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The effect of an educational approach based on Schmidt's Schema Theory on learning some basic tennis skills

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Abstract

The research seeks to develop an educational curriculum based on Schmidt's Schema Theory for acquiring fundamental tennis skills, implement this curriculum, and assess its impact on the learning of these skills. The researchers employed the experimental technique by configuring the experimental and control groups to align with the nature of the issue. The research sample comprised tennis players aged 11 to 13 years, categorized into a primary experimental group of 20 players, alongside a control group and an experimental group system. The control group comprised 10 participants, and the experimental group also consisted of 10 participants. The exploratory experiment group consisted of three participants, while three players were removed for lack of commitment. The investigators ran a pilot study on 8 July 2025, with three participants. Subsequently, the research sample was given pre-tests in two days (the first day on October 7th, 2025) by using a serve skill test and for backhand driving skills. The main experiment was carried out for a period of 8 weeks, with three lessons per week. Subsequently, the post-tests were administered, using identical methods regarding timing, location, instruments utilized, and the preparation of all conditions surrounding the pre-tests, to mitigate variables that could influence the post-test outcomes. Subsequently, the results were statistically analyzed, tabulated, and scientifically examined, culminating in conclusions and recommendations.

Keywords : educational approach, schmidt's theory, motor learning, tennis.

Introduction

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Motor learning is considered one of the fundamental topics in physical education and movement sciences, as it focuses on studying the processes related to acquiring, developing, and retaining motor skills thru practice and experience. It is viewed as an internal, indirect process that cannot be directly observed, but is inferred thru the individual's observable performance. Motor learning aims to understand how the learner transitions from the stage of imperfect performance to automatic and proficient performance, thru multiple stages including: the cognitive stage, the associative stage, and then the autonomous stage. It also focuses on the role of practice and feedback in improving performance and equipping the learner with the ability to adapt to environmental changes and different situations, which makes it fundamental in the preparation of educational and training curricula in various activities and sports. (Al-Samhi, 2015, p. 22).

Schmidt's Schema Theory is considered one of the most prominent explanatory models in the field of motor learning. It was introduced by Richard Schmidt in 1975 to explain how motor programs are formed and how motor performance is organized in changing situations. This model is based on the idea that an individual does not store separate motor responses for each situation, but rather forms general schemas that are recalled and adjusted according to environmental variables, allowing for flexibility in motor performance and effective transfer of learning to new situations. Studies have proven that variable practice is fundamental in enhancing these schemas, which makes the theory highly valuable in teaching open skills, such as those characterized by tennis, where the speed, direction, and angles of the ball constantly change. (Schmidt, 2011, p.393)

Motor learning is one of the theoretical supports in physical education and sports sciences which attempts to explain how human movements are learned, developed, and maintained through practice and experience. Motor learning is considered a continual process shaped by biological, cognitive and instructional elements through which the mover passes through several stages involving: cognition and perception; to practice and consolidation; towards automaticity (skilful performance). In sport, skill-learning and training programs that are based on scientific principles to promote the learning of specific motor skills. They have assumed special significance because we know that in games like tennis, with open skills, the player must adjust himself to changes of play conditions (direction, speed, height and angle of ball-bounce). More specifically, as of here based on the principles of motor learning that underpins educational programs in which there is a progression from simple to complex tasks and used varied practice and feedback, we can contribute with improving the serve and forehand and backhand strokes among junior players. It develops their capability to play effectively under real playing conditions, and this is reflected positively in the technical skills and competitive levels (Al-Hadidi 2010:61).

The skills of tennis are considered open motor skills that require the player to quickly adapt to constantly changing situations such as the direction, speed, and angle of the ball's bounce. This

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makes the process of teaching and developing these skills in young players a complex issue if traditional training methods are relied upon, which focus on fixed repetition of the skill without varying the practice conditions. Many studies in the field of motor learning have indicated that using educational programs based on varied practice contributes to the formation of general motor patterns in players, enhancing their ability to perform correctly in new situations and transferring learning from the training environment to actual competition. However, the reality of training in many clubs and centers shows a heavy reliance on traditional methods for teaching basic skills (serving, forehand, backhand), which leads to slow skill acquisition and poor performance under playing pressure. From here, the research problem emerges in the need to prepare and implement an educational program according to Schmidt's Schema Theory to verify its impact on developing some basic skills of junior tennis players and compare it with the traditional method used.

Research Objectives

1. Preparing an educational curriculum according to Schmidt's Schema Theory model in learning some basic skills in tennis. Preparing an educational curriculum according to Schmidt's Schema Theory model in learning some basic skills in tennis.
2. Implementing an educational curriculum according to Schmidt's Schema Theory model in learning some basic skills in tennis. Applying an educational curriculum according to Schmidt's Schema Theory model in learning some basic skills in tennis.
3. Recognizing the impact of the educational curriculum according to Schmidt's Schema Theory model in learning some basic skills in tennis. Identifying the impact of the educational curriculum according to Schmidt's Schema Theory model in learning some basic skills in tennis.

Research Hypotheses

1. There are statistically significant differences between the pre-test and post-test results of the control group in some basic skills (serve, forehand, backhand) in tennis. There are statistically significant differences between the pre-test and post-test results of the control group in some basic skills (serve, forehand, backhand) in tennis.
2. There are statistically significant differences between the pre-test and post-test results for the experimental group in favor of the post-test in some basic skills (serve, forehand, backhand) in tennis. There are statistically significant differences between the pre-test and post-test results for the experimental group, favoring the post-test in some basic skills (serve, forehand, backhand) in tennis.
3. There are statistically significant differences between the post-test results of the two groups (experimental and control) in favor of the experimental group in some basic skills (serve, forehand, backhand) in tennis. There are statistically significant differences between the post-test results of the two groups (experimental and control), favoring the experimental group in some basic skills (serve, forehand, backhand) in tennis.

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Research Areas

1. Human field: Junior players aged 11-13 years. Human field: Youth players aged 11-13 years.
2. The spatial domain: Al-Jadriya fields / College of Physical Education and Sports Sciences. Spatial domain: Al-Jadriya fields / College of Physical Education and Sports Sciences.
3. Time frame: 3/6/2025 to 25/9/2025

Definition of Terms

Schmidt's Schema Theory: It is a model in motor learning that explains that the learner does not store separate movements, but rather forms general motor programs that develop thru varied practice, helping them adapt to new situations and transfer learning (Schmidt, 2011, p.394).

Methodology

The nature of the problem determines the researcher in choosing the appropriate methodology for this problem (Raheem, Shaker, 2025, p14). Therefore, the researchers used the experimental method with the design of the experimental and control groups to suit the nature of the problem.

Research Sample

The research sample was determined from tennis players aged (11-13) years, and the research sample was divided into: the main experimental sample consisting of (20) players, using the control and experimental group system. The number of the control group was (10), and the number of the experimental group was (10) as well. The number of the pilot experiment group was (3) players, and (3) players were excluded for non-compliance. Table (1) shows the distribution of the research sample.

Table 1. *Distribution of the Research Sample*

No.	Description	Number
1	Experimental Group	10
2	Control Group	10
3	Pilot Study Group	3
4	Excluded Subjects	3
Total		**26**

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Table 2. *Homogeneity of the Sample in Terms of Height, Weight, and Age*

Variables	Unit	Mean	SD	Skewness
Weight	kg	53.385	4.548	0.367
Height	cm	155.850	2.513	0.881
Age	years	12.532	5.833	0.431

Devices and Tools

The following devices, tools, and information collection methods were used: a Dell laptop, tennis rackets and balls, measuring tapes, a Sony camera, a tennis court, a Casio stopwatch, a Dolphin whistle, cones, hurdles, Arabic sources and references, tests and measurements, and the internet.

The tests used

1. Tennis Serve Accuracy Test: (Al-Badri, 2002, p. 153)
Objective: To measure the player's ability to accurately direct the serve toward specific areas in the service box.
Procedure: The player stands behind the service line and performs 10 service attempts to the designated box, and the number of successful attempts within the target is counted.
Scoring: Each successful attempt within the target = one point.

2. Forehand Accuracy Test (Al-Sharqawi, 2010, p. 211)
Objective: To measure the accuracy of the forehand performance toward a specific target in the opponent's half of the court.
Procedure: (10) balls are sent from the coach toward the player, and the player performs a forehand shot toward a target (1.5 × 1.5 m square) specified in the middle of the opponent's half.
Scoring: Ball inside the target = one point, outside the target = zero.

3. Backhand Accuracy Test (Hussein, 2008, p.198)
Objective: To measure the player's ability to accurately direct the backhand shot toward a specific target.
Procedure: The player performs (10) attempts of the backhand stroke after the coach passes the balls, and is asked to direct the ball to a target (a specific area) in the opponent's half of the court.
Scoring: The ball that lands inside the target = one point, and outside the target = zero points.

The Pilot Study

The pilot study is considered "a practical training for the researcher to personally identify the difficulties encountered during the test in order to avoid them in the future" (Al-Shouk and Al-

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Kubaisi, 2004, p. 91). Therefore, the researcher conducted a pilot experiment on (8/7/2025) on a sample of (3) players. Thru this experiment, the researcher was able to:

1. Knowing the validity of the tests used in the research. Knowing the validity of the tests used in the research.
2. Knowing the problems and obstacles that the sample may face during the application of the tests. Knowing the problems and obstacles that the sample may face during the application of the tests.
3. Identifying the validity of the devices and tools used in the test. Identifying the validity of the devices and tools used in the test.
4. The duration of time taken to perform each test. The duration of time taken to complete each test.

Pre-tests

The researchers conducted the pre-tests for the research sample over two days, on (10/7/2025), by applying the basic skills tests (serving, forehand, backhand).

Table 3. *Means, Standard Deviations, Calculated t-Values, and Statistical Significance of the Pre-Test (Equivalence) for the Experimental and Control Groups*

Variables	Unit	Group	Mean	SD	*t*-value	Sig. Value	Result
Serve	Score	Control Experimental	4.000 3.900	0.816 0.233	0.287	0.777	Non sig
Forehand Stroke	Score	Control Experimental	3.400 3.500	0.516 0.527	0.429	0.673	Non sig
Backhand Stroke	Score	Control Experimental	3.400 3.700	0.516 0.483	1.342	0.196	Non sig

The main experiment

The educational and training program was prepared according to Schmidt's theory of motor schemas, on (12/7/2025), and extended over eight weeks with three sessions per week, each lasting (60) minutes. It aimed to develop the basic skills in tennis (serve, forehand, backhand) among the research sample of beginner juniors. The program included progressive stages from simple to complex, where the first two weeks (1–2) were dedicated to basic movement education and providing players with the correct initial form of performance thru serve exercises to nearby target squares using various stances, forehand drills after one bounce from the coach at different angles, and backhand wall drills using various balls (hard and soft) to develop initial control. As for weeks (3–4), moderate variation was introduced in practice by reducing the targets for serves and increasing the accuracy of direction, varying the heights and angles of the ball in forehand and backhand strokes, and involving players in short exchanges with teammates within half the court. As the weeks progressed (5–6), the level of variety and complexity was increased by changing the

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type of ball used during serves and alternating the distribution of balls to different areas of the court. Additionally, directed constraints were imposed, such as playing with one or two touches in forehands and backhands, and changing standing positions near or far from the net to expand the players' motor experiences. During the last two weeks (7–8), participants played small-sided games through quick half-court matches or playing with a scoring zone worth double points. The rules of the game were modified to promote rapid decisions and develop motor flexibility. The sessions also featured activities, students hadn't done before, to assess 'transfer of learning' such as returning balls from odd forcing angles. The sequence for each training was equal consisting of general and specific warm up (10 min), continuous part centred on the three skills to be developed (35–40 min) depending on the exercises we intended to perform at each stage. This was followed by a short directed play (10 minutes) that connected the exercises with actual game situations, ending with a cool-down and quick review (5 minutes). In this way, the program ensured a logical progression from basic education to high variability, reaching real game situations, which aligns with the principles of Schmidt's theory in forming motor schemas and developing the ability to adapt to situational changes in tennis.

Post-tests

After completing the main experiment, the post-tests for the research sample were conducted on (15/9/2025) to achieve accurate results, as "one of the most important ways to determine quality is to conduct tests to ensure the validity of the training program" (Lazem, 2005, p.156). The same procedures in terms of time, place, and tools used were adopted, and all conditions surrounding the pre-tests were prepared to avoid variables that could affect the results of the post-tests.

Statistical methods

The researcher used the Statistical Package for the Social Sciences (SPSS):

- Arithmetic mean.
- Standard deviation.
- Skewness coefficient.
- Cronbach's alpha.
- T-Test formula for independent samples.

Results

Table 4. *Means, Standard Deviations, Calculated* t-*Values, and Statistical Significance of the Pre- and Post-Tests for the Control Group*

Variables	Unit	Test	Mean	SD	*t*-value	Sig. Value	Result

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Serve	Score	Pre-test	4.000	0.816	7.586	0.000	sig
		Post-test	5.000	0.900			
Forehand Stroke	Score	Pre-test	3.400	0.516	9.633	0.000	sig
		Post-test	4.500	0.600			
Backhand Stroke	Score	Pre-test	3.400	0.516	11.677	0.000	sig
		Post-test	4.600	0.600			

Note. Results are statistically significant at $p < 0.05$ with 11 degrees of freedom.

Table 5. *Means, Standard Deviations, Calculated* **t**-*Values, and Statistical Significance of the Pre- and Post-Tests for the Experimental Group*

Variables	**Unit**	**Test**	**Mean**	**SD**	**t-value**	**Sig. Value**	**Result**
Serve	Score	Pre-test	3.900	0.233	9.336	0.000	sig
		Post-test	7.900	0.737			
Forehand Stroke	Score	Pre-test	3.500	0.527	11.243	0.000	sig
		Post-test	7.500	0.750			
Backhand Stroke	Score	Pre-test	3.700	0.483	12.659	0.000	sig
		Post-test	7.700	0.483			

Note. Results are statistically significant at $p < 0.05$ with 11 degrees of freedom.

Table 6. *Means, Standard Deviations, Calculated* t-*Values, and Statistical Significance of the Post-Test Comparisons Between the Experimental and Control Groups*

Variables	**Unit**	**Test**	**Mean**	**SD**	**t-value**	**Sig. Value**	**Result**
Serve	Score	Control	5.000	0.816	8.333	0.000	sig
		Experimental	7.900	0.737			
Forehand Stroke	Score	Control	4.400	0.516	13.286	0.000	sig
		Experimental	7.500	0.750			
Backhand Stroke	Score	Control	4.400	0.516	14.758	0.000	sig

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Experimental	7.700	0.483

Note. Results are statistically significant at $p < 0.05$ with 18 degrees of freedom.

Discussion

The research results showed significant differences between the pre-test and post-test measurements for the experimental group in all basic skills (serving, forehand, backhand), favoring the post-test measurement, indicating the effectiveness of the educational curriculum based on the Schmidt model of motor schemas in improving the performance of junior players. This improvement is attributed to the adoption of varied practice that focused on changing performance conditions (ball angle, speed, standing position, type of ball), which contributed to the formation of general motor patterns in the players, allowing them greater flexibility in performance and a higher ability to adapt to game variables. This result aligns with what Al-Samie and Al-Sheikh (2015) indicated, that varied practice is fundamental for acquiring open skills because it provides multiple opportunities to experiment with and develop responses (Al-Samie, 2015, p. 85).

The results also showed that the improvement in the control group was limited and non-significant in some cases, which can be attributed to the reliance on the traditional method (fixed repetition of attempts under the same conditions) that may give the player a preliminary form of the skill but does not provide the necessary flexibility to handle changing situations in tennis. This aligns with what Al-Hadidi (2010) mentioned, that relying solely on fixed repetition in skill teaching leads to slow learning and difficulty in transferring performance to real game situations (Al-Hadidi, 2010, p. 61).

When comparing the two groups in the post-test, significant differences were found in favor of the experimental group, which reflects the strength of the program based on the Schmidt theory, as the method of practice variability increased the players' accuracy and consistency in performance. This result is consistent with what Al-Shartawi (2010) explained, that educational programs based on modern motor learning principles contribute to improving performance quality and increasing the ability to adapt to changes in the educational and training environment (Al-Shartawi, 2010, p. 211).

Therefore, it can be said that the application of the educational curriculum according to the Schmidt model has effectively contributed to improving the players' results significantly in the post-tests, whether compared to the pre-measurements or the control group, which confirms the importance of introducing modern educational programs based on diverse practice in teaching and training the basic skills of tennis.

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Conclusions

1. The educational curriculum based on the Schmid model of motor patterns has shown high effectiveness in developing some basic skills (serving, forehand, backhand) among junior tennis players.

2. The differences were significant and in favor of the post-measurements in the experimental group, indicating that varied practice contributes to the formation of general motor patterns that enhance the accuracy and consistency of performance.

3. The control group limited to the traditional method (fixed repetition) showed only limited and non-significant improvement in some skills, confirming the limited effectiveness of traditional methods in developing open skills.

4. The comparison between the two groups after the experiment showed a clear superiority of the experimental group, which reflects the importance of modern educational programs based on the principles of motor learning.

5. The research confirms that developing tennis skills requires the introduction of innovative educational strategies that keep pace with the nature of the open skills characteristic of this game.

Recommendations

1. The necessity of adopting educational programs based on diverse practices when training and teaching young tennis players instead of relying solely on traditional repetition.

2. Incorporating the Schmidtt model of motor patterns into physical education and sports science curricula as a practical framework for teaching open skills.

3. Preparing similar programs to develop other skills in racket sports (badminton, squash) to verify the generality and effectiveness of this approach.

4. Encouraging coaches to use standardized practical tests to periodically monitor players' progress (serve – forehand – backhand).

5. Conduct future research on larger samples and different age groups to ensure the consistency of the results and expand their applicability in the sports field.

6. Focusing on training coaches to apply modern motor learning strategies and incorporating them into training plans for youth.

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