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The Effect of Motor Activity Based Learning on the Acquisition of Two Tennis Groundstroke Skills

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Abstract

This research is concerned with the effect of learning on movement activity to develop groundstroke (Forehand and backhand) tennis skills for 14-year age group female players at Diyala specialized Center of Baghdad. The study was conducted with two groups (experimental and control), one of which was taught using motor activity based instructional modules, while the other was taught through traditional teaching techniques. Analysis included before and after for each set of skills. The results showed that the experimental group was able to achieve a significantly better improvement in accuracy and consistency than the control group, thanks to variety of practice including immersion in practical experience. This made them even more motivated to learn the strokes and deepened their understanding of what is the base technical element of each smash and clear. Conversely, the control group was able to reduce EF through mere repetition. The findings of the study provide support for programs with structured progressive educational content that mesh practical and sensory-motor learning experience, expedite skill acquisition as well as maintain performance progression in young tennis players.

Keywords: learning, motor activities, forehand stroke, backhand stroke.

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Introduction

Motor learning generally investigates human movement, and in particular athletic performance to explore the different levels from which one may study movement (Shalash, 2002, p. 62). Covering tennis, a game that captures the heart and soul of fans, is News coverage: As the French Open draws up to begin May 23 (it will be over June 6). The reason that the game has gained international notoriety is due to its appeal as a source of excitement for male and female players, keeping them in shape (Al-Hajjiya, 1990, p. 5).

The two basic groundstrokes are fundamental shots in tennis and form the basis of technical and tactical developments in junior and senior pupils. Educational and sports literature emphasises the need for a shift to novel teaching methods that are based on practical experience, and take into consideration integrated movement with the aim of developing these abilities as opposed to traditional pedagogical practice. This approach is known as activity-based learning. A key element in this context, which has a direct improving effect on the tennis player's performance, is their level of concentration. They meet great resistance from distraction s and lack of concentration which undermine to an extent the accuracy finesse of their strokes (Hashem, 2000 p. 152). A study comparing the learning methods unveiled that they are effective not only to enhance the accuracy of learners' groundstrokes but also to produce a distinct advantage over those employed in the traditional approach concerning skill acquisition speed, although no difference seemed to exist in long-term retention (CCSE, 2021).

In the motor learning literature, training with varied practice has received a great deal of attention. A field experiment revealed that contrasted exercise in terms of goals and distances is the most effective way to promote stroke accuracy in young people than when fixed training, supporting "the contextual interference" hypothesis as a basic device of motor learning (ResearchGate, 2006). Additionally, a study also recently found that the use of motor imagery during high-intensity physical training sessions-maintained performance levels when compared to performance after having trained without this component, without affecting physiological responses including heart rate (PMC, 2015).

"A neuromuscular training program that is effective in improving balance and neuromuscular coordination can potentially improve fine motor skills, such as hitting a forehand or backhand in tennis," according to findings reported recently by a team of researchers who conducted topicrelated systemic reviews (BMC Sports Science 2025).

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In view of this evidence, it appears that motor-based learning, through multiple exercises and station-based learning, represents an effi cacious conceptual model to expedite the achievement of basic tennis skills and maximize their retention. Our study points to the importance of studying how these kinds of learning protocols effect on groundstroke development and it provides empirical scientific evidence, which will give the coaches the tools for implementing interactive motor learning strategies that serve to improve accuracy-consistency levels.

The study also aims to clarify the terminology related to the topic. "Motor-based learning" refers to all methods that employ motor variety and direct practical experimentation as teaching tools, while "accuracy" is used as an indicator of the ability to repeatedly direct strokes toward specific targets, and "retention" signifies the extent to which learning remains effective after the completion of the training program.

Research problem

The two ground strokes (forehand and backhand strokes) are among the most important technical pillars of tennis, as they form the basis for ball exchanges and controlling the flow of the game. Through field observation of the training of players at the Diyala Specialized Center (14 years old), a relative weakness in the accuracy and speed of their performance was noted, in addition to fluctuations in neuromuscular coordination during the execution of these two strokes. This deficit stems from a classic instruction which is focused on mechanical repetition and lacks motor pattern that responds to the specific features of this age-group. This gap is detrimental to the players' development, who receive less instruction and struggle in mastering the basic skills needed for progressing to a higher level of technical play. This conclusion is based on field observations and examination of educational and training units, as well as the experience of the researcher as a tennis trainer in Diyala Governorate. This prompted the researcher to explore the possibility of applying a method based on motor activities to address this problem and achieve tangible progress in learning the two ground strokes.

Research objectives

1. To identify the effect of activity-based learning on improving the forehand groundstroke skill among 14-year-old female tennis players at the Diyala Specialized Center.

2. To identify the effect of activity-based learning on improving the backhand groundstroke skill among 14-year-old female tennis players at the Diyala Specialized Center.

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3. To compare the results of the experimental group (which underwent activity-based learning) with the results of the control group (which followed the traditional method) in terms of learning both groundstrokes.

Research hypotheses

1. There are statistically significant differences at the 0.05 level between the pre-test and post-test results for the experimental group, favoring the post-test in learning the forehand groundstroke.

2. There are statistically significant differences at the 0.05 level between the pre-test and post-test results for the experimental group, favoring the post-test in learning the backhand groundstroke.

3. There are statistically significant differences at the 0.05 level between the post-test results of the two groups (experimental and control), favoring the experimental group in learning both groundstrokes.

Research areas

1. Human Resources: Ten (10) female tennis players aged 14 years old at the Diyala Specialized Center, divided into two groups (experimental and control), with five players in each group.
2. Location: The courts of the Diyala Specialized Tennis Center.
3. Timeframe: From July 15, 2025, to September 1, 2025.

Methodology

The researcher used the experimental method with a design based on two groups (experimental and control) with pre- and post-tests, as it is suitable for the nature of the research problem and its objectives, and because it is the most appropriate for measuring the effect of learning based on motor activities in learning the two groundstrokes in tennis.

Research population and sample

The research community was determined from the players of the Diyala Specialized Tennis Center in the age group (14 years), and the number of members of the community was (10) players

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who were chosen intentionally and then randomly distributed using the method of drawing lots into two equivalent groups, experimental and control, with (5) players in each group.

Data collection methods and research tools

The researcher relied on several methods to collect data, including: Arabic sources, the internet, personal interviews with experts and specialists, direct observation and the researcher's practical experience, and the use of a performance scoring form for the two groundstrokes.

The equipment used included: a regulation tennis court, ten tennis rackets, a measuring tape, seventy tennis balls, a whistle and a manual timer, a computer for data analysis, and colored adhesive tape to mark performance zones on the tennis court.

Two Groundstrokes Test (ITF: 2004: 9)

Test Purpose: To measure the depth of groundstrokes (forehand and backhand).

Equipment: 1 tennis racket, 10 tennis balls.

Performance: The player stands behind the baseline, and the coach is opposite them on the T-line. The coach feeds the player four balls for warm-up, one for each skill. The player then performs the test, using 10 balls (5 for each skill).

Scoring: Points are awarded for the first and second bounces of the ball, based on the location of the bounce. If the first bounce is in the one-point zone and the second in the two-point zone, three points are awarded. If the first bounce is in the three-point zone, for example, and the second in the double-point zone, six points are awarded for that shot. This process is repeated for all other point zones, as shown in Figure 1. The maximum score for the test is 90. One point is awarded for each successful attempt within the court. Notes: If the ball touches the lines, it is considered to be in the field; if it touches the lines between the divided zones, it is considered to be in the field.

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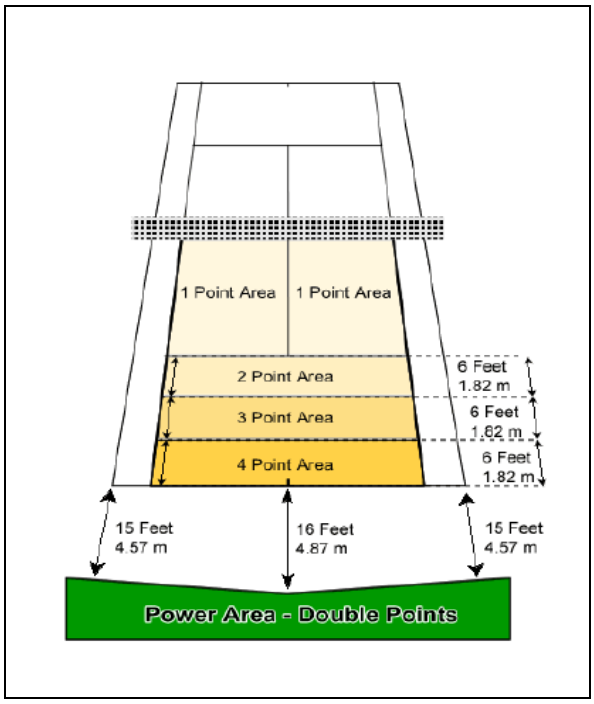

Figure 1. *Illustrates The Method For Performing The Front And Back Stroke Test*

Main Experiment

The researcher prepared 10 instructional units, each 90 minutes long, delivered twice a week on Tuesdays and Wednesdays for five weeks. Each unit included two practical exercises focused on developing the twogroundstrokes in tennis. The researcher drew upon his practical experience as a tennis coach in Diyala Governorate, as well as scientific resources and expert consultations. The exercises were carefully designed to be appropriate for the participants' level, with a gradual increase in difficulty, and to achieve the learning objectives of each exercise.

The program was implemented on Tuesday, July 29, 2025, with the research participants under the researcher's supervision. Each instructional unit included a 45-minute main practical activity, delivered twice a week in the afternoon from 5:00 PM to 6:30 PM.

Results

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Table 1. *shows the significance of the differences between the pre-test and post-test for the experimental group*

Test	Unit of measurement	Mean	Std. Deviation	Std. Error Mean	T	Sig. (2-tailed)	Type of indication
Front stroke	Point	8	3.082	1.54	6.44	0.000	sig
Back stroke	Point	7.8	3.273	1.63	4.76	0.001	sig

At a significance level of 0.05 and degrees of freedom n-1=4

Table 2. *shows the significance of the differences between the pre-test and post-test for the control group*

Test	**Unit of measurement**	**Mean**	**Std. Deviation**	**Std. Error Mean**	**T**	**Sig. (2-tailed)**	**Type of indication**
Front stroke	Point	8.6	2.607	1.3	6.59	0.000	sig
Back stroke	Point	6.8	3.508	1.78	3.87	0.001	sig

At a significance level of 0.05 and degrees of freedom n-1=4

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Table 3. *The results of the tests for the experimental and control groups are shown*

Skill	The group	N	mean	SD.	T	Sig. Value	Type of indication
Front stroke	Experimental group	5	28	4.243	3.49	0.001	sig
	Control group	5	20.8	4.494			
Front stroke	Experimental group	5	25.6	2.88	3.68	0.001	sig
	Control group	5	20.6	2.87			

At a significance level of 0.05 and degrees of freedom n-2=8

Discussion

Table (1) shows that the differences between the mean scores of the pre-test and post-test for the experimental group in the forehand and backhand stroke skills were statistically significant at a p-value of less than (0.05), favoring the post-test. This indicates that the activity-based learning units clearly contributed to improving the performance level of the group members, both in terms of accuracy and consistency in executing the two skills.

This gain is explained by the nature of activity-based learning, which provides more chances for hands on experimentation process and learning in various contextual forms. Such a method allows learners to learn by doing rather than simply memorizing. This is consistent with the evidence provided by CCSE (2021), that indicates how active learning allows for a higher accuracy on ground strokes than traditional practices based on mechanical repetition without variation. In addition, the findings of ResearchGate (2006) support the idea that diverse training increases the efficiency of motor performance by increasing the ability of subjects to adapt during playing in different environments.

Moreover, the motor activities developed the learners' thinking skills by combining theory application with kinaesthetic cognition. This was reflected in their increased focusing on specific features of the stroke, for example racket angle, timing and ball-contact point. Conclusion Force increase could be primarily due to the character of exercises that focused on body balance and a symmetrical distribution of effort between the arms, which resulted in better performance of movement with the backhand top spin. These components were described in BMC Sports Science

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(2025) as being crucial for the formation of fine movement skills. Thus the positive differences recorded at post test tests can be attributed to the match between the educational program and these learners, in as much it had clear aims and was adequately matched to their level of competence. This led to a substantial improvement in skill performance.

Table (2) The pre-test and post-test comparison results of the control group had significant differences in as much as the error level is (0.01)The post test result was better for both the forehand and backhand for same group. This means that the educational units received by this group also led to an increase of performance level of these two skills, although at a lower degree than in the experimental group.

A greater performance observed may be related to the organization of training sessions, its regularity and coresearchers´ rigorous work in colour resolution. This created an increased sense of confidence and willingness to learn in the trainee level. And the motivation from those who were in charge of executing the exercises helped to speed up their learning how to perform them (Amin, 2020, p. 198). Whilst this procedure suffered from a lack of complexity in test conditions in practice recollection was assisted by stability between learning and testing, and availability of multiple trials to 'get the feel' for each ground stroke, which appears to have facilitated a kinematic representation of the two ground strokes as evidenced by the positive gain observed across pre- and post-test measures.

This is in accordance with the result obtained by ResearchGate (2006) that even though it may not be very effective, repetitive constant practice can increase doing smaller number of trials which influence motor performance among beginners. As pointed out by CCSE (2021), although conventional methods sometimes can achieve significant gain in short-term performance, they are less effective at enabling adaptation to diverse playing situations, compared with active or differential approaches.

On the other hand, the improvement in backhand stroke among the control group may be due to dedicating sufficient time to repeated practice of this skill, which is relatively more difficult than the forehand stroke. This aligns with what was indicated in the BMC Sports Science (2025) review, which stated that continuous repetition helps develop the balance and neuromuscular coordination necessary for the backhand stroke, even within traditional training programs.

Therefore, it can be said that the results achieved by the control group confirm that traditional training programs are capable of leading to progress in learning basic tennis skills. However, the extent of this progress remains relatively less than that achieved by programs that

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rely on diverse motor activities, as will be revealed in the final comparisons between the two groups.

The findings table (3) show that the experimental group was significantly better than the control in both forehand and backhand posttests. The mean forehand score at the experimental group was (28), while in control group, they were (20.8) and there is statistical significant d difference (< 0.05). For backhand stroke, the experimental group had average 25.6 score and control group 20.6 score. The computed t-value of (3.68) was also significant at the 0.05 level. The above significant differences indicate that the skill performance increased more among the participants in education programmed compared to traditional education.

These results indicate that the design of instruction with a focus on motor activity practice was successful. Such a design provided a rich multisensory learning environment, as well as functional-motor drill instruction for the acquisition of knowledge and motor performance. By guiding learners to attend to sequentially staged attention attraction and goal clarification, presenting stimuli and organizing responses, as well as by providing reinforcement and assessment, this experience is systematically and deeply constructed. This result aligns with Magill and Anderson's (2021) review that structured repetition and immediate feedback increase motor learning.

The training units on the other hand, applied a gradual escalation of intensity and variety in the exercises, enabling development of physical qualities like 'neuromuscular coordination' and balance that would improve ability to perform skills. This is consistent with Schmidt & Lee's (2019) contention that success in motor performance depends on the degree of coupling between cognitive and motor processes during practice.

The experimental group outperformed the control group may due to that such an intervention program provides more occasions for active environmental intervention and participation, which increased their interest in playing and improved their confidence. The other group was limited by transition to the traditional form that lack diversified stimuli and is dependent on rote learning and mechanical repetition, with few opportunities for rapid skill development. The results of other studies (Hussein, 2023) confirm the fact that interactive-based educational curricula has an impact on a greater progress in learning fundamental tennis skills than do traditional models.

Based on the above, it can be said that the superiority of the experimental group in the post-test represents practical evidence of the success of educational units based on motor activities in creating substantial differences in the level of skill performance, which is consistent with the

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research hypothesis that assumed the existence of significant differences in favor of the experimental group. Therefore, these results confirm the importance of employing modern educational models in tennis programs because of their effective role in developing basic motor skills and ensuring the achievement of qualitative and sustainable progress in the level of junior players.

Conclusions

1. Effectiveness of Activity-Based Learning: The results showed that using activity-based learning units significantly improved the tennis players' performance in both forehand and backhand strokes compared to the traditional method.
2. Variety in practice, enhanced accuracy, and diverse training situations and learning stations helped the players gain broader practical experience, leading to increased accuracy and consistency in executing the strokes. This highlights the importance of integrating sensory-motor stimuli into the learning process.
3. Program Impact on Cognitive Aspects and Motivation: Integrating kinesthetic thinking and active practice stimulated the trainees' cognitive abilities and increased their awareness of the importance of the basic technical aspects of the stroke. It also boosted their motivation and confidence during training compared to traditional methods that rely on repetition.
4. Comparison with the Traditional Method: Although the control group showed some improvement due to continuous repetition of skills, the experimental group's progress was significantly greater. This indicates the superiority of activity-based learning over traditional education in terms of speed of skill acquisition and quality of performance.
5. The importance of designing gradual and organized educational programs to provide an organized and gradual learning environment that helps players build sequential motor experiences, which enhances the stability of learning and ensures the improvement of skill performance in a sustainable way.

Appendix (1)

Model of the first educational unit

Educational objective:	**Learning Unit Number: 1**	**Today: Tuesday**
Ground kicks	**Time: 90 minutes**	**Date: 29/7/2025**

sequence	Unit sections	Duration	the details	Notes

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1	Preparatory Section General Warm-up Specific Warm-up	20 minute 10 minute 10 minute	 ---------- ----------	
2	Main Section Educational Aspect Practical Aspect	60 minute 15 minute 45 minute 20 minute 20 minute 5 minute	 Explanation and presentation of practical exercises Exercise No. (1(Exercise No. (11(Organizing, collecting balls, and alternating between exercises	
3	**Concluding Section** **Calming Exercises** **Relaxation Exercises**	**10 minute** **5 minute** **5 minute**	---------- ----------	

Learning Unit	Day	Date	Exercises Completed	
1.	Tuesday	29/7/2025	1	11
2.	Wednesday	30/7/2025	2	12
3.	Tuesday	6/8/2025	3	13
4.	Wednesday	7/8/2025	4	14
5.	Tuesday	13/8/2025	5	15
6.	Wednesday	14/8/2025	6	16
7.	Tuesday	20/8/2025	7	17

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8.	Wednesday	21/8/2025	8	18
9.	Tuesday	27/8/2025	9	19
10.	Wednesday	28/8/2025	10	20

Appendix (2)

Exercises prepared by the researcher and used in the educational units

front strike

1. Simulating a shot without a ball: Repeating the hand and foot movements in the air.
2. Hitting a stationary ball: A ball suspended by a string that allows for hitting.
3. Hitting a slow, controlled shot towards the wall: To control timing.
4. Hitting from a hand pass by the coach: Easy balls on the right side.
5. Hitting from a bat pass by the coach: Medium-height balls, focusing on accuracy.
6. Hitting a target: Small areas of the court (circles or squares).
7. Hitting with a sideways movement: The player moves from the center to the right side, returns the ball, and then quickly returns.
8. Forehand half rallies: The player and coach exchange 6–8 balls using only a forehand, maintaining the rhythm of the game.
9. Full-court rallies using only a forehand: The player returns balls from various directions over a longer distance.
10. Semi-play position (Rally Drill): The player and coach (or another player) play an open exchange of forehands up to 10–12 consecutive balls.

Backstroke

1. Simulating a shot without a ball: Repeating the arm movement with a torso rotation.
2. Hitting a stationary ball: From a cone or the coach's hand.
3. Slowing a wall shot: Using only a backhand.
4. Hitting from a hand pass by the coach: Easy balls on the left side.
5. Hitting from a bat pass by the coach: Medium balls on the back side.
6. Target shooting: Squares in the back half of the court.
7. Sideways shooting: From the center to the left side, then quickly returning to the ready position.
8. Back-half rallies: The player and coach exchange 6–8 balls using only a backhand, maintaining the rhythm.
9. Full-court rallies using only a backhand: The player returns balls from the center and the wings.

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10. Rally Drill: The player engages in a long rallied with an open backhand for up to 10–12 consecutive balls.

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