinking Questionnaire, respectively. The scores of social skills and creative thinking of the two groups before and after the intervention are given in table 2.

Due to the significant difference in the pre-test data of social skills between the two groups ( $P \leq 0.001$ ), it was necessary to perform ANCOVA with controlling the pre-test data. The Levene's test was used to investigate the variance equality, which, with 95% confidence, the condition for variance equality was met. Therefore, ANCOVA was applicable.

Table 3 represents the results of ANCOVA of the strategy of educational computer games in the management of creative thinking and social skills.

Based on the data in table 3, it was found that the strategy of educational computer games had a significant effect on creative thinking ( $P = 0.001$ ,  $F_{(1,59)} = 12.34$ ), with an impact intensity of 17.8%. Additionally, the strategy of educational computer games had a significant effect on social skills ( $P = 0.003$ ,  $F_{(1,59)} = 9.83$ ) and the impact intensity of 49.9%.

**Table 1.** Demographic characteristics of the study groups

Variable	Group		Total	P value (Inter group)
	Control	Experimental		
Age (year)	7	15 (50.0)	20 (66.7)	0.197
	7.5	15 (50.0)	10 (33.3)	
Gender	Boy	30 (100)	30 (100)	60 (100)

Data are reported as number (%).

**Table 2.** Scores of social skills and creative thinking of the two groups before and after the study

Variable	Group	n	Pre-test	Post-test	P value (Intragroup)
Social skill	Experimental	30	2.85 ± 0.89	3.77 ± 1.30	0.005
	Control	30	2.13 ± 0.59	2.36 ± 0.86	0.002
	Total	60	2.49 ± 0.83	3.06 ± 1.31	0.011
	P value (Intergroup)		0.001	≤ 0.001	
Creative thinking	Experimental	30	2.68 ± 0.78	3.43 ± 1.30	0.004
	Control	30	2.44 ± 0.66	2.48 ± 0.75	0.021
	Total	60	2.56 ± 0.73	2.96 ± 1.16	0.003
	P value (Intergroup)		0.207	0.001	

Data are reported as mean ± standard deviation (SD).

### Discussion

The present study was accomplished with the aim to investigate the effect of educational computer games on the management of creative thinking in children using interactive strategies. The results suggested that playing educational computer games increased the social skills and creative thinking among the subjects in the experimental group, which could be observed during and after the computer game training sessions.

Play is generally a spontaneous, conscious, and unrealistic activity in which the child actively participates and enjoys performing it. Due to the flexibility in accessing a variety of programs, self-dynamism, rich content, and the ability to meet the needs of learners, understanding the types of games has received much attention from educational systems (21). This cognitive and interactive activity in a simulated or virtual environment can lead to the development of cognitive, perceptual, and motor processes, and its performance requires rapid information processing and the presentation of logical and dramatically rapid responses (22). Computer

games are referred to the games based on personal computers and order games, and are a type of game that is performed through computer technology (23) equipped with a processor (24). These types of games can help learning in scientific fields as an interactive content (25). In fact, in computer games, users are attracted to the game for non-educational reasons, but learn learning skills during the game (26).

The findings of a study revealed that training educational computer games significantly improved the academic achievement scores of the elementary school female students, in addition to enhancing their creativity; however, it seems that among the components of creativity, flexibility, initiative, expansion, and fluidity, these games led to a significant improvement only in the components of flexibility and fluidity (1). It is also claimed that these games promote problem-solving skills in students and stabilize social skills and are directly related to creative thinking. However, there was an inverse and significant correlation between perceived social support with the family scale and the use of computer games (27).

**Table 3.** Analysis of covariance (ANCOVA) results of the strategy of educational computer games in creative thinking management and social skills

Source	Total sum of squares	Degree of freedom	Mean squared	F	P value
Corrected model	14.135 <sup>*</sup>	2	7.068	6.180	0.004
Pre-test creative thinking	0.598	1	0.598	0.523	0.473
Group	14.111	1	14.111	12.338	0.001
Error	65.190	57			
Total	604.430	60			
Corrected model	79.326	59			
Adjusted R Squared = 0.149, R Squared = 0.178					
Corrected model	49.214 <sup>*</sup>	2	24.607		
Pre-test Social skill	19.533	1	19.533	27.253	≤ 0.001
Group	8.879	1	8.879	21.634	≤ 0.001
Error	51.465	57	0.903	9.834	0.003
Total	663.720	60			
Corrected model	100.679	59			
Adjusted R Squared = 0.417, R Squared = 0.489					

Given the studies, the growth of creative thinking in students in strategic computer games is better compared to the recreational computer games (28) and there is a significant difference between creativity and performance of students in proportion to experience and duration of performing computer games (29). In general, computer games involve creative and challenging issues that engage children and adolescents, and even many adults. Engaging with these games helps students with high-level cognitive skills such as problem solving and creativity (7). Another study revealed that there was no significant difference between the rate of group activity and entertainment of students who used computer games compared to the ones who did not use it, and the social relationships of students who used computer games were better compared to the students who did not use them (13). Moreover, computer games are said to be able to interfere with students' scientific and academic performance by creating a more attractive environment compared to homework (30). Thus, the results of the present study were consistent with the findings of previous investigations (1,4,7,10,13,27-29).

Many school students and even university students lack the power of proper reasoning and judging, which is the result of the lack of training them to think and reason in the childhood (31). Accordingly, the creativity development is one of the important goals of any country and its various educational systems. An examination of the vast changes in the last two decades of the twentieth century indicates that creativity is the core of all social, economic, and technological processes that has transformed the foundations of educational systems and has led the educational systems from providing purely educational programs to creative thinking training programs and teaching methods (32). In Iran, more than 50% of the population is under 15 years of age (33). A large percentage of children in this important period of their lives are engaged in mobile and computer games. The fact is that they cannot be removed from this powerful and enjoyable tool, but by designing serious and content-oriented games, they can be involved in games that, while enjoyable, also improve skills among them (34,35).

Computer games, due to their attractiveness, simultaneous use of different senses, and interaction with the user, provide an attractive and enjoyable environment for the user; so that many users play this type of games spontaneously and with a high level of desire (30). Therefore, it is recommended that authorities, administrators, teachers, and parents

prioritize computer games for students in the teaching and learning process. It is hoped that by conducting more studies on this model, therapists and educators will become more aware of the power and influence of technology and be able to benefit the most from the positive aspects of this powerful tool.

### Limitations

One of the most important limitations of the present study was that, given the timing of the conference, the researchers did not have sufficient time to conduct follow-up tests to examine the persistence of the effectiveness of educational computer games.

### Recommendations

It is recommended that officials, administrators, teachers, and parents make computer games a priority in the process of teaching and learning students.

### Conclusion

The results of the present study suggested that the application of educational computer games can be an important tool to increase creativity and social interactions in children and adolescents, which has a wide impact on life and social and personal skills of individuals.

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### Authors' Contribution

Narges Mirani-Sargazi: Study design and ideation,

data collection, manuscript preparation, specialized manuscript evaluation in terms of scientific concepts, confirmation of the final manuscript to be submitted to the journal office, responsibility for maintaining the integrity of the study process from the beginning to publication, and responding to the referees' comments; Maryam Shafie-Sarvestani: Analysis and interpretation of results, manuscript preparation, specialized manuscript evaluation in terms of scientific concepts, confirmation of the final manuscript to be submitted to the journal office, responsibility for maintaining the integrity of the study process from the beginning to publication, and responding to the referees' comments; Fatemeh Poodineh: Attracting financial resources for the study, supportive, executive, and scientific services of the study, providing study equipment and samples, analysis and interpretation of results, manuscript preparation, specialized manuscript evaluation in terms of scientific concepts, confirmation of the final manuscript to be submitted to the journal office, responsibility for maintaining the integrity of the study process from the beginning to publication, and responding to the referees' comments; Mohammad Sadegh Besharat: Attracting financial resources for the study, data collection, specialized statistics services,

manuscript preparation, specialized manuscript evaluation in terms of scientific concepts, confirmation of the final manuscript to be submitted to the journal office, responsibility for maintaining the integrity of the study process from the beginning to publication, and responding to the referees' comments.

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### Conflict of Interest

The authors declare no conflicts of interest.

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