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ORIGINAL STUDY

The Effect of Educational Games on Distance Perception and the Performance of the Volleyball Serving Skill Among Female Students

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Abstract

Educational games are among the most effective tools for teaching fundamental skills, particularly in volleyball. The present study addresses the issue of weak performance among second-year female students at the College of Physical Education and Sport Sciences for Women in executing the volleyball serve. This weakness is attributed to the learners' limited perception of the appropriate distance required to toss the ball upward before striking it, as well as their poor understanding of the correct serving distance. Additionally, there is a need to incorporate engaging methods into the educational process. Therefore, the study aimed to design instructional units utilizing educational games to teach the serving skill and to examine their impact on distance perception and skill acquisition. The researchers adopted the experimental method, employing a pre-test/post-test design with control and experimental groups. The sample consisted of 30 randomly selected second-year female students from the College of Physical Education and Sport Sciences for Women at the University of Baghdad. An exploratory sample of four students was also selected. Research tools included two tests: one for measuring distance perception and another for assessing the serving skill. After conducting the pre-tests and ensuring group equivalence, the main experiment was implemented over eight instructional units, delivered weekly, with each session lasting 90 minutes. Post-tests were then administered. The findings indicated that educational games had a positive effect on both distance perception and the acquisition of the serving skill. Moreover, the experimental group outperformed the control group. The researchers recommend using educational games in teaching volleyball skills, particularly the serve. and this achieves one of the sustainable development goals of the United Nations in Iraq which is (Quality Education)

Keywords: Distance perception, Educational games, Serving skill, Volleyball

1. Introduction

This era has been referred to as the "Age of Speed" due to the immense scientific advancements in various fields of life, particularly in education and its core components—teacher, learner, and curriculum—as well as the inputs and outputs of instructional processes, both theoretical and practical (Ahmed & Hamoodi, 2021).

Educational games are considered practical motor learning tools. They contribute to developing fundamental movements and enhance individuals' ability to perform correct movements across various sports disciplines. Moreover, educational games serve as a motivational tool that encourages students to develop cognitive abilities and learn basic skills progressively and sequentially. This process helps improve coordination, balance, and the accuracy of sports movements.

These games blend entertainment with learning to achieve educational objectives engagingly and

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enjoyably, increasing learners' motivation to participate in the learning process. Educational games can be categorized as group-based, individual, competitive, or cognitive.

Visual perception is a crucial element in sports, as it enables learners to understand their positioning, identify their weaknesses and those of their peers, and perceive the movements of teammates and opponents. This perception stems from sensory input; thus, the more observant a learner is and the broader their field of vision, the better their perceptual abilities—and consequently, their skill acquisition.

Distance perception, a subset of spatial perception, reflects the learner's ability to estimate the distance between themselves and others or between them and surrounding objects. In volleyball, the serve is a fundamental skill that initiates play. Therefore, learners must understand the required distance and direction for the service to succeed.

The significance of this research lies in the importance of using educational games in learning due to their role in enhancing the educational process. It also emphasizes the importance of learners' ability to perceive distances accurately and execute the volleyball serve effectively. Since the serve marks the beginning of play and can score direct points, mastering it is essential.

1.1. Research problem

The research problem is the poor technical performance of the volleyball serve among most female students despite repeated practice and sufficient instructional time. The researchers attribute this issue to a lack of excitement and stimulation during skill learning, which reduces learners' motivation. Additionally, many students appear to have poor distance perception when tossing the ball and judging the serving distance needed for the ball to cross the net and reach the opponent's court.

Thus, the researchers decided to conduct this study to examine whether educational games could improve excitement, motivation, and learners' distance perception, enhancing their ability to perform the volleyball serve effectively.

1.2. Research objectives

- To develop instructional units using educational games for learning the volleyball serve.
- To investigate the effect of educational games on distance perception and the performance of the volleyball serve among female students.

1.3. Research hypotheses

- There were statistically significant differences between the pre-and post-tests of both the control and experimental groups regarding distance perception and the volleyball serve.
- There are statistically significant differences in the post-test results between the experimental and control groups in favor of the experimental group.

1.4. Research domains

- **Human Domain**: Second-year female students at the College of Physical Education and Sports Sciences for Women, University of Baghdad.
- **Temporal Domain**: From January 31, 2024, to April 2, 2024.
- **Spatial Domain**: Indoor gymnasium, College of Physical Education and Sports Sciences for Women, University of Baghdad.

2. Methodology and procedures

The researchers employed the experimental method using a randomized pre-test–post-test design with two equivalent groups: an experimental group and a control group. This design was deemed appropriate for addressing the research problem and objectives.

The study population consisted of second-year female students enrolled at the College of Physical Education and Sports Sciences for Women, University of Baghdad, during the academic year 2023–2024. The total number of students was 34, distributed across two sections.

The research sample comprised the entire study population, representing 100% participation. Accordingly, the experimental and control groups were selected randomly using a lottery method. Section (A) was designated as the control group, consisting of 15 students out of a total of 19, after randomly excluding 4 students to serve as the pilot sample. Section (B) was designated as the experimental group, consisting of 15 students.

Thus, the main experimental sample represented 88.235% of the total, while the pilot sample accounted for 11.764%, as shown in Table 1. Given that all

Table 1. Population and sample distribution.

Sections	Total Students	Main Experimental Sample	Pilot Sample
A	19	15	4
B	15	15	–
Total	34	30	4
Percentage	100 %	88,235 %	11,764 %

participants were within the same age group and had similar heights and weights, the sample was considered homogeneous.

2.1. Tools and instruments

The researchers employed the following tools, equipment, and devices:

Arabic and foreign references, Exploratory questionnaires, Data collection and tabulation forms, Volleyballs, Volleyball court, Medicine balls, Adhesive tape, Measuring tape, Video recording camera, DVDs, Laptop computer, Hand calculator, Smooth wall, Markers, Ropes.

1. **Tests Used in the Study**

Distance Perception Test (Abu Eid & Dalasha, 2024, p. 73)

Test Name: Horizontal Spatial Perception Test in Throwing

Purpose of the Test: To measure the perception of horizontal space in throwing.

Test Description: Two lines are drawn with a distance of 5.12 meters between them. The subject performs a two-handed throw from behind the throwing line while blindfolded, after being given a chance to visually estimate the distance.

Scoring Method: The distance between the point where the ball lands and the second line is recorded. The subject is given six attempts, and the best five attempts are used for scoring.

2. **Serving Test** (Abu Eid & Dalasha, 2024, p. 8)

Purpose of the test: To assess the serving skill of a volleyball player in a game-like situation.

Equipment: A standard volleyball court, an official volleyball, and a court prepared as shown in Fig. 1.

Performance specifications: The player stands at the center of the end line on the side of the court facing the marked half. From this position, while holding the ball, the player performs a serve—using any legal serving technique—so that the ball crosses the net and lands in the designated area on the opponent's side of the court.

Conditions:

1. Each player is allowed ten attempts.
2. If the ball lands outside the court, the attempt is counted among the ten but receives no points.

Scoring:

For each successful serve, the score corresponds to the number of the zone where the ball lands on the marked half of the court. Since the player has ten attempts and the scores range from 1 to 4 points per zone as Fig. 1 presenting that, the maximum possible score for this test is 40 points.

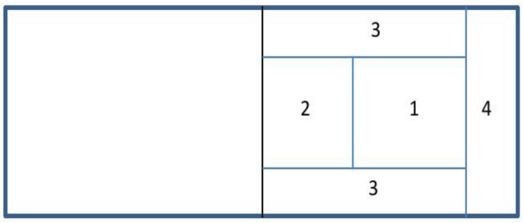

Fig. 1. Serving skill test.

Note: If the ball lands on a line separating two zones, the player is awarded the score of the higher-value zone.

2.2. Pilot study

An exploratory trial was conducted using the distance perception test, the serving skill test, and the instructional units based on educational games. This was carried out on a pilot sample consisting of four students from Section (A), selected randomly from outside the main experimental sample. The pilot study was held on January 31, 2024, in the indoor hall of the College of Physical Education and Sports Sciences for Women at the University of Baghdad.

The purpose of the pilot study was to verify:

- The appropriateness of the selected tests, instructional games, and exercises for the students' level.
- Identification of any potential challenges during the main experiment.
- Familiarity of the assisting staff with the implementation procedures.
- Estimation of the time required for conducting the tests and executing each part of the instructional units.

Following the pilot study, it was confirmed that all components were suitable and ready for implementation.

2.3. Pre-test procedures

After completing the pilot study, the main experiment began with the pre-testing phase. Pre-tests for both the distance perception test and the serving skill test were conducted for both the control and experimental groups on February 5–6, 2024, in the indoor hall of the College of Physical Education and Sports Sciences for Women, University of Baghdad.

- On the first day, the distance perception test was administered to both groups.
- On the second day, the serving skill test was conducted.

Table 2. Equivalence of control and experimental groups in pre-test variables.

No.	Tests	Control Group AM	Control Group SD	Experimental Group AM	Experimental Group SD	Calculated T value	Error value	Statistical Significance
1	Distance Perception	1,67	0,55	1,71	0,47	1,43	0,07	Not significant
2	Serving Skill	8,08	0,87	8,14	0,69	0,92	1,28	Not significant

Significance is determined at $p < .05$.

Table 2 shows that there were random differences between the control and experimental groups in the pre-tests of the study variables (distance perception and serving), indicating the equivalence of the two groups in the study variables. Subsequently, educational games were implemented for the experimental group from February 7, 2024, to March 27, 2024, over a period of eight instructional units, at a rate of one unit per week. Each instructional unit lasted a total of 90 minutes and included the following:

1. **Preparatory Section (20 minutes):**

This included the introduction and general warm-up exercises for all muscle groups, in addition to physical exercises with ball warm-up activities.

2. **Main Section (60 minutes):**

This consisted of both instructional and practical aspects. The instructional aspect lasted 10 minutes and included explaining the skill, demonstrating it in front of the students, providing them with feedback, and explaining the games. The practical aspect lasted 50 minutes and involved the implementation of various educational games and serving exercises.

3. **Concluding Section (10 minutes):**

This involved recreational games, corrective feedback for all students, collecting equipment, and concluding the lesson.

After completing the implementation of the main experiment, post-tests were conducted for both the distance perception and serving tests on April 1–2, 2024, in the indoor hall of the College of Physical Education and Sports Sciences for Women at the University of Baghdad. The researchers ensured that the pre- and post-tests were carried out under similar conditions to obtain accurate results. The statistical analysis was conducted using the Statistical Package for the Social Sciences (SPSS), and the statistical measures used included: mean, standard deviation, percentage, paired sample t-test, and independent sample t-test.

See the description in (Appendix 1) for the whole process.

3. Results and discussion

Tables 3 to 5 show that there were significant differences between the pre- and post-tests for both the control and experimental groups in the study variables (distance perception and serving), in favor of the post-tests. This indicates that both the curriculum used by the course instructor and the curriculum developed by the researchers achieved positive results. The researchers attribute this to the fact that the instructor's approach played a role in the students' perception of the required distance, which in turn contributed to better performance in the serving skill. This suggests that the instructor's curriculum was implemented in a scientific manner and that progress came as a result of practice, repetition, and feedback provided by the instructor, all of which contributed to learning the serving skill.

Table 3. Results of the pre- and post-tests for the control group on the study variables.

Variables	Pre-Test Mean	Post-Test Mean	Mean Difference (MD)	SD of Diff (SDD)	Calculated t-value	Significance Level	Statistical Significance
Distance Perception	1.67	1.11	0.56	0.12	2.71	0.02	Significant
Serving	8.08	16.59	8.51	0.87	4.54	0.001	Significant

Significant when the error level < (0.05).

Table 4. Results of the pre- and post-tests for the experimental group on the study variables.

Variables	Pre-Test Mean	Post-Test Mean	Mean Difference (MD)	SD of Diff (SDD)	Calculated t-value	P-value	Statistical Significance
Distance Perception	1.71	0.76	0.95	1.02	3.06	0.00	Significant
Serving	8.14	21.41	13.27	1.32	7.46	0.00	Significant

Significant when the error level < (0.05).

Table 5. Shows the results of the post-tests between the control and experimental research groups in the study variables.

No.	Tests	Control Group		Experimental Group		Calculated t-value	Error Value	Statistical Significance
		AM	SD	AM	SD			
1	Distance Perception	1,11	0,43	0,76	0,54	3,73	0,003	Significant
2	Serving	16,59	1,22	21,41	1,46	8,47	0,00	Significant

Significant when the error level < (0.05).

The researchers also attribute the superior performance of the experimental group to the curriculum they designed, particularly the use of educational games, which played a key role in enhancing distance perception and learning the volleyball serving skill. Engaging in fun and interesting games helped the students estimate the required distance at the moment of the serve and the appropriate force needed to execute it, leading to better learning outcomes compared to the control group. The use of games added enjoyment to the learning process, making the exercises more appealing. This aligns with what Ilias (2020) pointed out that the superiority is due to the content of small games that include exercises and movements beloved by players and easy to perform, in addition to factors of excitement, encouragement, and competition.

Furthermore, Abdul Hafez (2009) emphasized that play is the best tool for learning in all that learning entails for the learner and their personality. The use of educational games increases the learner's motivation to perceive distance and learn the serving skill. The competitive nature of the games enhanced excitement and motivation among the students, as the presence of winners and losers increased the students' drive to give their best effort.

Team-based games also enhanced cooperation and interaction among group members, fostering a collective effort to win. This encouraged the students to exert their full potential, which in turn contributed to improved distance perception and learning of the volleyball serving skill. Play also ensures that all students participate actively, which helps reduce individual differences among them. This aligns with what Nassif (2019) noted, that "having a group composed of students with varying levels (weak – average – good) contributed to reducing individual differences." (p. 274)

Moreover, the educational games included exercises that enhanced the learner's perception of throwing distance, thereby improving the learning of the serving skill. As Ahmed and Hamoodi (2021) noted that Perceptual-motor exercises help learners gain a deeper understanding of the nature of skill performance. This is also confirmed by Mashkour and Hamoudy (2022), stimulating a single sensory experience during the learning process is not enough for the learner to fully understand the material. Acquiring experience requires engaging multiple senses, which is essential for cognitive processing and meaningful learning.

Al-Alawi (2024) also emphasized that including exercises that develop sensory perceptions in the curriculum led to the enhancement of those perceptions.

The researchers further attribute the experimental group's superior performance to the curriculum they developed, which included comprehensive explanations, practical applications, and error correction. Hussein and Ahmad (2000) showed that importance of verbal instruction during skill explanation, error correction, and guidance increases the speed of learning new movements effectively.

Additionally, Hammoudi (2019) highlighted the importance of clear educational objectives for each unit and their alignment with the learners' level and capabilities.

Finally, it's important to note the psychological impact of the serving skill. Since it is an offensive skill that can score a direct point without much effort from the team, its success can boost a player's psychological state. Conversely, failure in serving can cost the team a point and affect the player's mental and physical state, thereby influencing in-game communication. This is supported by Samir et al. (2016).

4. Conclusion

1. The traditional method used contributed to the development of distance perception and learning the volleyball serving skill among the students.
2. Educational games played a significant role in enhancing distance perception and learning the volleyball serving skill among the students.
3. The experimental group that used educational games outperformed the control group, which followed the traditional method, in developing distance perception and learning the volleyball serving skill.

5. Recommendations

1. Adopt educational games in teaching sports skills, particularly the volleyball serving skill.
2. Utilize the curriculum prepared by the researchers for teaching the volleyball serving skill, as it has shown positive results in skill acquisition.
3. Emphasize the importance of using educational games in teaching volleyball skills.
4. Develop exercises aimed at improving distance perception among students.
5. Conduct similar studies on other volleyball skills not addressed in the current study to explore the impact of educational games on them.

Conflicts of Interest

None declared.

All tables and figures included in this manuscript were created and written by the authors themselves.

Ethical Clearance

This manuscript was approved by *the Ethics Committee of* College of Physical Education and Sports Sciences for Women, University of Baghdad on 13/11/2024.

Authors' contributions

All aspects of this study were carried out by the research team, consisting of Dr. Luma Samer, Ms. Marwa Saadi, Asst. Lect. Ghufran Basheer, and Dr. Özgür Eken. The researchers collaboratively developed the idea, conducted the research, wrote the manuscript, and drew the conclusions, with consultation from several experts in the field.

- Prof. Dr. Luma Samer: Led the statistical analysis and overall study design.
- Ms. Marwa Saadi: Contributed to content revision and refinement.
- Asst. Lect. Ghufran Basheer: Participated in drafting the introduction and data collection.
- Assoc. Prof. Dr. Özgür Eken: Provided academic support in sourcing references and citation alignment.

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Data availability

The data that support the findings of this study are available on request from the corresponding author.

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Appendix 1: A Selected Model for an Educational Unit

Educational Objective: Teaching the volleyball serving skill
Date: 14/2/2024
Pedagogical Objective: Promoting cooperation and competition among the students
Duration: 90 minutes

Unit Sections	Duration	Details	Notes
Preparatory Section	20 min 4 min 8 min 8 min	Introduction General body warm-up Physical exercises targeting specific muscle groups	Emphasize attendance, orderly standing, and maintaining proper distances between students, then emphasize performing physical exercises correctly.
Main Section	60 min		
Educational Aspect	10 min	- Explanation of how to perform the skill - Demonstration by the subject teacher - One student performs the skill	Emphasis on students' understanding of the skill
Practical Aspect	50 min 10min 10 min 10 min 10 min 10 min	- Divide students into four groups to compete while performing the exercises. - Throw the ball with one hand as far as possible and select the winning group. - Two groups on each court side perform serving from behind the end line to the opposite court, identify the group with the most accurate serves. - The four groups perform serves over a curtain placed 6 meters from the net. - Serve toward a marked wall target, determine the winning group with the highest score. - Serve towards the opposite half of the court, aiming to land the ball behind the attack line; determine the group with the most accurate serves.	- Emphasizing the correct performance of the skill, while instilling a spirit of cooperation among the group and competing with other groups in a sportsmanlike spirit.
Concluding Section	10 min	- Recreational game. - Praise the best-performing group- Provide feedback to all learners. - Collect equipment and conclude the lesson.	