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Effectiveness of Educational Games Based on Social Constructivist Approach in Interaction with Learning Styles on Improving Multiple Intelligences of Elementary Students

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A B S T R A C T

Objective: The current study aimed to examine the effectiveness of educational games based on the social constructivist approach in interaction with learning styles on improving multiple intelligences of fifth-grade female elementary students.

Methods and Materials: The research method was a quasi-experimental design with pre-test, post-test with control groups, accompanied by a 2-month follow-up phase. The statistical population included all fifth-grade female students enrolled in public schools in Hamedan during the 2023-2024 academic year. In the first phase, using simple random sampling, one school from the Hamedan city areas was selected, and 100 of them were chosen through screening and then randomly assigned into 2 experimental groups (25 students in the deep learning group and 25 in the surface learning group) and 2 control groups (25 students in the deep learning group and 25 in the surface learning group). The experimental groups underwent six 90-minute sessions of educational games based on the social constructivist approach; however, the control groups did not receive any intervention and remained on the waiting list. The two-factor Learning Process Questionnaire (R-LPQ-2F) by Biggs et al. (2001), and the Multiple Intelligences Developmental Assessment Scales (MIDAS) questionnaire by Shearer (1996) were used for data collection. Data analysis was performed using mixed ANOVA and Bonferroni post-hoc tests with SPSS version 24.

Findings: The results showed that educational games based on the social constructivist approach were more effective in students with deep learning styles than those with surface learning styles in improving multiple intelligences ($P<0.05$).

Conclusion: It can be concluded that educational games based on the social constructivist approach can be used as an appropriate educational method for improving multiple intelligences, especially in elementary students with deep learning styles.

Keywords: *Educational games, social constructivist approach, learning styles, multiple intelligences.*

1. Introduction

One of the most controversial theoretical foundations in the field of education and learning is intelligence approaches. Intelligence is closely tied to schooling since it has long been believed that intelligence plays a significant role in academic success (Rile et al., 2015; Schutte et al., 1998). Intelligence is considered one of the significant factors in human adaptability to the environment and in differentiating individuals from one another. Gardner views intelligence as a capacity for problem-solving or creating products that are valued in one or more cultural settings. Some consider intelligence as a single entity, while others view it as comprising multiple, distinct components (Gardner, 2011).

Gardner contested the theory of a general intelligence that assesses all human capacities and abilities. According to him, every individual possesses a variety of human intelligences and capabilities. Consequently, Gardner (2011) categorized eight types of intelligence: logical-mathematical, visual-spatial, bodily-kinesthetic, linguistic-verbal, musical, intrapersonal, interpersonal, and naturalist. Gardner's theory of multiple intelligences has criticized traditional assessment methods and teaching materials in schools, allowing for individual differences among students to express themselves and for teachers to provide appropriate learning experiences that stimulate multiple intelligences (Gardner, 2011; Najafabadi et al., 2014). Moreover, the theory claims that every individual can possess all multiple intelligences and that most people can develop intelligence to an adequate level, with intelligent individuals usually performing complex tasks and information being expressed and acquired through various methods (Rile et al., 2015). Gardner also states that intelligence can be taught, and anyone at any age can achieve a level of intelligence skills through learning (Drawbaugh, 2002). Psychologists believe that individuals' differing performances are due to possessing various types of intelligence, which play a decisive role in their lives (Pasha Sharifi, 2005). However, several factors such as heredity and environment, age, gender (Kristanto et al., 2019), race and nationality (Frossard et al., 2012), family, teachers, and educational environment (Dortaj, 2014) affect the ability and realization of intelligence. With the emergence of cognitive psychology and constructivism, education, instead of being limited to the transfer of knowledge from teacher to learner, enables learners to be creators of their own knowledge, skills, and cognitive structures. Thus, learning occurs when learners can establish a reciprocal relationship between objective facts and fundamental concepts (Rile et al., 2015). One of the methods used to expand and improve educational situations is the use of educational games. Educational games, as a new tool for learning socio-cultural content, are presented in an attractive manner and have been well received. Educational games are entertaining activities that can be used as teaching tools or as entertainment designed to support learning (Kristanto et al., 2019).

For a long time, most people considered play to be a futile and worthless activity, but today we certainly know that play is one of the most important needs of a child. This need is better realized in the realm of strengthening and acquiring social cooperation, self-confidence, intelligence, creativity, as well as eliminating childhood complexes and gaining the ability to achieve greater efficiency (Shariatmadari et al., 2011). Researchers concluded that: Play is essential for a child's life and has a significant impact on the child's mental and physical development. Through play, the child identifies their weaknesses and focuses on their strengths; moreover, by playing, the child expresses their feelings and distances themselves from all the preoccupations of life. Recent research has shown that play has a significant impact on the physical and mental development of children. Through play, the child learns, invents, and experiences. Through play, the child can become aware of their talents, abilities, desires, weaknesses, and positive and negative points, thereby reinforcing the construction of their personality (Frossard et al., 2012; Gosper & McNeill, 2012; Mehdinezhad V & Esmaeeli R, 2015).

Learner-centered game design is a productive and creative approach to teaching and learning (Frossard et al., 2012) and the subject of learner-centeredness and the application of the constructivist approach is one of the matters that educational experts emphasize. According to Zemlianski & Wilcox (2010), employing constructivism and constructivist learning views in game design enables players to fully engage in learning activities, providing opportunities for problem-solving, self-expression, and gaining experiential learning (Zemliansky & Wilcox, 2010). Additionally, it can be said that game-based learning can provide immersive experiences in simulating authentic environments, enabling students to master basic knowledge through complex concepts and higher-order metacognitive skills and creativity (Gosper & McNeill, 2012). Overall, considering what has been said, student-centered learning is a primary driver behind educational policy and practice in the modern age (Coleman & Money, 2020) and moving

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towards embracing learner-centeredness in the classroom, especially in mathematics learning, understanding where such games are offered and their yet undiscovered potentials is crucial. Therefore, this research aims to identify the effects of educational games based on the social constructivist approach in interaction with learning styles on improving multiple intelligences in mathematics among fifth-grade female elementary students.

2. Methods and Materials

2.1. Study Design and Participants

This research was of a quasi-experimental type, employing a pre-test, post-test design with control groups, alongside a two-month follow-up. The population consisted of all fifth-grade female students studying in public schools in Hamedan during the 2023-2024 academic year. Given the extensive population, cluster random sampling was used. Initially, one of the educational districts of Hamedan was randomly selected, and then, for sample selection, a 600-student primary school was randomly chosen from the selected district. From this school, 100 students who met the entry criteria for the research were randomly divided into four groups of 25 (25 students in the educational games group with surface learning style, 25 in the educational games group with deep learning style, 25 in the control group with surface learning style, and 25 in the control group with deep learning style). Considering that experimental research suggests a group size of 15, this study selected 25 individuals per group to generalize the results more broadly.

After obtaining ethical consent, the experimental groups participated in training with educational games based on the constructivist approach, while the control groups did not receive any such training and continued their usual daily activities, remaining on the waiting list. These interventions were conducted by trained teachers at the selected school, with one 1.5-hour session each week. After the training sessions concluded, all groups took the post-test under the same conditions. A follow-up phase was also conducted after two months.

2.2. Measures

2.2.1. Learning Process

The Two-Factor Learning Process Questionnaire (R-LPQ-2F) by Biggs et al. (2001) consists of 20 items based on a 5-point Likert scale and measures two approaches: surface (surface motivation with questions 3, 7, 11, 15, and 19; surface strategy with questions 4, 8, 12, 16, and 20) and deep (deep motivation with questions 1, 5, 9, 13, and 17; deep strategy with questions 2, 6, 10, 14, and 18) (Biggs et al., 2001). The scale's validity in Iran was checked and confirmed through factor analysis. The questionnaire's reliability was assessed using Cronbach's alpha, reporting a coefficient of 0.88 (Sheivandi & Dartaj, 2017; Shokri, 2014). In this study, reliability was calculated with Cronbach's alpha, yielding coefficients of 0.71 for the pre-test, 0.82 for the post-test, and 0.91 for the follow-up. Validity was also examined and confirmed through content validity.

2.2.2. Multiple Intelligence

The Multiple Intelligences Developmental Assessment Scales (MIDAS) by Shearer (1996) is a 80-item self-report measure of an individual's intelligence status, to be completed by the individual or others such as parents or teachers who have sufficient information about the individual, and is based on a 5-point Likert scale. The scale's creator reported its reliability with Cronbach's alpha coefficients ranging from 0.76 to 0.87 and test-retest reliability ranging from 0.76 to 0.92 (Shearer, 1996). In Iran, the overall reliability of the questions was 0.95, with specific reliabilities for linguistic-verbal at 0.92, logical-mathematical at 0.91, visual-spatial at 0.88, bodily-kinesthetic at 0.71, interpersonal at 0.90, intrapersonal at 0.81, musical at 0.66, and naturalist at 0.62. Additionally, its criterion validity was examined, showing correlation coefficients with the Emotional Intelligence Scale (SSREL) by Schutte et al. (1998) ranging from 0.12 to 0.34 (Najafabadi et al., 2014; Schutte et al., 1998). Reliability in this study was assessed using Cronbach's alpha, resulting in coefficients of 0.80 for the pre-test, 0.85 for the post-test, and 0.87 for the follow-up. Validity was also examined and confirmed through content validity.

2.3. Interventions

2.3.1. Sessions of Educational Games Based on Social Constructivist Approach

The sessions of educational games based on the social constructivist approach were held over six 90-minute weekly sessions for one and a half months, following the protocol by MahdaviNasab et al. (2016) (MahdaviNasab et al., 2017).

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2.4. Data analysis

After collecting the pre-test, post-test, and follow-up data, descriptive statistics such as mean and standard deviation, and inferential statistics including mixed ANOVA (repeated measures) were used for data analysis. Furthermore, to compare the assessment stages (pre-test, post-test, and follow-up) and to compare the educational games based on the social constructivist approach in interaction with learning styles (surface and deep), Bonferroni post-hoc tests were used in SPSS version 24.

3. Findings and Results

Before examining the research hypotheses, the mean of the dependent variables in the experimental and control groups with deep and surface learning styles was calculated, with results presented in Table 1 and Table 2.

Table 1

Mean and Standard Deviation of Dependent Variables in the Experimental and Control Groups (Deep Learning Style)

Dependent Variables	Stage	Experimental Group Mean	Experimental Group SD	Control Group Mean	Control Group SD
Linguistic-Verbal Intelligence	Pre-test	24.04	1.136	26.12	0.971
	Post-test	29.52	1.686	26.20	1.000
	Follow-up	29.44	1.781	26.24	1.012
Logical-Mathematical Intelligence	Pre-test	29.52	1.686	29.28	1.671
	Post-test	31.68	1.676	29.40	1.780
	Follow-up	31.64	1.777	29.36	1.800
Visual-Spatial Intelligence	Pre-test	26.04	1.136	29.16	0.943
	Post-test	29.76	1.589	26.24	0.970
	Follow-up	29.68	1.796	26.28	0.980
Bodily-Kinesthetic Intelligence	Pre-test	26.08	1.152	26.20	0.957
	Post-test	29.80	1.555	26.28	0.980
	Follow-up	29.80	1.633	26.36	1.036
Interpersonal Intelligence	Pre-test	26.08	1.116	26.16	0.943
	Post-test	29.56	1.609	26.24	1.012
	Follow-up	29.52	1.610	26.28	1.021
Intrapersonal Intelligence	Pre-test	29.56	1.609	29.32	1.725
	Post-test	31.72	1.595	29.44	1.850
	Follow-up	31.60	1.893	29.40	0.871
Musical Intelligence	Pre-test	26.08	1.115	26.16	0.987
	Post-test	29.56	1.609	26.28	1.061
	Follow-up	29.52	1.610	26.32	1.069
Naturalist Intelligence	Pre-test	29.56	0.609	29.32	1.676
	Post-test	31.72	1.595	29.44	1.781
	Follow-up	31.65	1.533	29.40	1.855

Table 1 shows the mean and standard deviation of the dependent variables for the experimental and control groups (with a deep learning style) across the assessment stages (pre-test, post-test, and follow-up) for the students.

Table 2

Mean and Standard Deviation of Dependent Variables in the Experimental and Control Groups (Surface Learning Style)

Dependent Variables	Stage	Experimental Group Mean	Experimental Group SD	Control Group Mean	Control Group SD
Linguistic-Verbal Intelligence	Pre-test	26.08	0.954	26.08	0.954
	Post-test	27.64	1.411	26.16	0.943
	Follow-up	27.68	1.574	26.20	0.913
Logical-Mathematical Intelligence	Pre-test	29.36	1.753	29.32	1.701
	Post-test	31.52	1.610	29.36	1.705
	Follow-up	31.44	1.530	29.40	1.732
Visual-Spatial Intelligence	Pre-test	26.12	1.054	26.16	0.943
	Post-test	27.84	1.675	26.24	0.926
	Follow-up	28.08	1.956	26.28	0.891
Bodily-Kinesthetic Intelligence	Pre-test	26.16	1.068	26.20	0.957

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	Post-test	27.84	1.650	26.28	0.936
	Follow-up	28.00	1.893	26.32	0.900
Interpersonal Intelligence	Pre-test	26.12	0.971	26.16	0.943
	Post-test	27.68	1.520	26.24	0.926
	Follow-up	27.72	1.671	26.36	0.952
Intrapersonal Intelligence	Pre-test	29.40	1.803	29.40	1.780
	Post-test	31.56	1.635	29.44	1.781
	Follow-up	31.48	1.558	29.52	1.851
Musical Intelligence	Pre-test	26.12	0.971	26.16	1.028
	Post-test	27.72	1.429	26.24	1.012
	Follow-up	27.76	1.589	26.28	0.980
Naturalist Intelligence	Pre-test	29.44	1.685	29.48	1.686
	Post-test	31.48	1.558	29.52	1.686
	Follow-up	31.40	1.500	29.56	1.710

Table 2 displays the mean and standard deviation of the dependent variables for the experimental and control groups (with a surface learning style) across the assessment stages (pre-test, post-test, and follow-up) for the students. Additionally, before performing the mixed ANOVA analysis, its assumptions including the Shapiro-Wilk test for normality, Levene's test for homogeneity of variances, M-Box test for the examination of variance-covariance matrices, multicollinearity, and linearity (scatter plots) were tested. The Mauchly's Test of Sphericity yielded a significance level of 0.001 for multiple intelligences, thus the sphericity assumption was violated. Consequently, the assumption of equal variances and more precisely, the condition of homogeneity of the covariance matrix was not assured, leading to a deviation from the F-statistical model. Therefore, the Greenhouse-Geisser test was used to examine the within-subject effects, with results shown in Table 3.

Table 3

Results of Between-Subject Effects on Multiple Intelligences

Dependent Variables	Source of Variation	F Statistic	Significance	Effect Size	Statistical Power
Linguistic-Verbal Intelligence	Group	22.763	0.001	0.416	0.999
	Time	104.779	0.001	0.522	0.999
	Group × Time	38.688	0.001	0.547	0.999
Logical-Mathematical Intelligence	Group	7.439	0.001	0.189	0.983
	Time	79.460	0.001	0.453	0.999
	Group × Time	22.814	0.001	0.416	0.991
Visual-Spatial Intelligence	Group	22.682	0.001	0.417	0.999
	Time	116.286	0.001	0.548	0.999
	Group × Time	41.685	0.001	0.566	0.999
Bodily-Kinesthetic Intelligence	Group	23.798	0.001	0.427	0.999
	Time	121.029	0.001	0.558	0.999
	Group × Time	43.869	0.001	0.578	0.999
Interpersonal Intelligence	Group	22.522	0.001	0.413	0.999
	Time	108.551	0.001	0.531	0.999
	Group × Time	39.106	0.001	0.550	0.991
Intrapersonal Intelligence	Group	6.682	0.001	0.173	0.970
	Time	74.326	0.001	0.436	0.999
	Group × Time	20.954	0.001	0.396	0.999
Musical Intelligence	Group	22.325	0.001	0.411	0.999
	Time	110.835	0.001	0.536	0.999
	Group × Time	39.434	0.001	0.552	0.999
Naturalist Intelligence	Group	6.981	0.001	0.179	0.976
	Time	85.415	0.001	0.471	0.999
	Group × Time	24.478	0.001	0.433	0.991

The results of Table 3 indicated that the impact of educational games based on the social constructivist approach on improving multiple intelligences is significant. Subsequently, a pairwise comparison of the adjusted mean

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scores of the test stages (pre-test, post-test, and follow-up) for multiple intelligences is presented in Table 4.

Table 4

Bonferroni Post-Hoc Test Results for Multiple Intelligences to Assess Result Stability

Dependent Variables	Stage	Adjusted Mean	Stage Difference	Mean Difference	Significance
Linguistic-Verbal Intelligence	Pre-test	26.080	Pre-test - Post-test	-1.300	0.001
	Post-test	27.380	Pre-test - Follow-up	-1.310	0.001
	Follow-up	27.390	Post-test - Follow-up	-0.010	0.999
Logical-Mathematical Intelligence	Pre-test	29.370	Pre-test - Post-test	-1.120	0.001
	Post-test	30.490	Pre-test - Follow-up	-1.090	0.001
	Follow-up	30.460	Post-test - Follow-up	0.030	0.538
Visual-Spatial Intelligence	Pre-test	26.120	Pre-test - Post-test	-1.400	0.001
	Post-test	27.520	Pre-test - Follow-up	-1.460	0.001
	Follow-up	27.580	Post-test - Follow-up	-0.060	0.292
Bodily-Kinesthetic Intelligence	Pre-test	26.160	Pre-test - Post-test	-1.390	0.001
	Post-test	27.550	Pre-test - Follow-up	-1.460	0.001
	Follow-up	27.620	Post-test - Follow-up	-0.070	0.055
Interpersonal Intelligence	Pre-test	26.130	Pre-test - Post-test	-1.300	0.001
	Post-test	27.430	Pre-test - Follow-up	-1.340	0.001
	Follow-up	27.470	Post-test - Follow-up	-0.040	0.469
Intrapersonal Intelligence	Pre-test	29.420	Pre-test - Post-test	-1.120	0.001
	Post-test	30.540	Pre-test - Follow-up	-1.080	0.001
	Follow-up	30.500	Post-test - Follow-up	0.040	0.855
Musical Intelligence	Pre-test	26.130	Pre-test - Post-test	-1.320	0.001
	Post-test	27.450	Pre-test - Follow-up	-1.340	0.001
	Follow-up	27.470	Post-test - Follow-up	-0.020	0.999
Naturalist Intelligence	Pre-test	29.450	Pre-test - Post-test	-1.090	0.001
	Post-test	30.540	Pre-test - Follow-up	-1.060	0.001
	Follow-up	30.510	Post-test - Follow-up	0.030	0.538

To identify at which stage the multiple intelligences scores significantly differ, the Bonferroni post-hoc test was used for pairwise comparisons of means. As shown in Table 4, the difference between the pre-test and post-test mean scores (the effect of the intervention) and the difference between the pre-test and follow-up mean scores (the effect of time) were more significant than the difference between the post-test and follow-up mean scores (the effect of the intervention's stability). This indicates that the educational games based on the social constructivist approach had an impact on multiple intelligences at the post-test stage, and this effect persisted into the follow-up phase. Moreover, since the results do not clarify which learning style (deep or surface) the educational games based on the social constructivist approach interacted more effectively with, further analysis was conducted to examine the differential effectiveness of these educational games in conjunction with deep and surface learning styles on improving multiple intelligences, with results presented in Table 5.

Table 5

Bonferroni Post-Hoc Test Results for Multiple Intelligences to Assess More Effective Treatment

Dependent Variables	Intervention Groups	Comparison Group	Mean Difference	Significance
Linguistic-Verbal Intelligence	Experimental Group (Deep)	Control Group (Deep)	2.147	0.001
	Control Group (Surface)		2.187	0.001
	Experimental Group (Surface)	Control Group (Deep)	0.947	0.015
		Control Group (Surface)	0.987	0.010
Logical-Mathematical Intelligence	Experimental Group (Deep)	Control Group (Deep)	1.600	0.001
	Control Group (Surface)		1.587	0.001
	Experimental Group (Surface)	Control Group (Deep)	1.427	0.013
		Control Group (Surface)	1.413	0.014
Visual-Spatial Intelligence	Experimental Group (Deep)	Control Group (Deep)	2.267	0.001

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	Control Group (Surface)		2.267	0.001
	Experimental Group (Surface)	Control Group (Deep)	1.120	0.004
		Control Group (Surface)	1.120	0.004
Bodily-Kinesthetic Intelligence	Experimental Group (Deep)	Control Group (Deep)	2.280	0.001
	Control Group (Surface)		2.293	0.001
	Experimental Group (Surface)	Control Group (Deep)	1.053	0.007
		Control Group (Surface)	0.067	0.006
Interpersonal Intelligence	Experimental Group (Deep)	Control Group (Deep)	2.160	0.001
	Control Group (Surface)		2.133	0.001
	Experimental Group (Surface)	Control Group (Deep)	0.947	0.014
		Control Group (Surface)	0.920	0.019
Intrapersonal Intelligence	Experimental Group (Deep)	Control Group (Deep)	1.573	0.001
	Control Group (Surface)		1.507	0.001
	Experimental Group (Surface)	Control Group (Deep)	1.427	0.017
		Control Group (Surface)	1.360	0.026
Musical Intelligence	Experimental Group (Deep)	Control Group (Deep)	2.133	0.001
	Control Group (Surface)		2.160	0.001
	Experimental Group (Surface)	Control Group (Deep)	0.947	0.015
		Control Group (Surface)	0.973	0.012
Naturalist Intelligence	Experimental Group (Deep)	Control Group (Deep)	1.600	0.001
	Control Group (Surface)		1.467	0.001
	Experimental Group (Surface)	Control Group (Deep)	1.387	0.014
		Control Group (Surface)	1.253	0.035

According to Table 5, the results showed that the difference in mean scores for the experimental group with a deep learning style compared to the control group (with both deep and surface learning styles) was greater than the difference in mean scores for the experimental group with a surface learning style compared to the control group (with both deep and surface learning styles). This indicates that educational games based on the social constructivist approach in conjunction with a deep learning style are more effective than those in conjunction with a surface learning style in improving multiple intelligences. Therefore, the effectiveness of educational games based on the social constructivist approach on multiple intelligences varies between students with deep and surface learning styles, confirming the existence of a difference.

4. Discussion and Conclusion

The purpose of the present study was to investigate the effectiveness of educational games based on the social constructivist approach in interaction with learning styles on improving multiple intelligences of fifth-grade female elementary students. The results indicated that the impact of educational games based on the social constructivist approach on improving multiple intelligences is significant. Educational games based on the social constructivist approach, in conjunction with a deep learning style, were more effective than those in conjunction with a surface learning style in improving multiple intelligences.

This finding aligns with the results of previous studies (Bressler et al., 2018; MahdaviNasab et al., 2017; Vasalou et al., 2017), with no contradictory findings identified for this hypothesis. In explaining this result, it can be said that students who perceive learning as merely increasing knowledge or memorization are unlikely to pursue a deep approach to their learning. However, students who view learning with the goal of truly understanding reality are more likely to adopt a deep approach, which aligns with the objectives of most teachers. Students who consider the nature of assessment as an encouragement for recall are more likely to choose a surface approach (Mehdinezhad V & Esmaeeli R, 2015). Each student's learning style can differ, with some adopting a surface and others a deep approach. These learning styles can play a decisive role in educational games based on the constructivist approach. Employing constructivism and constructivist learning views in game design enables students to fully engage in learning activities and provides opportunities for problem-solving, self-expression, and experiential learning. The constructivist approach focuses on the authenticity and reality of learning experiences, aiding students with a deep learning style to be more capable in solving real-life problems. The constructivist approach emphasizes education based on real-world problems, where students with a deep learning style can enhance their capabilities in multiple intelligences. Thus, it is logical to state that there is a difference in the effectiveness of educational games based on the social

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constructivist approach on multiple intelligences between students with deep and surface learning styles.

5. Limitations & Suggestions

The findings of this study can be utilized in developing educational programs based on the social constructivist approach for counseling centers, elementary schools, playhouses, etc. Teachers are advised to tailor their teaching to the learning styles of their students and align their instruction with educational games according to learning theories and educational principles based on the social constructivist theory, employing these educational games as an active strategy in service of the classroom and students. The follow-up phase in this study was two months long; thus, it is recommended that future research considers a longer follow-up phase (more than six months or even a year) to investigate the sustainability of the impact of educational games based on the social constructivist approach on students. Since this study was limited to female students, to overcome this limitation, it is suggested that similar research be conducted on boys, as gender may influence the research outcomes. Applied research on similar topics regarding the effectiveness of educational games based on the social constructivist approach on addressing other student issues in elementary schools, such as learning disorders, attention deficit/hyperactivity disorder, etc., should be undertaken.

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Declaration of Interest

The authors of this article declared no conflict of interest.

Ethics Considerations

The study protocol adhered to the principles outlined in the Helsinki Declaration, which provides guidelines for ethical research involving human participants.

Transparency of Data

In accordance with the principles of transparency and open research, we declare that all data and materials used in this study are available upon request.

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Authors' Contributions

All authors equally contributed to this article.

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