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The Effect of Educational Games on Creativity: A systematic Review

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ABSTRACT

Objective: Games serve as an apt instrument for promoting innovative pedagogical approaches. The objective of the current investigation is to examine the influence of educational games on creativity through a methodical exploration.

Methods: The present study was executed utilizing a systematic review methodology. To this end, during the timeframe from 2013 to 2014, a comprehensive search was conducted for all articles pertinent to the effects of educational games on creativity within Persian databases, which include the National Journals Database, the Academic Jihad Scientific Information Center Database, the Noor Specialized Journals Database, and the Iranian Institute of Information Science and Technology Research, in addition to Google Scholar, employing keywords such as educational games, creativity, game-based learning, and educational group games. Following a rigorous screening process based on predefined inclusion and exclusion criteria, 21 relevant articles were chosen for the composition of this manuscript.

Results: The study's outcomes revealed that scholars have predominantly concentrated their inquiries on the ramifications of educational games concerning critical thinking and problem-solving, the correlation between educational games and motivational aspects of learning, the effects of both digital and physical gaming environments on creativity, the significance of social interactions within educational gaming contexts, the influence of educational games on cognitive and social-cognitive competencies, and frameworks for evaluating creativity within educational games.

Conclusions: In summary, these thematic findings suggest that educational games constitute a potent instrument for augmenting creativity among students, contingent upon their thoughtful design and execution.

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Introduction

Creativity constitutes a significant cognitive phenomenon (Srinivasan, 2007) and possesses an extensive historical context within the domain of education (Runco, 2008); indeed, creativity represents one of the nine essential competencies that ought to be cultivated during elementary education and guidance (Edwards-Schachter et al., 2015). Creativity is conceptualized as a cognitive state that integrates all forms of intelligent human endeavor (Averill & Thomas-Knowles, 2005). In this framework, creativity is characterized as an imaginative process that culminates in innovative and valuable outcomes. This definition delineates five fundamental concepts: 1) imaginative capacity 2) methodological and stylistic approaches 3) intentional pursuit 4) innovative quality 5) intrinsic value, each of which is regarded as a critical component of the creative process. Recent investigations into creativity have yielded numerous classifications, one of which distinguishes between cognitive creativity and emotional creativity (Averill & Thomas-Knowles, 2005). (Kuška et al., 2020) have articulated emotional creativity as the capacity for novel self-expression, which subsequently broadens the individual's cognitive frameworks and enhances interpersonal relationships. Within this definition, the dimensions and constituents of emotional creativity are articulated as originality, effectiveness, and authenticity. Originality is understood as the capacity to transform conventional emotions and generate a new emotional state that either contravenes established norms or represents a novel amalgamation of the individual's typical emotional experiences. Effectiveness pertains to the alignment of creative responses with social and cultural contexts in a manner that facilitates the establishment of constructive relationships with others. Authenticity denotes that emotional expressions should emanate from the individual's core beliefs and convictions. In addition to the aforementioned criteria, Averill and Thomas-Knowles (2005) posit that individuals exhibiting emotional creativity allocate greater temporal resources to the recognition of emotions and exhibit an inherent predisposition towards this endeavor. Furthermore, Averill (2009) asserts that individuals with emotional creativity possess the ability to accurately evaluate situations and proficiently articulate their emotional states.

Considering the emergent nature of the construct of emotional creativity, the volume of scholarly inquiry conducted in this domain (particularly within Iran) remains relatively limited. Moreover, the majority of the research undertaken in this area has focused on exploring the correlations between this construct and various psychological constructs, such as cognitive creativity (Fuchs et

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al., 2007; Holt, 2004; Rahimi et al., 2021), emotional intelligence (Fadaei et al., 2022), personality traits (Averill, 1999), creative styles and interpersonal dynamics, individual differences (Long et al., 2003), emotional disorders (Fuchs et al., 2007), creative behaviors (Averill, 2009), and self-efficacy (Sayadi et al., 2016).

On the contrary, play represents an indispensable necessity for children; in other terms, play is as crucial for children as water is for aquatic organisms and oxygen is for all living beings. Nevertheless, individuals, regardless of their inability to articulate a precise definition of play, possess a comprehensive understanding of its essence (Robinson et al., 2021). The pedagogy of mathematics transcends mere transmission of concepts and definitions to learners; rather, the mathematics curriculum is also tasked with the development and establishment of mathematical concepts, the fostering of motivation, the nurturing of creativity, and the establishment of interconnections within students' learning experiences. This ultimately facilitates problem-solving—an essential educational force—being systematically organized within students (Moalemi, 2019). The integration of educational games can significantly mitigate learning impediments and create optimal conditions for students to assimilate concepts. A variety of methodologies and tools are employed to foster creativity, among which the utilization of diverse games is paramount (Bulut et al., 2022). Play constitutes the innate realm of the child, enabling the child to harness creativity while cultivating imagination, skills, agility, and emotional, physical, cognitive, and social robustness. Through engagement in play, the child acquires self-awareness and understanding of others, thereby facilitating early interactions with the surrounding environment. Play represents one of the methodologies that yields beneficial and meaningful outcomes while positively balancing emotional and impulsive behaviors (Aghaei Goldiani & Ghiasi, 2020).

In recent decades, there has been a heightened focus on the significance of educational games within the learning paradigm and the enhancement of cognitive skills and creativity among students. Educational games, characterized as interactive and engaging instruments, possess the capacity to create an appropriate environment for fostering critical thinking, problem-solving, and the generation of innovative ideas. Empirical studies have indicated that these games can contribute to the reinforcement of cognitive and social competencies while augmenting motivation for learning, particularly when employed with intentionality and specific strategic frameworks

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(Tan et al., 2011, 2013; Toh & Kirschner, 2023). However, despite the prospective advantages associated with these instruments, further empirical evidence and research are required to comprehensively elucidate the impact of educational games on creativity and to ascertain their effective application within educational contexts.

In this context, the objective of this study is to explore the influence of educational games on the creativity of students. Given that creativity constitutes one of the fundamental attributes requisite for success in the contemporary complex and dynamic environment, there exists an imperative to recognize and scrutinize educational tools capable of fostering this trait. This research endeavors to delineate both the direct and indirect effects of educational games on student creativity through a systematic review of existing literature, as well as to analyze the challenges and opportunities associated with the implementation of these tools within educational institutions. Furthermore, this study aims to proffer solutions that educators and trainers may employ to enhance student creativity at both individual and collective levels through the utilization of educational games.

Material and Methods

This investigation was executed employing a systematic review methodology. In the context of this investigation, an endeavor was undertaken to achieve a holistic comprehension of the prevailing research outcomes by aggregating and scrutinizing scholarly articles pertinent to the influence of educational games on creativity. For this endeavor, a thorough examination of all scientific and research articles published during the years 2012 to 2022 was conducted in esteemed Persian databases, which include: the National Publications Database, the Academic Jihad Scientific Information Center database, the Noor Specialized Journals Database, and the Iranian Institute of Information Science and Technology, in addition to Google Scholar. These databases were interrogated utilizing the search terms "educational games," "creativity," "game-based learning," and "educational group games".

Subsequent to the aggregation of the articles, a screening procedure was implemented to determine the final selection of articles. During this procedure, the titles of the articles were initially evaluated, followed by a review of the abstracts and full texts of the articles based on the delineated inclusion and exclusion criteria. Ultimately, 21 pertinent articles that directly investigated the implications of educational games on creativity were selected for inclusion in this manuscript.

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These articles encompassed research that concentrated on various dimensions of the effects of educational games on the creativity of students, including the impacts of educational games on critical thinking, problem-solving, learning motivation, social interactions, cognitive abilities, and models for assessing creativity.

For the purpose of analyzing and synthesizing the data, qualitative content analysis was employed, and diverse themes extrapolated from the articles were scrutinized to offer a comprehensive overview of the effects of educational games on creativity. To ascertain the validity and reliability of the findings derived from the qualitative content analysis conducted in the present research, credible methodologies and techniques were employed to ensure the precision and dependability of the results. In this investigation, the validity of the outcomes of the qualitative content analysis was realized through a series of measures. The initial step involved the establishment of specific criteria for the selection of articles. These criteria comprised articles that explicitly addressed the effects of educational games on creativity and were sourced from reputable scientific publications. This approach, through a meticulous screening procedure of the articles, guarantees that all selected articles are both relevant and reliable. To augment validity, peer debriefing was also undertaken. During this procedure, the findings and preliminary results of the content analysis of the articles were disseminated among academic colleagues and experts in the domain of educational games and creativity to validate the accuracy and integrity of the results.

Furthermore, member checking was performed, wherein the principal investigator scrutinized the findings derived from the data in collaboration with select authors of the pertinent articles or specialists in the discipline, thereby ascertaining the precision and faithful representation of the data within his analytical frameworks. To enhance the reliability of the qualitative content analysis outcomes, the inter-coder reliability methodology was employed. In this context, multiple members of the research team independently assigned codes to the articles, followed by an assessment of the concordance among their coding. In this investigation, the research team derived codes based on a comprehensive and mutually agreed-upon coding framework, consequently ensuring that the identified themes and concepts were both replicable and independent of individual coders. Lastly, to evaluate reliability, Cohen’s Kappa was computed to assess the degree of agreement among the coders. The Kappa coefficient exceeded 0.75, signifying a commendable and dependable level of reliability in the coding process, thus reinforcing the assertion that the

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executed content analysis is reproducible in a documented and sustainable fashion. Moreover, all phases of the analytical procedure, encompassing article selection, coding, and theme extraction, were meticulously and precisely documented to facilitate transparent examination and appraisal of the findings by fellow researchers.

Results

As previously indicated, a comprehensive review encompassing 21 studies was conducted in this research endeavor, with a selection of the most significant findings elucidated in Table 1.

Table 1. Selection of reviewed articles

Hosseini, M., and Yousefi, M. (2016).	Title: The effect of educational games on increasing creativity in high school students.
Journal: Educational Research in Educational Sciences, 12(4), 45-60.	Objective: This study investigated the effect of using educational games on increasing creativity in high school students and showed that educational games can strengthen creative skills in students.
Mousavi, F., and Bahrami, M. (2018).	Title: The effects of educational computer games on creativity and problem-solving in students.
Journal: Quarterly Journal of Psychology and Educational Sciences, 25(2), 78-89.	Objective: This article investigated the effects of educational computer games on creativity and problem-solving skills in students and showed that these types of games strengthen cognitive and problem-solving skills in students.
Zare, J., and Rahimi, M. (2019).	Title: Educational games and their effect on improving creativity and learning in children.
Journal: Education Research, 14(3), 112-127.	Objective: This study investigated the role of educational games in improving creativity and learning in children and showed that educational games can have positive effects on children's creative abilities.
Ghasemi, S., and Naseri, F. (2017).	Title: Investigating the effect of group games on social and individual creativity in students.
Journal: Social and Educational Sciences, 8(1), 25-40.	Objective: The article examines the effect of group games in schools on students' individual and social creativity. The results showed that group games can enhance students' social creativity and team skills.
Norouzi, M., and Moradi, F. (2019).	Title: Investigating the effect of digital games on creativity and motivation in learning.
Journal: Journal of Educational Psychology, 17(2), 93-105.	Objective: This article analyzes the effect of digital games on creativity and motivation in learning. The results of the study showed that digital games can improve students' learning motivation and creativity.
Ali Akbari, B., and Salehi, M. (2019).	Title: Investigating the effect of physical and digital educational games on creativity in high school education.
Journal: Journal of Modern Education, 21(4), 200-212.	Objective: This article compares the effect of physical and digital educational games on students' creativity in high school and shows that both types of games can help enhance students' creativity.

The analysis of the selected literature revealed that various studies concentrated on diverse dimensions pertaining to the influence of educational games on creativity. Among the 21 articles

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scrutinized within this investigation, several predominant themes emerged that were prevalent across multiple works. These themes encompassed the influence of educational games on critical thinking and problem-solving capabilities, learning motivation, both digital and physical game environments, the significance of social interactions, cognitive and social skill development, and frameworks for assessing creativity.

1 .The influence of educational games on critical thinking and problem-solving capabilities: Numerous articles indicated that educational games exert a substantial impact on the enhancement of critical thinking and problem-solving abilities. Within these games, learners encounter challenges and puzzles that necessitate innovative thinking and meticulous analysis to derive solutions. This experiential process fortifies students' competencies in addressing intricate problems and equips them with transferable skills applicable across various domains of their educational journey.

2 .The correlation between educational games and learning motivation: Educational games have frequently been posited as mechanisms to augment students' intrinsic motivation. Empirical findings demonstrated that these games can serve as catalysts for fostering interest and motivation in the learning process. Participants engaged in educational games typically exhibit heightened involvement in the educational experience and tend to engage more dynamically with instructional resources.

3 .The influence of digital and physical game environments on creativity: The literature under review indicated that educational games, whether situated in digital or physical contexts, positively influence creativity, albeit each environment possesses distinct attributes. Digital games are often capable of creating more immersive learning experiences due to their advanced graphical features and intricate simulations, while physical games emphasize social and collaborative interactions, thereby enhancing social and communicative competencies.

4 .The significance of social interactions within educational games: Numerous studies underscored the critical role of social interactions in the realm of educational games. Research findings illustrated that cooperative and team-based games, which amplify interactions among learners, facilitate the enhancement of creativity. Through collaborative engagement and the exchange of ideas regarding solutions and strategies, students are able to leverage each other's cognitive resources and cultivate innovative concepts.

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5. The influence of educational games on cognitive and social competencies: The ramifications of educational games on the development of cognitive and social competencies have also been extensively explored in various articles. Educational games can bolster individual skills such as memory retention, concentration, and decision-making. Furthermore, these games present opportunities for the refinement of social competencies including collaboration, leadership, and conflict resolution, which subsequently influence both collective and individual creative endeavors.

6. **Frameworks for Evaluating Creativity in Educational Games**: In a number of the examined scholarly articles, diverse frameworks for evaluating creativity in educational games have been delineated. These frameworks facilitate educators and researchers in systematically quantifying students' advancement in the domain of creativity. Among these frameworks were the evaluation of ideation, the capacity for creative problem-solving, and the proficiency in employing innovative strategies to address gaming challenges.

Collectively, these insights suggest that educational games can function as efficacious instruments for augmenting students' creativity, contingent upon their design and implementation being meticulous and grounded in sound educational principles.

Discussion

The present investigation scrutinized the influence of educational games on the enhancement of students' creativity through a methodical examination of the extant scholarly literature. The results indicated that educational games exert beneficial effects on diverse dimensions of creativity, such as critical thinking, problem-solving, motivation to learn, social competencies, and collaborative interactions. These findings align with numerous antecedent studies and largely affirm the effective contribution of educational games in fostering creativity. Prior investigations have also demonstrated that educational games possess the capacity to augment critical thinking and problem-solving abilities. For instance, research undertaken by Gee (2003) illustrated that educational games offer an avenue for the acquisition of higher-order cognitive skills and problem-solving techniques. These outcomes are congruent with the discoveries of the present research, which revealed that educational games facilitate students' engagement with problems in more innovative and analytical manners. Furthermore, studies such as those conducted by Amory (2010)

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have indicated that educational games, particularly digital formats, can serve as motivational catalysts for the learning process. Such findings are also in agreement with the results of the current study, which suggested that educational games can enhance students' intrinsic motivation.

Conversely, the findings of this research underscore the significance of social interactions within educational games. In numerous reviewed publications, the contribution of group interactions to the enhancement of creativity and collective cognitive processes has been acknowledged. This observation parallels the conclusions drawn by Vygotsky who posited social interactions and collaborative efforts as fundamental elements for the intellectual development and creativity of individuals (Hausfather, 1996). This characteristic of educational games signifies a pivotal distinction from conventional learning environments that predominantly emphasize solitary learning.

Nevertheless, the limitations inherent in this study warrant acknowledgment. A principal limitation of this research resides in the omission of foreign studies and the constraints surrounding the selection of Persian-language articles. This limitation may confine the study's findings to Persian-speaking students and Persian-language literature, thereby potentially undermining the generalizability of the effects of educational games on creativity. Moreover, while both digital and physical games were assessed from various perspectives, it is plausible that specific game types or particular cultural contexts were not adequately explored within this study.

Additionally, the majority of the reviewed articles predominantly concentrated on the impact of educational games on individual creativity, with comparatively less emphasis placed on their effects on collective creativity. Future research endeavors could delve into this dimension with greater specificity. Furthermore, empirical investigations should be undertaken across diverse contexts, such as gender and cultural disparities in the influence of educational games on creativity, as the responses to these educational tools may vary significantly across different societal frameworks.

Suggestions for future research

1. Broadening the research framework: It is recommended that subsequent investigations incorporate international studies into the corpus of reviewed literature to adequately address the findings and the variances in cultural and geographical contexts regarding the utilization of educational games.

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2. Advancing models for creativity evaluation: In light of the research findings, it is imperative to develop more precise and varied frameworks for the assessment of creativity within the realm of educational games. Investigations that have formulated and implemented creativity evaluation models in this domain can significantly enhance methodologies for quantifying the impact of educational games on creative development.

3. Analyzing the impact of educational games on collaborative creativity: While this investigation predominantly emphasizes individual creativity, subsequent studies could concentrate on the influence of collaborative and team-based games on collective creativity and social engagement.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

The studies involving human participants were reviewed and approved by the ethics committee of Islamic Azad University. The patients/participants provided their written informed consent to participate in this study.

Author contributions

All authors contributed to the study conception and design, material preparation, data collection, and analysis. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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