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تأثير تطبيق استراتيجيات اللعب في التعلم الحركي على اكتساب بعض مهارات التنس الاساسية لدى الأطفال ٨-١٠ سنة

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مستخلص البحث :

كان الهدف من الدراسة هو فحص تأثير اللعب على دقة الضربات الأمامية والخلفية في التنس لدى ٣٠ طفلاً تتراوح أعمارهم بين ٨ و١٠ سنوات من المدرسة التخصصية في بغداد. **الإجراءات:** تم تقسيم المشاركين عشوائياً إلى مجموعة تجريبية (15) طفل باستخدام المنهج التعليمي مدته ٨ أسابيع باستخدام النقاط والشارات والتحديات ولوحات الصدارة لزيادة الحافز والمشاركة، ومجموعة الضابطة (15) طفل باستخدام برنامج التعلم التقليدي الذي تم تحليله في هذه الدراسة مع تكرار التمارين السلبية كتعليمات مباشرة. تم إجراء اختبار مهارات الاتحاد الدولي للتنس (ITF) قبل وبعد الاختبار، وتم تحليل البيانات بواسطة الإحصاءات الوصفية واختبارات t عند مستوى دلالة $p < 0.05$. **النتائج:** أظهرت المجموعتان تحسنًا، لكن المجموعة التجريبية حققت مكاسب أعلى بشكل ملحوظ في دقة الضربة الأمامية ($p < 0.001$) والضربة الخلفية ($p < 0.001$). كما كانت هناك اختلافات واضحة بين المجموعتين لصالح المنهج القائم على اللعب (الضربة الأمامية: $p < 0.001$؛ الضربة الخلفية: $p < 0.001$). **الاستنتاجات:** يحسن التدريب القائم على الألعاب تدريب التنس بجعله ممتعًا وفعالًا، وفي الوقت نفسه يسمح للأطفال بتبني المهارات الحركية بشكل أسرع مع الحفاظ على دافع عالٍ. هذه الاستراتيجية ذات أهمية كبيرة لتعزيز التربية البدنية، خاصة في ظل الظروف غير المواتية في العراق حيث سيتم تشجيع مثل هذه الرياضة النشطة والمستمرة بين الأجيال.

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children, especially aged 7–9 (Ermenova et al., 2021). Children with ASD have also seen significant development of motor skills via computer gaming (Sadruddin, 2025). In addition to this, digital gaming has afforded researchers the opportunity to investigate how children modify their movements in remote vs. constrained surroundings (Corey et al., 2025).

This research investigates the use of game design strategies to promote a child's skill proficiency within fundamental tennis skills, through the usage of groundstrokes such as forehand and backhand. Research shows that adding game-like features to sports training really boosts boys' motivation and performance, tennis in particular. For example, one study demonstrated that gasified sports programs provide a more engaging and effective learning context for tennis skills training (Liu & Lipowski, 2021). It has also been shown that enjoyable, age-appropriate tennis lessons using a game-based approach may facilitate children's focus and cognitive abilities, particularly for children between 6 and 12 years of age (Ishihara et al., 2017). Furthermore, recent data report that mini-tennis game-based training largely increased young players' forehand accuracy as well (6–8 years old) (Fauzi et al., 2021). Tennis programs embedded in physical education at school that include skill-based games for children have been successful in

The Effect of Applying Gamification Strategies in Motor Learning on the Acquisition of Selected Basic Tennis Skills in Children 8-10 year

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Abstract

Introduction

Gasification teaches the natural language through the use of game characteristics ranging from points and badges to challenges – and studies have shown that this helps children to develop their motor skills effectively. The ultimate aim is to maintain the level of interest, thus stimulating motivation in learning and a child's ability to learn new skills by turning practice into an amusing and engaging experience. There is empirical evidence that a gasified program can make an important difference to leg strength, agility and coordination in children aged 8–11 (Cenizo-Benjumea et al., 2022). By transferring gameplay to physical education, gasification stimulates the motivation and enjoyment of children, as it makes activities fulfilling and entertaining (Six et al., 2021). These game-like approaches have been found to increase confidence and sustain engagement in physical education school teaching setting, as well as developing motor skills of

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2. To examine the effect of gasification strategies on the acquisition of backhand groundstroke accuracy in children.
3. To compare the performance of an experimental group using gasification with a control group using traditional training methods.

Research Hypotheses

1. There are statistically significant differences in forehand groundstroke accuracy favoring the experimental group compared to the control group after implementing a gamified training program.
2. There are statistically significant differences in backhand groundstroke accuracy favoring the experimental group compared to the control group after implementing a gamified training program.
3. The use of gamification leads to an overall improvement in motor skill accuracy compared to traditional training methods.

This study further develops PE curricula through providing empirical support that gamification could be an effective approach to enhance sports skill learning among children. It provides a framework to design enjoyable training sessions that limit annoyance and increase the presence in exercise. At the social level, teaching sport-specific skills and knowledge (Yan et al., 2023). These results were supported by the synthesis of studies, which found that game-based PE makes sports fun for children and young people, matching this with their enjoyment (Camacho-Sánchez et al., 2023).

There are challenges in teaching children basic tennis skills, including forehand and backhand ground-strokes. It is an additional in training for many young beginners find hard to maintain motivation, easy lose interest on homework, and so on due to the repetition of lessons traditional. Traditional teaching methods often inhibit engagement, and hence the learning of new skills. But as innovative teaching methods become more popular, there's potential for us to consider the application of gamification—leveraging mechanism that make games fun—in addressing these problems. Such an approach is especially important in settings like Iraqi schools where the resources for sports programs are limited, so that also identifying novel and effective means by which to maintain children’s excitement surrounding learning are necessary.

Research Objectives

1. To investigate the effect of gamification strategies on the acquisition of forehand groundstroke accuracy in children.

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examination of the usefulness of the program can be made.

Study Sample

The children in the department special school for retarded, aged between 8 to 10 years were included in this study. A total of thirty children were chosen from the school's physical education classes, as they all shared a common characteristic: none of them had received any formal tennis training before in order to start with standard skills. Volunteers were randomly assigned to one of two groups: an experimental group (15 children who took part in the game-based training) and a control group (15 children trained using standardised protocols). The groups were controlled for fairness by matching initial forehand and backhand ability using a pre-study baseline test.

The study was conducted at the Specialized School in Baghdad, Iraq, where sports facilities were available and consisted of outdoor tennis courts and indoor gyms. Ideal settings for teaching our youth the sport of a lifetime, in that it provides uniform court sizes along with the full range of appropriate equipment (such as smaller rackets and low-compres- sion balls). This design had the effect that both the gamified and traditional training groups received an equivalent practice level, thus keeping reliability of attention during study.

this research contributes to the physical and mental health of children, offering a scalable, cheap-to-deliver model that can be integrated to schools and sports clubs at schools1 in socially undermining contexts such as Iraq.

Participants were 30 children of both genders aged 8-10 years who were selected from the Specialized School in Baghdad, Iraq. Practices were held on school tennis courts suitable for tennis training. The study was conducted between August 2025 and October 2025 over an 8-week period, twice week (45 minutes each), training.

Methodology

Study Design

This study is a quasi-experimental work on how gamification affects the learning of some specific fundamental tennis skills (forehand accuracy and backhand accuracy) in children. The quasi-experiment approach was adopted since randomization of students in a school setting are practical constraints that allow the comparison between an experimental group undergoing training using gamification techniques and a control group who participated in regular training. The pre-test post-test design used in this study aims at directly comparing the improvement of motor skills between intervention and control groups so that a more thorough

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and backhand groundstrokes. Modified versions of the ITF Skill Test for Ground Strokes were devised for children, based on a target accuracy task in which participants hit balls from a line using only ground strokes to target zones on the court. The testing score was calculated as the number of successful hits inside the target zones (0–10 per trial, 5 trials per skill). Equipment was comprised of regular tennis rackets (23–25 inches, suitable for 8-10 year-old), low-compression tennis balls and clearly marked on-court zones. Digital tools (having a mobile application), to provide points and badges of glory and follow progress, with physical game objects like scoreboards and challenges cards were used for the gamified intervention.

Procedures

Pre-test Prior to beginning to the training, all participants completed and the pre-test in with forehand and backhand groundstroke accuracy test based on international tennis federation (ITF) Skill Test. The test was done by trained coaches using the same court and child rackets as part of low compression balls with all children receiving consistent instructions. Five trials were performed by each child for each skill, graded on a 0 to 10 scale of correctness in each trial, achieving thus a maximum total of 50 points per skill. These scores were averaged to create a baseline score to assess whether the two groups

To make sure both the experimental and control groups started on equal footing, we ran a pre-test to check their forehand and backhand groundstroke accuracy using the International Tennis Federation (ITF) Skill Test. This helped us confirm that the two groups had similar skill levels before the training began, keeping the comparison fair as see in table 1.

Table 1. *Baseline Equivalence of the Experimental and Control Groups in Forehand and Backhand Groundstroke Performance*

Skill	Group	n	Mean	SD	t-value	p-value
Forehand Groundstroke Accuracy	Experimental	15	12.40	2.85	0.287	0.776*
	Control	15	12.73	2.92		
Backhand Groundstroke Accuracy	Experimental	15	10.67	2.64	0.154	0.879*
	Control	15	10.87	2.71		

*: non-significant at $p > 0.05$

Time Frame

The training program ran for 8 weeks, from August to October 2025, with kids practicing twice a week for 45 minutes each time, adding up to 16 sessions. We planned the schedule to fit smoothly into the school's physical education routine, so it wouldn't interfere with the kids' regular schoolwork.

Instruments and Tools

Tennis skill was assessed using standardized tennis skill tests for forehand

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conducted twice weekly, each lasting 45 minutes. The program focuses on enhancing motivation and engagement through the integration of gamification elements such as points, badges, challenges, and leaderboards. Each session begins with a 5–10-minute warm-up, followed by a 25–30-minute main activity featuring fun, tennis-based games, and concludes with a 5-minute cool-down and review, during which rewards are distributed or the leaderboard is updated. The games are inspired by sources such as Thrive Tennis and i9 Sports' fun tennis activities for children, adapted to specifically focus on forehand and backhand strokes. The program develops motor skills such as coordination, agility, and accuracy, while gradually increasing complexity to generalize these skills for application in real-world contexts as show in table 2.

started with similar level of skill and performance on the basis of which an index was developed.

The experimental group participated in a gamified training program designed to enhance motivation and engagement. The program incorporated game elements such as:

1. **Points System**: Participants earned points for successful hits, with bonus points for consecutive accurate shots.
2. **Badges and Rewards**: Digital badges were awarded for milestones (e.g., completing a session or achieving a high score in a drill).
3. **Challenges**: Tasks such as hitting a specific number of accurate shots within a time limit were introduced to maintain engagement.
4. **Leaderboards**: A visual leaderboard displayed participants' progress, fostering friendly competition. Training sessions included warm-ups, skill drills (e.g., forehand/backhand rallies with a coach), and gamified challenges, all delivered in a playful, interactive format. A mobile application tracked individual progress and provided real-time feedback.

This program is designed for a duration of 8 weeks, with training sessions

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Table 2. *Eight-Week Gamified Tennis Training Program for Children Aged 8–10: Session Objectives, Activities, and Gamification Elements*

Week	Session	Objectives	Activities	Gamification Elements	Total Duration
١	1	Enhance hand-eye coordination and introduce the forehand groundstroke.	Warm-up: Light jogging with coordination exercises (e.g., ball toss and catch). Main Activity: "Balloon Rally" – hitting a balloon with a forehand stroke to maintain a rally. Cool-down: Discuss successes and award points.	Points: 1 point per successful forehand hit. Badges: "Balloon Champion" for the longest rally. Leaderboard: Record weekly points.	45 minutes
	2	Improve agility and control in forehand groundstrokes.	Warm-up: Jumping with arm movements. Main Activity: "Target Toss" – hitting a ball with a forehand stroke toward large drawn targets. Cool-down: Review performance.	Points: 2 points per target hit. Challenge: Increase hits within a time limit. Badges: "First Shooter" for the highest score.	45 minutes
٢	1	Develop basic accuracy in forehand groundstrokes.	Warm-up: Balance exercises (standing on one leg). Main Activity: "Tennis Bowling" – hitting a ball with a forehand to knock down cones. Cool-down: Count points and update leaderboard.	Points: 3 points per cone knocked down. Leaderboard: Rank "Top Shooters". Challenge: Increase distance for bonus points.	45 minutes
	2	Enhance control in forehand groundstrokes with movement.	Warm-up: Torso rotation exercises. Main Activity: "Move & Hit" – run to a spot, then hit a forehand to a target. Cool-down: Share achievements.	Points: 2 points per accurate hit after movement. Badges: "Movement Star" for best performance. Challenge: Add lateral movements.	45 minutes
٣	1	Introduce the backhand groundstroke and enhance coordination.	Warm-up: Slow backhand swings with a ball. Main Activity: "Backhand Bounce" – bouncing a ball with a backhand for the longest duration. Cool-down: Review progress.	Points: 1 point per successful bounce. Leaderboard: "Backhand Keeper". Challenge: Increase bounces for extra rewards.	45 minutes
	2	Improve accuracy in backhand groundstrokes.	Warm-up: Ball toss with left/right hand. Main Activity: "Backhand Targets" – hitting a ball with a backhand to small drawn circles. Cool-down: Distribute points.	Points: 1–5 points based on target accuracy. Badges: "Backhand Sniper" for the highest score. Challenge: Reduce target size.	45 minutes
٤	1	Enhance backhand groundstrokes with competition.	Warm-up: Torso rotation exercises. Main Activity: "Backhand King" – backhand stroke challenge in a short match format. Cool-down: Update leaderboard.	Points: 3 points per challenge win. Leaderboard: "Backhand King" crown. Challenge: Increase strokes to win.	45 minutes
	2	Integrate movement with backhand groundstrokes.	Warm-up: Lateral sprints. Main Activity: "Backhand Dash" – run to a spot, then hit a backhand to a target. Cool-down: Award achievements.	Points: 2 points per accurate hit after running. Badges: "Backhand Runner". Challenge: Increase distance or speed.	45 minutes
٥	1	Combine forehand and backhand groundstrokes.	Warm-up: Mixed slow strokes. Main Activity: "Switch Rally" – alternating forehand and backhand strokes in a rally. Cool-down:	Points: 2 points per continuous rally (5 strokes). Leaderboard: "Switch Champion".	45 minutes

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			Review rally performance.	Challenge: Extend rally length.	
	2	Improve quick response in mixed groundstrokes.	Warm-up: Reaction drills (coach signals). Main Activity: "Quick Switch" – hitting forehand or backhand based on coach's commands. Cool-down: Distribute points.	Points: 3 points per correct response. Badges: "Quick Responder". Challenge: Random commands for added difficulty.	45 minutes
٦	1	Enhance accuracy in mixed groundstrokes.	Warm-up: Short mixed rally. Main Activity: "Target Combo" – alternating forehand and backhand hits to rotating targets. Cool-down: Update leaderboard.	Points: 1–5 points based on target accuracy. Badges: "Accuracy Master". Challenge: Smaller targets for double points.	45 minutes
	2	Promote continuity in mixed groundstroke rallies.	Warm-up: Stroke counting. Main Activity: "Rally Master" – maintaining a rally with forehand and backhand strokes. Cool-down: Share achievements.	Points: 1 point per 5 continuous strokes. Leaderboard: "Rally Master". Challenge: Longer rally goal for rewards.	45 minutes
٧	1	Apply skills in a competitive context.	Warm-up: Mixed rally. Main Activity: "Mini-Match" – short matches using forehand and backhand strokes. Cool-down: Distribute rewards.	Points: 4 points per match win. Leaderboard: "Match Champion". Challenge: Multiple matches for point accumulation.	45 minutes
	2	Enhance generalization in match-like settings.	Warm-up: Random strokes. Main Activity: "Court Conqueror" – mixed strokes in a match with targeted points. Cool-down: Review performance.	Points: 3 points per accurate stroke in a match. Badges: "Court Conqueror". Challenge: Precise targets in matches.	45 minutes
٨	1	Generalize skills in a full match context.	Warm-up: Quick rally. Main Activity: "Tennis Tournament" – mini-tournament with forehand and backhand strokes. Cool-down: Final leaderboard update.	Points: 5 points per match win. Leaderboard: Final ranking. Challenge: Individual performance challenges.	45 minutes
	2	Final evaluation and skill generalization.	Warm-up: Selected games from prior weeks. Main Activity: "Final Rally Challenge" – long rally with mixed strokes in a match-like context. Cool-down: Final awards ceremony.	Points: 5 points for the longest rally. Badges: "Tennis Star Finalist". Challenge: Personalized challenges for skill reinforcement.	45 minutes

points, badges or competitive game components. Fairness was kept by giving both groups with the same amount of training and instructor's attention.

After the 8-week intervention, a post-test was implemented with both groups using the ITF Skill Test protocol identical to that used in pre-testing. As a post-test, The control players took part in traditional tennis training that focused on repetitive practice and direct instruction, with no gamified aspects. Each training session consisted of warm-up, technical learning on the forehand and backhand strokes, and practice rallies. Although these sessions mirrored the experimental goal of fostering skill practice, they did not feature

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Result

Table 3. *Descriptive Statistics for Pre- and Post-Test Scores*

Skill	Group	Test	n	Mean	SD
Forehand Groundstroke Accuracy	Experimental	Pre-Test	15	12.40	2.85
		Post-Test	15	28.73	3.62
	Control	Pre-Test	15	12.73	2.92
		Post-Test	15	20.47	3.18
Backhand Groundstroke Accuracy	Experimental	Pre-Test	15	10.67	2.64
		Post-Test	15	25.80	3.45
	Control	Pre-Test	15	10.87	2.71
		Post-Test	15	18.13	3.09

forehand and backhand groundstroke accuracy improvements were measured under the same testing conditions used for pre-test to make the results reliable and comparable.

Data Analysis

Statistical software, in particular SPSS, was used to analyze the quantitative information. Descriptive statistics (means, standard deviations), paired-sample t-tests to examine changes within each group and independent-sample t-tests comparing post-test results were conducted for all dependent variables. The effect size (d) was used to determine the difference magnitude, and acceptable significance level $p < 0.05$ was set to test the hypothesis that gamification is more effective than traditional way in acquiring skills.

Table 4. *Show Within-Group Improvements (Paired-Sample T-Tests)*

Skill	Group	Mean Difference	t-value	df	p-value	Cohen's d
Forehand Groundstroke Accuracy	Experimental	16.33	14.25	14	0.000	1.87
	Control	7.74	7.92		0.000	0.98
Backhand Groundstroke Accuracy	Experimental	15.13	13.67		0.000	1.79
	Control	7.26	7.45		0.000	0.92

*: significant at $p \leq 0.05$

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Table 5. *Between-Group Comparisons (Independent-Sample t-Tests)*

Skill	Group Comparison	Mean Difference	t-value	df	p-value	Cohen's d
Forehand Groundstroke Accuracy	Experimental vs. Control	8.26	6.12	28	0.000*	1.15
Backhand Groundstroke Accuracy	Experimental vs. Control	7.67	5.89		0.000*	1.10

*: significant at $p \leq 0.05$

Moreover, the successful application of game-based teaching methods in tennis lessons have contributed to improving technical skills and physical fitness; thus, explaining gamification success in the current study (Zhao et al., 2025).

Results from the experimental group with significant improvement in forehand and backhand strokes reflect that the gamification elements, points, badges as well as challenges helped this monotonous drill to be more attractive and interesting for kids. This result is consistent with existing research that found gamification to improve motor skills and increase the fun in physical education among children and adolescents (Abdulkareem et al., 2025; Cenizo-Benjumea et al., 2022). In addition, virtual reality (VR) technology that entails the use of gamified training

Discussion

The present results of this study imply that a gamified training can improve the forehand and backhand groundstrokes in 8–10-years-old children, and that game elements using (game group) children did better than those not using them (control group). These results are consistent with previous studies showing that enhanced gamification has a positive effect on children's engagement and on the development of motor skills during physical education classes, especially in young students. For example, gamified contexts are known to increase motivation and participation among adolescents, leading to improvements in sports skills (Sal-de-Rellán et al., 2025).

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programmes that have helped young children acquire fundamental movement skills and increase their confidence (Fitton Davies et al., 2024), demonstrating the potential flexibility of this approach. Also, incorporating AI as part of gamified learning has been reported to result with improved physical literacy that is consistent with the higher tennis accuracy in this study (Wang et al., 2024). Also, there are many successes with using game-based training methods in youth sports that suggest that our gamified training is practical and effective (Anguera et al., 2025).

In theoretical terms, these findings correspond to self-determination theory suggesting that gamification is a tool for appealing to children's intrinsic motivations towards autonomy, competence and relatedness, helping them acquire skills. From a practical point of view, the results suggest that game-type strategies should be used in physical education classes (especially for children living in poverty-stricken countries as Iraq) to enhance young individuals' activity levels and help them learn new skills. Nonetheless, the design of the study is quasi-experimental and prone to bias; also, we only has been shown capable in improving coordination and reaction time, on which the promotion of an interactive learning model for skill acquisition is also supported (Utamayasa et al., 2025).

The clear benefit found in the gamified class versus the regular class, suggests that not only does gamification speed up learning but it also sustains motivation of children. This is consistent with studies regarding game-based physical education programs, which reveal these educational methodologies lead to promote enjoyment and adherence of children towards exercise (Hassan & Abdulkareem, 2025; Mo et al., 2024). These outcomes further contribute to the growing literature of evidence towards the effectiveness of gamification on motor learning and rehabilitation, facilitating all-abilities children to achieve gains through attractive features such as games and rewards (Fernández-Vázquez et al., 2024). In the field of a sports, designing gamified systems has been proven to lead to improved skill-levels, also related directly to the focus on tennis skills development in this study (Feng et al., 2023). Moreover, not only in schools but good experiences have also been reported at home for gamified

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which says the way to help you grow interpersonally as well as intellectually and creatively is by helping cultivate a sense of independence, competence and social relatedness. The results of this study support the strong evidence that gamification could be an efficient method for teaching tennis skills within gym classes at schools, specifically in resource-limited areas like Iraq. This study adds to the growing evidence that the gamified approach can facilitate motor learning and encourage participation in sports of young children.

Recommendations

According to the results in this study, physical education for schools especially in Iraq they should use low cost gamification strategies like points and leaderboards to maximize motor skills learning and amplify student engagement. Furthermore, coaches are recommended to be educated on play/ games-based methodologies and future research is encouraged to investigate long-term effects of gamification, across various sports domains as well as the use of digital environments (e.g., virtual observed for 8 weeks which might not be enough to capture long term retention of skills. Future work should enhance sample diversity, extent the design time and apply gamification in different sport practices in order to confirm meditated effects identified here. In conclusion, by incorporating gamification into tennis training, this study seems to have provided an effective framework for improving PE in the young children.

Conclusions

The current study concluded that a 2-month focus training intervention using game elements (points, badges, challenges and leaderboards) improves the acquisition of forehand and backhand strokes for tennis for children 8–10 years old. The group using these gamification methods had significantly better result than the class who follow traditional teaching method, which confirms our initial hypotheses with strong evidence. Then only taught player in the class how to play after-the-recess games, which are large-grupos for game preparation/game running-by turning it into a game itself, just as they learned to score more easy and remained interested/inhabit even. This is on all fours with self-determination theory,

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reality) along with larger and more diverse sample populations.

Limitations

This study has some limitations that need to be taken into account for interpretation of the findings. First, the small sample size (N = 30) that would limit the generalization of the results to other populations or context. Second, the 8-week duration of the intervention may not allow for a valid exploration of long-term skill retention or an enduring impact of gamification on motor learning. Third, all participants in this study were from one school (The Specialized School, Baghdad-Iraq), which could be a limitation regarding the generalizability to other sociocultural backgrounds. Lastly, the between-subject design of the current study may not have held for individual differences in either participants' levels of physical activity prior to intervention, or for their predisposition with a particular level of motor function given that pre-testing was used to verify baseline equivalency.

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