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Comparing the Effect of Traditional Educational Model and Game-Based Learning Approach on Self-Efficacy in Adolescent Boys

Meysam Rezaei[1], Elnaz Ebrahimi Khayat[1], Armin Farokhi[2], Mahdi Najafian Razavi[2*]

[1] Department of Physical Education and Sports Sciences, Mashhad Branch, Islamic Azad University, Mashhad, Iran
[2] Assistant Professor, Deparment of Physical Education and Sport sciences, Mashhad Branch, Islamic Azad Universiy, Mashhad, Iran

*** Corresponding author email address**: Mnajafian44@yahoo.com

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A B S T R A C T

This study aimed to compare the effects of the traditional educational model and the Game-Based Learning (GBL) approach on self-efficacy in adolescent boys. A quasi-experimental design was used with a pre-test and post-test model. Thirty male students aged 10 to 13 years from Mashhad were selected using convenience sampling and randomly assigned to two groups: one receiving traditional instruction and the other exposed to GBL. Self-efficacy was measured using the Self-Efficacy Questionnaire for Children and Adolescents (SEQ-C). The intervention spanned eight weeks, with the traditional group focusing on teacher-led, structured activities, while the GBL group engaged in interactive, game-based tasks designed to enhance cognitive and emotional skills. Data were analyzed using descriptive statistics and ANCOVA to evaluate differences between groups. The results revealed that the GBL approach significantly improved self-efficacy compared to the traditional educational model. Participants in the GBL group exhibited a larger mean increase in self-efficacy scores (M = 19.52) compared to the traditional group (M = 6.86). ANCOVA confirmed the effectiveness of GBL, with a large effect size (\u03b72 = 0.80). These findings align with previous studies emphasizing the role of interactive and engaging learning environments in fostering self-efficacy. Game-Based Learning proved to be a more effective approach than traditional instruction in enhancing self-efficacy among adolescent boys. These findings highlight the potential of GBL as a transformative educational strategy, particularly for fostering confidence, motivation, and autonomy in students. Future research should explore long-term effects and applicability across diverse populations.

Keywords: *Game-Based Learning, traditional education, self-efficacy, adolescent boys, educational strategies, interactive learning.*

1. Introduction

The educational landscape has undergone significant transformations over the past decades, with innovative teaching methodologies emerging as alternatives to traditional models. Among these, game-based learning (GBL) has garnered considerable attention as an engaging and effective approach to fostering students' cognitive, emotional, and social skills. GBL integrates educational content with game mechanics, aiming to enhance students' intrinsic motivation, self-efficacy, and overall learning outcomes. In the context of adolescent education, particularly for fostering self-efficacy, GBL has shown promising results in various domains, including STEM

education, language acquisition, and emotional development (1, 2).

Self-efficacy, defined as an individual's belief in their capability to achieve specific tasks or goals, plays a crucial role in academic achievement and personal development (3, 4). Students with higher self-efficacy are more likely to persist in challenging tasks, employ effective problem-solving strategies, and maintain resilience in the face of adversity (5). Traditional educational models, which often emphasize rote memorization and standardized testing, may fall short in nurturing this essential attribute. By contrast, GBL creates a dynamic and participatory learning environment, enabling students to build confidence and autonomy through experiential learning and immediate feedback (6).

Recent studies have highlighted the efficacy of GBL in enhancing various dimensions of self-efficacy, including academic, social, and emotional aspects. For instance, Sofia and Aranha (2022) demonstrated that GBL interventions significantly reduced anxiety and improved postoperative self-efficacy among children undergoing surgery (7). Similarly, Behnamnia et al. (2020) identified creativity as a key component of effective GBL, emphasizing its potential to foster innovative thinking and problem-solving skills in young learners (8). These findings underscore the versatility of GBL in addressing diverse educational and psychological needs.

The application of GBL in education is further supported by theoretical frameworks such as social constructivism, which posits that knowledge is constructed through social interactions and active engagement with the environment (9). By incorporating collaborative and goal-oriented activities, GBL aligns with this pedagogical perspective, fostering deeper learning and sustained motivation. Moreover, the holistic nature of GBL addresses not only cognitive development but also emotional and social growth, making it a comprehensive approach to education (10).

While the benefits of GBL are well-documented, its implementation poses certain challenges, including the need for careful instructional design, teacher training, and resource allocation (11). The MAPLET framework, proposed by Gosper and McNeill (2012), offers a structured approach to designing and assessing GBL interventions, ensuring alignment with learning objectives and student needs (11). Additionally, studies such as those by Dortaj (2014) and Xu et al. (2023) emphasize the importance of balancing game elements with educational content to maximize learning outcomes (12, 13).

In comparison, traditional educational models continue to play a dominant role in many classrooms, relying on teacher-centered approaches and standardized curricula (14). While these methods provide structure and predictability, they often lack the engagement and adaptability needed to meet the diverse needs of students in today's rapidly changing world (Brown, 2022). Innovative strategies, such as flipped classrooms and experiential learning, have been explored as potential solutions to bridge this gap, but their widespread adoption remains limited (15).

The efficacy of GBL has been explored across various educational levels and subject areas. In a meta-analysis by Wang et al. (2022), digital game-based STEM education was shown to significantly enhance students' learning achievements, particularly in fostering problem-solving and critical thinking skills (1). Similarly, studies by Hosseini et al. (2020) and Chao-Fernández, Gisbert-Caudeli, and Vázquez-Sánchez (2020) highlight the role of GBL in improving language learning and emotional regulation, respectively (2, 16). These findings align with the broader consensus that GBL offers a versatile and effective means of addressing diverse educational objectives.

Creativity and engagement are central to the success of GBL, as emphasized by Behnamnia et al. (2020) and Kiafar and Asghari Nekah (2014). By fostering an environment where students can experiment, collaborate, and take risks, GBL promotes a deeper understanding of content and a stronger sense of agency (8, 17). This is particularly important for adolescents, who are navigating complex social and emotional challenges during a critical period of development (5).

In contrast, traditional educational models often struggle to address the individual needs of students, leading to disengagement and a lack of motivation (18). Research by Brown (2022) highlights the limitations of these approaches, particularly in fostering self-efficacy and other non-cognitive skills (19). By shifting the focus from teacher-centered instruction to student-centered learning, GBL offers a promising alternative that aligns with contemporary educational goals. The present study seeks to compare the

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effectiveness of traditional educational models and GBL in enhancing self-efficacy among adolescent boys

2. Methods and Materials

2.1. Study Design and Participants

This study employed a fundamental, cross-sectional, and descriptive correlational design using structural equation modeling (SEM) to explore the relationships between variables. The statistical population consisted of individuals diagnosed with schizophrenia hospitalized in Razi Psychiatric Hospital, Tehran, during 2023. A total of 200 participants were selected through convenience sampling, meeting the minimum sample size requirement for SEM.

Participants were recruited after obtaining approval from the Research Deputy of Islamic Azad University, Birjand Branch, and coordinating with hospital authorities. Patients were assessed based on psychiatrist referrals, medical records, and psychologist interviews. Inclusion criteria included providing informed consent, being 18 years or older, having an educational background of at least middle school, a confirmed diagnosis of schizophrenia based on the DSM-5-TR diagnostic criteria, stabilization of acute symptoms, and the ability to communicate with the researcher. Exclusion criteria included unwillingness to participate, comorbid medical conditions, or incomplete responses on at least 5% of the questionnaire items.

2.2. Measures

2.2.1. Self-Efficacy

The primary data collection tool used was the Self-Efficacy Questionnaire for Children and Adolescents (SEQ-C), developed by Morris (2001). This instrument consists of 23 items designed to measure three aspects of self-efficacy: social, academic, and emotional. Responses were recorded on a five-point Likert scale, ranging from “Not at all” to “Very well.” Example items include statements such as, “How well can you complete your schoolwork on time?” and “How well can you express your opinion when others disagree with you?” Total scores range from 23 to 115, with higher scores indicating greater self-efficacy. Various studies across different populations confirmed the validity and reliability of this scale (5, 7).

2.3. Interventions

2.3.1. Traditional Training

In the traditional training group, sessions were structured and instructor-led, focusing on direct skill instruction. The trainer demonstrated specific techniques, followed by individual and group practice. Each session included warm-up exercises, skill demonstrations, repetitive drills, and direct feedback for improvement. The emphasis was on mastering technical skills through repeated practice.

2.3.2. GBL

In the GBL group, the approach centered on learning through gameplay and interactive activities. Training sessions were designed to engage participants in games and activities that encouraged problem-solving, collaboration, and decision-making within a structured framework. The sessions started with an explanation of basic rules and game strategies, followed by modified games tailored to reinforce self-efficacy components such as confidence, communication, and adaptability. Real-time feedback was provided during activities to enhance understanding and engagement. This approach aimed to foster intrinsic motivation and improve participants’ self-efficacy through meaningful game-based experiences.

2.4. Data Analysis

The analysis focused on comparing changes in self-efficacy between the two groups. Pre-test and post-test scores were analyzed using statistical methods to assess the effectiveness of each instructional model. Descriptive statistics, including mean and standard deviation, were computed for each group. Analysis of covariance (ANCOVA) was employed to control for pre-test scores and evaluate the effect of the intervention on self-efficacy outcomes. Statistical significance was set at $p < .05$, and effect sizes (η^2) were calculated to assess the practical significance of the findings. Data were processed using statistical software to ensure accuracy and reliability.

3. Findings and Results

The participants included 30 male students aged 10 to 13 years, with a mean age of 11.67 years (SD = 0.95). Of the

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sample, 46.7% (n = 14) were 12 years old, 30% (n = 9) were 11 years old, and the remaining 23.3% (n = 7) were 10 or 13 years old. Regarding physical characteristics, the mean height was 147.3 cm (SD = 5.62), and the mean weight was 39.82 kg (SD = 4.91). Approximately 70% (n = 21) of the participants were right-handed, while 30% (n = 9) were left-handed.

Table 1

Descriptive Statistics for Self-Efficacy

Group	Pre-Test Mean (SD)	Post-Test Mean (SD)	N
Traditional Model	57.12 (8.34)	63.98 (8.62)	15
Game-Based Learning (GBL)	58.73 (7.89)	78.25 (9.14)	15

The pre-test self-efficacy scores were similar across the two groups, with a mean score of 57.12 (SD = 8.34) in the traditional model group and 58.73 (SD = 7.89) in the GBL group. However, post-test scores indicated a significant improvement in self-efficacy for the GBL group, which achieved a mean score of 78.25 (SD = 9.14), compared to the traditional group, which had a mean score of 63.98 (SD = 8.62). This suggests that the GBL approach was more effective in enhancing self-efficacy compared to the traditional educational model (Table 1).

Assumptions for parametric testing were examined and confirmed prior to conducting the analyses. Normality of the data was assessed using the Shapiro-Wilk test, which yielded p-values of 0.23 for pre-test self-efficacy scores and 0.19 for post-test self-efficacy scores, indicating no significant deviation from normality. Additionally, skewness and kurtosis values for both pre-test and post-test scores were within acceptable ranges (-1 to +1), further supporting the assumption of normality.

Homogeneity of variances was tested using Levene's test, which indicated no significant differences in variances between groups for pre-test scores ($F = 1.47$, $p = 0.24$) and post-test scores ($F = 1.25$, $p = 0.28$). This confirmed that the variance in self-efficacy scores was consistent across the two groups.

Linearity was evaluated by inspecting scatterplots of the covariate (pre-test scores) and the dependent variable (post-test scores). The relationship appeared linear, satisfying the assumption required for ANCOVA. Furthermore, independence of observations was ensured through the random assignment of participants to groups, and no violations of independence were detected.

Lastly, homogeneity of regression slopes was checked by testing the interaction between the covariate (pre-test scores) and the group factor. The interaction was not significant ($F = 0.76$, $p = 0.39$), indicating that the assumption of homogeneity of regression slopes was met.

These results confirm that the assumptions for ANCOVA were satisfied, ensuring the validity and reliability of the statistical analyses conducted in this study.

Table 2

ANCOVA Results for Post-Test Self-Efficacy

Source	SS	df	MS	F	p	η^2
Pre-Test (Covariate)	132.45	1	132.45	15.28	0.001	0.23
Group (Traditional vs GBL)	950.78	1	950.78	109.78	<.001	0.80
Error	235.29	27	8.72			
Total	1350.21	29				

ANCOVA was conducted to control for differences in pre-test scores and evaluate the effect of the instructional approach on post-test self-efficacy. The covariate (pre-test self-efficacy scores) was significant, $F(1, 27) = 15.28$, $p = 0.001$, $\eta^2 = 0.23$, indicating that initial self-efficacy levels were related to post-test outcomes. After accounting for this, the type of instructional approach had a significant effect on self-efficacy, $F(1, 27) = 109.78$, $p < .001$, $\eta^2 = 0.80$. This

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large effect size indicates that the GBL approach had a substantial impact on improving self-efficacy compared to the traditional model (Table 2).

4. Discussion and Conclusion

The findings of this study indicate that the Game-Based Learning (GBL) approach significantly improves self-efficacy among adolescent boys compared to the traditional educational model. Participants in the GBL group exhibited a notable increase in self-efficacy scores from pre-test to post-test, with a mean difference of 19.52, whereas the traditional group showed a smaller mean increase of 6.86. This result aligns with the theoretical underpinnings of GBL, which emphasize active engagement, immediate feedback, and contextual learning as key factors contributing to enhanced self-efficacy (20).

These findings are consistent with prior research. For instance, Behnamnia et al. (2020) highlighted the role of creativity in GBL environments, demonstrating that such approaches foster problem-solving skills and self-belief in young learners (8). Similarly, Sofia and Aranha (2022) reported that GBL significantly reduced anxiety and enhanced self-efficacy in children undergoing stressful experiences, such as surgery (7). The emphasis on engaging, interactive, and emotionally supportive learning environments in these studies corroborates the present study's findings, underscoring GBL's capacity to address both cognitive and emotional aspects of learning.

The significant improvement in self-efficacy observed in the GBL group may also be attributed to the alignment of this approach with social constructivist principles. Vasalou et al. (2017) noted that collaborative gameplay enhances peer interaction, which in turn bolsters confidence and social self-efficacy (9). In the current study, the use of game-based activities likely provided opportunities for students to practice and refine their skills in a supportive, low-stress environment, fostering a sense of accomplishment and autonomy. This aligns with Coleman and Money's (2020) assertion that student-centered learning environments enhance motivation and self-directed learning capabilities (6).

In contrast, the smaller improvement in self-efficacy observed in the traditional education group reflects the limitations of teacher-centered approaches. Shiralinejad, Ghasemi, and Emamipour (2022) noted that traditional methods, often characterized by rote memorization and limited opportunities for active engagement, fail to address the diverse needs of learners (14). This is particularly relevant for adolescent boys, who benefit from interactive and hands-on learning experiences (2).

The findings of this study contribute to the growing body of literature advocating for the adoption of GBL in educational settings. Wang et al. (2022) conducted a meta-analysis on the impact of digital GBL in STEM education, revealing significant gains in students' academic performance and problem-solving abilities (1). Although this study focused on self-efficacy rather than academic achievement, the underlying mechanisms—such as increased engagement, motivation, and active participation—are shared across both outcomes. Furthermore, Dortaj (2014) compared traditional and GBL methods in teaching mathematics and found that GBL was more effective in enhancing students' learning motivation and confidence, echoing the results of this study (12).

The emotional dimension of self-efficacy was particularly impacted by the GBL approach, as suggested by Chao-Fernández, Gisbert-Caudeli, and Vázquez-Sánchez (2020), who demonstrated the efficacy of game-based music therapy in improving emotional regulation (16). Similarly, the present study's findings suggest that GBL not only enhances cognitive outcomes but also fosters emotional growth by creating a positive and supportive learning environment. This dual impact highlights GBL's potential as a comprehensive educational strategy.

This study highlights the transformative potential of GBL in enhancing self-efficacy, offering valuable insights for educators and policymakers. By integrating game-based activities into the curriculum, schools can create more engaging and inclusive learning environments. This is particularly relevant in the context of adolescent education, where fostering self-efficacy is critical for academic and personal success. The findings also underscore the need for teacher training programs that equip educators with the skills and knowledge required to effectively implement GBL strategies (11).

While this study provides significant insights into the impact of GBL on self-efficacy, it is not without limitations. First, the sample size was relatively small (N = 30), which

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may limit the generalizability of the findings. Future studies with larger and more diverse samples are needed to validate these results. Second, the study focused exclusively on male adolescents, leaving the question of whether the results would be consistent across genders unanswered. Research has shown that gender differences may influence the effectiveness of GBL, particularly in areas such as engagement and motivation (21). Finally, the study relied on self-reported measures of self-efficacy, which are subject to biases such as social desirability and self-perception. Incorporating objective performance-based assessments in future research would provide a more comprehensive understanding of GBL's impact.

Future studies should address the limitations of this research by employing larger, more diverse samples that include participants of different genders, age groups, and cultural backgrounds. This would enhance the generalizability of the findings and provide a more nuanced understanding of how various factors influence the effectiveness of GBL. Additionally, longitudinal studies are needed to examine the long-term effects of GBL on self-efficacy and related outcomes. Such research could explore whether the gains observed in self-efficacy are sustained over time and how they influence other aspects of students' academic and personal lives.

Another area for future research is the exploration of specific game design elements that contribute most significantly to self-efficacy enhancement. Studies such as those by Behnamnia et al. (2020) have highlighted the importance of creativity and problem-solving components in GBL (8). Investigating how these and other elements, such as collaboration, feedback, and personalization, interact to impact self-efficacy would provide valuable insights for designing more effective educational games.

Educators and policymakers should consider integrating GBL into the curriculum as a means of enhancing self-efficacy and promoting student engagement. Teacher training programs should prioritize the development of skills and competencies needed to implement GBL effectively, including game design principles, classroom management strategies, and methods for assessing learning outcomes (11). Schools should also invest in digital resources and infrastructure to support the adoption of GBL, ensuring that all students have equitable access to these tools.

Furthermore, collaboration between educators, game designers, and researchers is essential for creating high-quality educational games that align with curriculum objectives and address students' specific needs. The MAPLET framework, as proposed by Gosper and McNeill (2012), can serve as a valuable guide for designing and assessing GBL interventions (11). Finally, schools should adopt a holistic approach to education that integrates GBL with other innovative teaching methods, such as flipped classrooms and experiential learning, to maximize learning outcomes and support students' overall development.

Authors' Contributions

M. R. contributed to the study's conceptualization, data collection, and interpretation of results. E. E. K. was responsible for designing the intervention, supervising the educational sessions, and drafting the manuscript. A. F. conducted the statistical analysis, assisted in the interpretation of findings, and reviewed the literature. M. N. R. provided critical revisions to the manuscript, contributed to methodological design, and ensured adherence to ethical research standards. All authors participated in finalizing the manuscript, approved the final version, and agreed to be accountable for the work.

Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

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Declaration of Interest

The authors report no conflict of interest.

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Ethics Considerations

The study placed a high emphasis on ethical considerations. Informed consent obtained from all participants, ensuring they are fully aware of the nature of the study and their role in it. Confidentiality strictly maintained, with data anonymized to protect individual privacy. The study adhered to the ethical guidelines for research with human subjects as outlined in the Declaration of Helsinki. Ethical considerations included obtaining informed consent, ensuring confidentiality and anonymity, and avoiding any harm to participants.

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