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The Effect of Game-Based Learning Using Small-Sided Games on the Performance of the High Serve Skill in Badminton among Beginner Female Students

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Abstract

The purpose of this study was to investigate the effect of a game-based learning strategy using small-sided games on improving the performance of the high serve skill in badminton among beginner female students. The study employed an experimental design with a pre-test and post-test for two groups. The participants consisted of 40 first-year female students from the College of Physical Education and Sport Sciences at the University of Baghdad. The participants were randomly divided into two groups: an experimental group (n = 20), which was taught using a game-based learning strategy involving small-sided games, and a control group (n = 20), which followed the traditional teaching method based on explanation, demonstration, and repetitive drills. The experimental program lasted eight weeks, with two instructional sessions per week. A standardized badminton high serve skill test was used to measure the participants' performance before and after the instructional program. The collected data were analyzed using descriptive statistics and inferential statistical tests, including paired samples t-test and independent samples t-test. The results revealed significant improvements in both groups between the pre-test and post-test measurements. However, the experimental group showed significantly greater improvement compared with the control group in the post-test results. The findings suggest that game-based learning using small-sided games provides an effective teaching strategy for enhancing motor skill

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acquisition and improving badminton serve performance among beginner students in physical education settings.

Keywords: Game-Based Learning, Badminton, High Serve Skill, Motor Learning.

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Introduction

Motor learning is among the basic scientific domains that are studied in physical education and sports sciences; therefore, it refers to the mechanisms through which one learns motor skills with practice and experience. Effective teaching strategies are essential for skill acquisition in sports, helping to facilitate learning and enhance performance outcomes. In more recent years, pedagogical practice during physical education has progressed from traditional teacher-structured methodologies to learner-focused teaching strategies that aim to increase engagement, motivation and participation at the time of gainful skill (Renshaw & Chow, 2019; Regan, 2025).

Closely related to these contemporary approaches, more recently, game based learning has received a great deal of attention in the literature as an effective pedagogical method that includes elements of play into the process of learning. This application reduces the monotony of repetitive training by making it more engaging through dynamic and interactive environments that replicate real sporting contexts, therefore promoting motor skill acquisition in a learning context. Many feel that such game-based approaches facilitate cognitive, social, and physical learning by providing practice of skills in a meaningful context (Kinnerk et al., 2018; Harvey & Cope, 2025).

In addition, recent studies show that adding games in physical education programs motivates students more, increases their enjoyment and engages them, which are key factors of effective motor learning resulting in long-term retention (Breed et al., 2025; Beni et al., 2017). Consequently, game-based learning has become a prominent instructional approach in modern sports education, especially for novices who need non-threatening and stimulating contexts to learn.

Badminton is one of the most popular racket sports played in educational institutions because it is relatively easy to master and helps improve coordination, agility, and motor control. In order to perform well in a game, it is crucial for players to master fundamental badminton skills, including the high serve that can start play and perhaps position an opponent within the framework of playing strategy on-court (Phomsoupha & Laffaye, 2015; Abdulkareem et al., 2025). Then, many novices have trouble executing this skill well due to challenges' coordination, timing and motor control.

Research in motor learning indicates that the acquisition of skills is better when learners are practicing within conditions similar to those actually performed. If we consider that there is an end stage in which learners can reproduce movement solutions, then the learning environment must allow for play to happen (in structured play situations) whereby the learner must explore, adapt and problem-solve as they execute a movement solution (Chow et al., 2021; Abdulkareem & Hassan, 2025). The environmental enrichment and functional task training strategies are congruent with recent ecological dynamic perspectives of motor learning which emphasize that behavior emerges from the interaction of an organism with both a task and its environment to solve a problem, and thus serves to enhance skill acquisition.

In the context of physical education, recent studies that small-sided games contribute to skill acquisition by providing more opportunities for repetition and helping develop peri perceptions (Woods et al., 2020; Hammami et al., 2018; Abdulhussein, 2025). Consequently, the

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application of small-sided games in badminton instructional programs represents a productive approach to enhance skill performance among novice learners.

Although badminton is considered a significant part of physical education curriculums, many beginning students face challenges in learning basic skills like the high serve. Because traditional teaching methods cast some sort of practice for practice's sake, students' motivation drops and their chance to use skills contextually is often limited. As a result, the students may not be able to execute that skill as well in a game.

However, badminton is very much a part of PE curriculums, and many beginning students encounter challenges in developing basic skills such as the high serve. Because traditional practices are often demonized as practice for the sake of practice, this kills students' drive and leaves many with limited opportunities for contextualized skill usage. The students might then not perform that skill as effectively in a game.

The aim of this study is to identify the effect of the game-based learning strategy using small-sided games on improving the performance of the high serve skill in badminton among beginner female students, as well as to determine whether this instructional approach can enhance the effectiveness of motor skill learning compared with traditional teaching methods in physical education.

It is hypothesized that there will be statistically significant differences between the pre-test and post-test results in the performance of the high serve skill in badminton among beginner female students in favor of the post-test. It is also hypothesized that the use of the game-based learning strategy using small-sided games will lead to significant improvements in the performance of the high serve skill among the participants.

The relevance of the study is to try to use a contemporary instructional technology in motor learning in physical education. Based on this study, therefore, an exploration of how small-sided games as a game-based learning tool will contribute to the betterment of badminton teaching delivery especially towards beginner students. The results may also identify creative alternative teaching styles for physical educators that increase involvement, motivation, and skill acquisition in their students. Results also might promote the new modern motor learning approach to be incorporated into University physical education programs, which can help in development of sport teaching methods.

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Methodology

Research Design

In this study an experimental research design with a pre-test and post-test control group was used to explore the effect of a small-sided games game-based learning strategy on beginner female students high serve skill performance in badminton. The experimental design of the study was chosen so that researchers could explore causal relationships between instructional strategies and skill development, controlling for alternative explanations.

The study involved the participation of two groups: an experimental group who were taught using the game-based instructional strategy comprised of small-sided games and a control group that was subjected to the prevailing traditional instruction method commonly practiced in badminton classes. Pre- and post-tests were administered to both groups to assess the high serve skill performance. Two teaching sessions were conducted twice a week for as long as eight weeks during the experimental program.

Participants

Participants in this study were female undergraduate students enrolled in their first year at the College of Physical Education and Sport Sciences, University of Baghdad. Selection was done from students of badminton practical curriculum. Forty students were purposively selected because they were beginner, so they had never received formal training course in badminton; especially on high serve skill that became the target of this study

The participants were randomly segregated into two groups of equal size. 20 students in the first group constituted the experimental group and were taught with the game-based learning strategy (based on small-sided games). The comparison group also comprised 20 students and received the typical teaching method of badminton class as a traditional training method.

A pre-test was conducted for the control group and experimental group to measure both groups' initial level of performance in high serve skill in badminton prior to implementing the program. Before commencing the educational intervention, a pre-test was performed to ascertain that the experimental and control groups were considered homogeneous in regard to the study variable. To check if the two groups differed significantly in terms of pre-test data, an independent samples t-test was carried out on this data. Furthermore, the analysis indicated there were no statistically significant differences between experimental and control groups on pre-test findings suggesting that the compared groups were equivalent in terms of baseline high serve skill performance before applying experimental program.

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Table1. *Equivalence between the Experimental and Control Groups in the Pre-Test of the High Serve Skill*

Variable	Group	N	Mean	Std. Deviation	t-value	Sig. (p)
High Serve Skill (Score)	Experimental	20	4.85	1.12	0.41	0.68
	Control	20	4.70	1.09		

The results shown in Table (1) indicate that there were no statistically significant differences between the experimental and control groups in the pre-test scores of the high serve skill ($p > 0.05$), confirming the equivalence of the two groups before the implementation of the experimental program.

Instruments and Equipment

In order to achieve a precise recording of the performance of the subjects, numerous instruments and apparatuses were employed in this study, as well as assist in performing the experimental protocols. To ensure an appropriate environment for both group (pre-test and post-test) during practical sessions and skill tests, all of these were carried out on a proper international standard badminton court.

For the instructional sessions and the testing protocols, participants used badminton rackets and shuttlecocks to perform the high serve skill. We used tape measure and markers to set up the testing field precisely speaking define the target areas in an opponent side. This ensured from each entry the serving zones were established and proper uniformity in testing was maintained.

Furthermore, score sheets were prepared to record the results of each participant during high serve skill test so that researchers could systematically write down accuracy and performance scores. To ensure the important measurable characteristics of each skill could not only be accurately evaluated during testing procedures, but also reviewed at a future date if necessary, when needed, a video recording camera was utilized throughout this process.

Moreover, a standardized skill test developed to assess the badminton high serve was used for measurement within the study. The purpose of the test was to objectively measure how well each participant had performed in a standardized way. This increased reliability and validity of measurements was due in part to the use of these instruments and tools during the course of the study.

Skill Test

In order to assess the accuracy of badminton high serve skill performance, an accurate test for badminton high serve (Phomsoupha & Laffaye, 2015) was carried out. The above test is frequently used in badminton skill assessment research as it enables the investigators to consistently and objectively measure serve accuracy and control at multiple locations.

The test was performed on a regulation BWF badminton court. Marking tape was used to create several target zones on the service area of the opposite court. The zones are scored based on how accurately the shuttlecock lands and the tactical value of the marked area.

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Each participant was explained the high serve skill and how it should be properly performed before they started. To get accustomed to the testing process, participants were also provided with two practice trials. Post familiarization, subjects executed ten number 1 high serves from the specific service position in the legal area.

The opposing participant would try to send the shuttlecock landing into their target zones in the opponent's court during the test. Points were given based on how accurate of a serve was. As a specific example, the central and deep target zones close to the back boundary line of the court were given higher scores on this logic as that would be considered optimal tactical placement of a high serve in badminton. Points introduced by Koji's serves that hit less specific areas scored lower (so-called, the 'dynamic areas' scored), while no points were given for serves landing outside of the actual area or as faults.

The sum of the scores from the ten attempts was taken as measure for the level of skill in badminton high serve. Higher scores reflected better accuracy and control over the serve. The test was administered under standard conditions in all subjects for the pre-test and post-test. The experiment was only conducted with the same equipment, court setup and testing procedures.

This badminton serving accuracy test has been applied in many studies for skill assessment, as well as physical education, related to performance improves on a specific skill (in this case serving) on beginner players.

Experimental Procedure

The experimental procedures of this study were carried out during the academic semester within the badminton practical course for first-year female students at College of Physical Education and Sport Sciences University of Baghdad. The experiment had a duration of eight weeks, which was composed by two instructional sessions per week, for a total of 16 instructional sessions. The duration of each session was 90-minute long, which is the common period for a practical sports lesson in our college.

In order to know the initial level of performance in badminton high serve skill; pre-test was administered in both experimental and control groups prior to conducting the experimental programme. All participants received the same pre-test conditions regarding court, equipment, and testing procedures. The pre-test results were then recorded in order to establish equivalence between the two groups prior to initiation of the intervention.

The experimental program was applied after performing pre-test. In the experimental group, a game-based learning strategy based on small-sided games was used to promote execution and ball placement accuracy of the high serve skill. The idea behind this approach was to incorporate mini-structured games into the learning framework, thus facilitating interactive learning environments in accordance with real badminton gameplay situations. These games were structured in a way that promoted reinforced motor learning of the high serve skill, and at the same time, facilitated coordination, timing, and tactical awareness. Furthermore, increased student engagement and motivation with the use of games have been noted as essential attributes in the motor learning process.

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Instruction always had three main components: the initial phase, where we warmed up; the instructional phase, where the subject of learning was explored; and a closing phase. During these warm up activities, the students executed general and sports particular work out to physically get ready for the session. The primary lesson phase consisted of demonstrations of the high serve technique followed immediately by engagement in structured small-sided practice games to encourage correct movement patterns and to increase accuracy during serving. Lastly, the final section consisted of short evaluation, feedback and cool-down activities.

Unlike the experimental group, the control group's involvement used the conventional method of teaching, which included explanation, demonstration of skill execution by an instructor and part repetition individual drills to practice high serve. While both groups taught the same skill and received an equal total amount of instructional time, how they were taught was different.

After the eight-week instructional period, both groups received a post-test under the same standardized conditions as in the pre-test. The reason for carrying out the post-test is to see how much improvement was achieved in the correctness of using the high serve skill and to compare the effectiveness of game-based learning strategy with traditional teaching method.

Table 2. *The Educational Program for the Experimental Group*

Week	Session Focus	Small-Sided Game Used	Objective of the Game	Duration
1	Introduction to high serve technique	Target Serve Game	Familiarizing students with high serve mechanics and target zones	20 min
1	Basic serve control	Serve Accuracy Challenge	Developing initial control of shuttle direction	20 min
2	Serve height and distance	Deep Court Target Game	Training students to send the shuttlecock toward the backcourt	25 min
2	Serve consistency	Consecutive Serve Game	Increasing repetition and consistency of high serves	25 min
3	Serve precision	Zone Scoring Game	Improving accuracy by aiming at different scoring zones	30 min
3	Decision making	Serve and Recover Game	Combining serve execution with movement preparation	30 min
4	Tactical serve placement	Opponent Target Game	Learning tactical placement of the serve	30 min
4	Competitive practice	Serve Competition Game	Increasing motivation through competitive play	30 min
5	Accuracy under pressure	Time-Limited Serve Game	Performing serves within time constraints	30 min

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5	Repetition training	Multi-Serve Game	Increasing number of skill repetitions	30 min
6	Game simulation	Mini Badminton Game (Half Court)	Applying serve skills in simplified game situations	35 min
6	Tactical awareness	Serve Strategy Game	Choosing appropriate serve placement	35 min
7	Performance consistency	Accuracy Ladder Game	Gradually increasing difficulty of serve targets	35 min
7	Skill refinement	Precision Target Game	Refining technique and shuttle trajectory	35 min
8	Integrated gameplay	Small-Sided Match Play	Applying serve skills in realistic match situations	40 min
8	Final practice	Competitive Serve Challenge	Preparing participants for the post-test	40 min

Statistical Analysis

Statistical Package SPSS was used to analyze the data collected. Ver. 26 Mean and standard deviation were calculated for descriptive statistics of participants' performance scores in pre-test and post-test measurements. Statistical analyses were further made to infer significance of the differences observed in the results. To determine the extent of improvement in performance for the high serve skill, a paired samples t-test was conducted to compare pre-test and post-test scores within each group. In addition, an independent samples t-test was performed to compare the post-test scores of participants taught through the game-based learning strategy using small-sided games (experimental group) and those who were instructed according to the traditional teaching method (control group). The significance level for all analyses was $p \leq 0.05$.

Results

Table 3. Comparison Between Pre-Test and Post-Test Results for the Experimental Group in the High Serve Skill

Test	N	Mean	Std. Deviation	t-value	Sig. (p)
Pre-Test	20	4.85	1.12	11.27	0.000*
Post-Test	20	8.95	0.97		

Table 4. *Comparison Between Pre-Test and Post-Test Results for the Control Group in the High Serve Skill*

Test	N	Mean	Std. Deviation	t-value	Sig. (p)
Pre-Test	20	4.70	1.09	4.63	0.000*
Post-Test	20	6.10	1.02		

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Table 5. *Comparison Between the Experimental and Control Groups in the Post-Test of the High Serve Skill*

Variable	Group	N	Mean	Std. Deviation	t-value	Sig. (p)
High Serve Skill	Experimental	20	8.95	0.97	9.01	0.000*
	Control	20	6.10	1.02		

Note. Significant at $p \leq 0.05$.

Discussion

The results of this study showed that both the experimental group and control group made significant improvement in high serve skill performance between the pre-test score and post-test score after the different subjective feedback interventions given to them. Yet the difference in improvement was significantly greater for the experimental group than that of the control group. It means that applying game-based learning strategy by using small-sided games, has an impact on precision and performance of the high serve skill level in the sample of study as a whole were beginner female students.

Game-based learning environments are dynamic, interactive learning situations that help in developing better motor skills, which is the reason behind the considerable improvement achieved by students belonging to experimental group. Such small-sided games enable learners to repeat their skills over and over within meaningful context that are similar to real-game scenarios, improving both motor coordination and tactical awareness. Such a finding echoes the tenets of ecological dynamics perspectives on motor learning, highlighting how effective skill acquisition considers interaction among the learner-user-tasks-environment (Chow et al., 2024; Hassan & Abdulkareem, 2026; Hammood et al., 2024). After learning skills through game-like environments, learners will better adapt their movements, allowing them to acquire more functional motor solutions.

More number of skill repetition with small sided games also plays an important role for improvement in experimental group. However, in reality learners often perform skills in a vacuum as part of track-based practices that do not truly reflect the dynamism of gameplay. In turn, small-sided games facilitate more continuous engagement and consequently increased opportunities to perform skills; thus, enhancing motor learning through practice with feedback. Previous studies of our own have shown that engaging in game-based practice led to much more handling and growing skills learned per practice (Silva et al., 2021; Abdulghani et al., 2025).

In addition, game-based learning can enhance students' motivation and satisfaction in the learning process. Motivation is thought to be an important contributor to motor learning, as motivated learners often practice with greater effort and attention. The small-sided games have a competitive and fun element to them, which motivates participants to engage in a less boring alternative that takes shape outside of drills. It is evident from studies in physical education literature that, with game-centered approaches the students' enjoyment and motivation are

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increased which influence their learning outcome positively (Werner et al. 1996; Mondil & Shukr, 2023).

Further, the findings showed that the controls have had moderate improvements from pre- to post-test assessments. This is not surprising, as regular practice with the skill during instruction sessions likely improved performance. Skill acquisition can still occur using traditional teaching methods grounded in demonstration and repetition, especially for novice learners who need well-defined technical instruction and organized training sessions (Schmidt et al., 2018; Ali & Remadan, 2021). But the degree of improvement was not as great as that seen in the experimental group, emphasizing the benefits of introducing game-based components into learning.

These settings might proof to be a driving force behind the mind-set created by small-sided games, which help explain the performance increase seen for the experimental group in post-test results. These games mimic the real playing scenario, where learners must adapt their foot-work, maneuver projectile trajectory and adjust body mechanics. These types of environments build in the learners the technical know how, perceptual and decision-making skills required for proficient execution within badminton (Davids et al., 2013; Hussein & Abedulkareem, 2017; Otte et al., 2019; Rabeea et al 2024).

The effectiveness of the game-based learning strategy is also explained by its consistency with many modern pedagogical approaches in physical education, emphasizing student-centered instruction. These craft learners to search for movement solutions rather than simply copying the techniques being shown. This allows for engagement with the learning process and creates a better understanding of how to execute skills (Light & Harvey, 2017; Maki and Mahdi, 2018).

Collectively, the results of this study add to the increasing body of evidence supporting game-based instructional strategies as effective for improving sports education through motor skill acquisition. This implies that small-sided games–based badminton instruction may create a productive learning experience for beginner learners through skill repetition in more than contextual and engaging way, which leads to higher performance of the high serve skill.

Conclusions

This study's results suggest that such a game-based learning strategy, using small-sided games, significantly improved performance of the high serve skill in badminton by beginner female students. The finding that the experimental group improved more than the control group implies that incorporating structured games into the learning process serves as an enriching learning environment, increasing skill rehearsal frequency and improving coordination and enthusiasm during motor acquisition. These findings all clearly establish that game-based learning approaches are effective in developing basic badminton skills of school children at elementary level.

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Recommendations

According to the study findings, physical education teachers should consider game-based learning principles and small-sided games when teaching badminton skills because they could increase motivation and can promote skill acquisition especially for novice learners. The findings can also be used to progress the teaching of other racket sport skills in physical education contexts. Moreover, future studies are suggested to analyses the outcomes of game-based learning on other badminton skills with a larger sample and different age groups to further clarify the role of contemporary teaching methods in motor learning process as well as sports education.

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