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Impact Of Educational Units According To Bybee 5Es Model To Learn Some Basic Tennis Skills

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Abstract

This study aimed to identify impact of educational units based on Bybee 5Es model to develop some basic tennis skills. It also aimed to demonstrate effectiveness of Bybee 5Es model to improve performance of serve, forehand, and backhand strokes in tennis among national team players. The researcher used experimental method with a two-group equivalent design control and experimental as it was suitable for nature of problem to be solved. Study community consisted of 12 players from the national tennis team representing various Iraqi clubs, while sample was selected using simple random sampling. Educational units were implemented from 1/2/2026 until 1/5/2026, at a rate of two units per week, with a duration of 90 minutes for each educational unit, included 14 educational units. The researcher concluded from results that appeared that use of educational units using Bybee 5Es model had a positive impact to learn and developing selected skills in research compared to methods used by coaches, as Bybee 5Es model contributed to enhancing understanding and applying skills accurately and correctly. The researcher recommends adopting Bybee 5Es model as an important part of tennis training for players of different ages, applying this model in different sports, whether individual or group, and for both genders.

Keywords: Bybee 5Es Model, Serving, Forehand, Backhand, Stroke Skills.

Introduction

Learning and teaching depend on many diverse factors and variables, including those related to nature of learner, their attributes and characteristics, those related to teaching methods, techniques and means, and others related to type and nature of skill and group and individual effectiveness(Fukuda, 2026; Sapta et al., 2023; YULIANTO et al., 2019).

Tennis is characterized by special individual skills and has multiple response motor programs, in different locations and at different times(Kasanrawali, 2021; Priyambada et al., 2026; Yasriuddin & Hudain, 2020). Sometimes player performs skill with both hands, due to his need to increase power of stroke. By transferring learning from a trained arm to an untrained arm, player will increase his control and enable second arm to perform and control skill, some of its skills are primary and some are secondary, so it is possible to transfer learning between them in order to facilitate learning and invest time and effort within time allocated for teaching(Bangun et al., n.d.; David J. Smith, 2003; Vealey, 2024).

Focus on developing technical, physical, and tactical skills among players has become extremely important. Researchers and scientists in this field have introduced many educational methods, approaches, and models that contribute to ease of learning and developing various athletic skills. One such model is the use of Bybee 5Es educational model is a constructivist model based on five stages preparation, exploration, explanation, expansion, and evaluation and is employed to integrate deep cognitive understanding with practical skill application within the field(McCormack, 2020; Vealey, 2024; Wright & Torrey, 2001).

This model is one of the most effective methods of human education, dividing learning process into five stages. First stage involves capturing players' attention and sparking their curiosity about skill to be learned. Second stage focuses on players' understanding of presented material and how to interact with it. Third stage model provides opportunities for players to express concepts they have discovered in their own words. Fourth stage involves applying what has been learned through field experiments to solidify their understanding of skill. Finally, last stage encourages players to evaluate their own performance and gain a deeper understanding of skill independently.

Selected tennis skills are considered among the most important basic skills in game of tennis, as they play a major role in determining results of most matches, importance of this study lies in using Bybee 5Es model in learning and developing some skills in tennis**,** which greatly contributes to enhancing level of athletic performance and employing mental skills to improve physical performance, which leads to improving skills serve, forehand and backhand(Faber et al., 2021; Yasriuddin & Hudain, 2020).

Coaches are backbone of educational process, and their influence is clearly evident in their careful and skillful implementation of lesson plans(Bangun et al., n.d.; Riyadi et al., 2025; Sutiyono et al., 2021). Bringing about desired changes in players by increasing their performance effectiveness is a shared goal and requirement of both teacher and learner, the researcher observed a weakness in basic tennis skills of national junior team players, despite significant attention given to learning these skills and improving learners' performance, noted that no single teaching method is inherently better than another, but some methods and approaches may be more suitable than others, the researcher decided to study this problem as a contribution to supporting the educational process.

This research seeks to highlight importance of Bybee 5Es model as an effective tool for improving teaching of athletic skills and developing physical performance of female players. Research objectives to prepare educational units according to Bybee 5Es model for junior national team players. Identifying effect of educational units according to Bybee 5Es model in learning some basic tennis skills for national junior team players.

Research hypotheses there are statistically significant differences between pre- and post-tests of experimental and control groups in learning some basic skills with a tennis ball. There are statistically significant differences between post-tests of experimental and control groups in learning some basic tennis ball skills, in favor of experimental group.

Materials and Methods

The researcher used experimental method with two equivalent groups approach, designing control and experimental groups with a pre-test and post-test, to suit nature of problem to be solved, study community included players of national

junior team, consisting of 12 players, sample was chosen randomly by lottery, and 4 female students were selected to conduct pilot experiment on them.

Pilot study

Pilot study was conducted on 4 female players on 10/2/2026, at tennis courts in Al Shaab International Stadium, objectives of pilot study were to identifying factors and obstacles that the researcher faced while implementing educational units. Measuring suitability of exercises for selected sample. Measure appropriate time allocated to each part of the learning unit.

Pre-tests

Pre-tests were conducted on study sample for experimental and control groups on 14/3/2026, at tennis courts in Al Shaab International Stadium, using same test steps, preparation of supplies, and assistance team.

Sample homogeneity and equivalence

To ensure growth indicators of female students, to determine homogeneity of sample, in order to prevent indicators that affect test results in terms of individual differences between members of sample, homogeneity was performed by height, age and mass, using mean and standard deviation.

Table 1. Homogeneity of sample in terms of variables height, age, mass

Variables	Measurement unit	Mean	Standard deviation	Median	Skewness coefficient
Age	Year	20.05	0.04	20	0.68
Height	cm.			169	0.06
Mass	Kg.			66	0.49

Values of skewness coefficient are limited to ±1, which indicates that scores are normally distributed. The researcher performed equivalence of sample with pre-tests for two research groups, control and experimental groups, in variables as shown in Table (2).

Table 2. Sample equivalence in pre- and post-tests for experimental and control research groups

Variables	Experimental group		Control group		(t) Value	Sig. level	Sig. type
	M.	St.d	M.	St.d			
Serve	4.52	0.47	4.32	0.64	0.16	0.193	Insig.
Forehand	1.63	0.17	1.66	0.47	0.67	0.218	Insig.
Backhand	1.11	0.24	1.31	0.34	0.24	0.175	Insig.

From table 2, we note that significance level is greater than 0.05, which indicates that two research groups are equivalent in terms of variables.

Educational approach according to Bybee 5Es model

The researcher conducted main experiment on 2/16/2026 and carried out pre-tests on sample and experimental and control groups using same tests to evaluate technical performance of serve, forehand and backhand strokes in tennis, curriculum continued to be implemented at a rate of two units per week, curriculum was implemented through 18 educational units, with (90) minutes for each educational unit, according to Bybee 5Es model, six educational units were allocated for each selected skill. Its name is composed of initial letters of following steps, which include six steps:

Mood:

Mood is the first step in Bybee 5Es model and involves preparing learner psychologically for studying by relaxing, eliminating distractions, and focusing on task. Mood refers to learner's psychological state during learning. Understanding: This step involves reading information carefully and focusing on understanding basic meaning of content.

This step can include taking notes or summarizing the main points. At this stage, player is asked to identify important and difficult ideas in exercise.

Recall:

In this step, key information and relevant ideas are retrieved without referring to text, player must be able to recall information by breaking it down into smaller units, then retrieving these units to achieve complete understanding. Two techniques can be used for recall: first is summarizing information using student's own words, and second is linking information together to facilitate recall process.

Digesting:

Digesting refers to player's ability to understand meaning of material by translating, interpreting, explaining, and summarizing it. In this step, player goes back to information that did not understand and reads it again until can comprehend it.

Expansion:

In this step, player makes connections between material learned and prior information, or within material itself. This helps in a broader understanding of texts and topics by asking questions and applying information in exercises.

Review:

In this step, player conducts a comprehensive review of material they have studied and recalls methods that help in understanding and memorizing information, such as recitation, writing, and diagrams, player is also asked to review their mistakes and identify their causes in order to gain a deeper understanding of material.

Each educational unit was divided into: Preparatory Section:

Total time for preparatory section 20 minutes and includes: Introduction and warm-up: Attendees are taken and given simple exercises and jogging in order to prepare body for physical exercises. Physical exercises: Special exercises are given to all body parts, especially the parts that are active for performance, and their duration is 10 minutes.

Main Section:

This section focuses on practical exercises for learning selected research skills and lasts 60 minutes.

It includes two parts:

Educational part: place designated for this part is either educational halls or a side of field or the players sitting on special stands of field. Through it, importance of educational units is explained according to Bybee 5Es model, and selected skills and how to learn them are explained to experimental group. More than one model is presented to perform skill, then the coach asks several questions about each part of the skill, and the players must give appropriate solutions to questions, students were taught partial method and then whole method to learn skill in order to understand all its parts and movements.

B- Practical part:

In this part of educational unit, skills are applied by players, and sample is divided into three small groups, and each of them is taught in detail to understand skills and educational units well, and feedback is given to them through still or moving pictures. Concluding part: In final part of curriculum, some preparation and recall exercises are given, followed by some advice and guidance for players, concluding learning unit, which lasts 10 minutes.

Post-tests

The researcher conducted post-tests on control and experimental research groups on 10/6/2026, after completion of educational curriculum proposed by the researcher, which included 18 educational units, and under same conditions in which pre-tests were conducted.

Statistical methods

The researcher used the statistical method SPSS in statistical analyses.

Results & Discussio

Present results of means, standard deviations and value of (t) for pre-test and post-test for experimental group.

Table 3. Means, standard deviations, and t-value for pre- and post-tests of experimental group

Skill	Measurement unit	Experimental group		Control group	
		M.	St.d	M.	St.d
Serve	Degree	4.52	0.46	5.32	0.28
Forehand	Degree	1.61	0.15	2.66	0.23
Backhand		1.14	0.22	1.81	0.13

From Table (2), we find that values of means and standard deviations for pre- and post-tests of skills selected in research for experimental group were as follows: Serve: It was found that value of mean in pre-test was (4.52) and standard deviation was (0.46), while mean for two post-tests was (5.32) and standard deviation was (0.28). As for front stroke, mean for pre-test was (1.61) and standard deviation was (0.15), while the value of mean in post-test was (2.66) and standard deviation was (0.23). In backhand stroke, mean value in pre-tests was (1.14) and standard deviation was (0.22), while in post-tests mean value was (1.81) and standard deviation was (0.13).

Table 4. Difference (F) between results of pre- and post-tests, error rate, and calculated (t) value for skill variables of the experimental group

Variables	D	MD	Calculated (t) value	Error rate	Sig. type
Serve	1.27	0.43	7.22	0.001	Sig.
Forehand	1.04	0.23	10.63	0.000	Sig.
Backhand	0.70	0.26	7.03	0.001	Sig.

From Table (3), we find that mean value of differences, value of (t), error percentage, and significance of differences between pre-test and post-test for basic tennis skills for experimental group are as follows: Serve: It was found that mean value of differences between pre-test and post-test was (1.27), and standard deviation of differences (0.43) while the calculated value of (t) was (27.2) and the error percentage was (0.001) at a significance level, and since calculated value is a percentage error, it indicates that differences between the pre-test and post-test are statistically significant. As for front ground stroke: it was found that the arithmetic mean of differences between pre-test and post-test was (1.04) and the standard deviation of differences was (0.23). calculated value of (t) was (10.63), and error percentage was (0.000) at a significance level of (0.05). Since calculated value is a percentage error, it indicates that differences between pre-test and post-test are statistically significant. As for backhand groundstroke: mean value of differences between pre-test and post-test was (0.70). standard deviation of differences was (0.26), while calculated value of (t) was (7.03), and error ratio was (0.001) at a significance level of (0.05). Since calculated value of error ratio indicated that differences between pre-test and post-test were statistically significant.

Present and analyze results of means, standard deviations, and t -values for pre- and post-tests of control group

Table 5. Means, standard deviations, and t -values for pre-test and post-test of control group

Skill	Measurement unit	Pre-test		Post-test	
		M.	St.d	M.	St.d
Serve	Degree	4.42	0.76	5.30	0.22
Forehand	Degree	1.65	0.45	2.61	0.24
Backhand	Degree	1.34	0.42	1.71	0.19

Table (4) shows means and standard deviations for pre- and post-tests of basic tennis skills for control group, as follows: For serve, mean in pre-test was (4.42) and standard deviation was (0.76), while mean in post-test was (5.30) and standard deviation was (0.22). For forehand groundstroke, mean in pre-test was (1.65) and standard deviation was (0.45), while mean in post-test was (2.61) and standard deviation was (0.24). For backhand groundstroke, mean in pre-test was (1.34) and standard deviation was (0.25), while mean in post-test was (1.34) and standard deviation was (0.42).

Table 6. Difference between pre-test and post-test results, error percentage, and value of Calculated (t) for control group

Variables	D	MD	Calculated (t) value	Error rate	Sig. type
Serve	1.09	0.53	4.22	0.001	Sig.
Forehand	0.94	0.43	4.63	0.000	Sig.
Backhand	1.43	0.46	2.71	0.003	Sig.

From Table (5), we find that mean value of differences, value of (t), error percentage, and significance of differences between pre-test and post-test of basic tennis skills for control group are as follows: Serve: It was found that mean value of differences between pre-test and post-test was (1.09), and standard deviation of differences (0.53) while the calculated value of (t) was (22.4) and error percentage was (0.001) at a significance level, and since calculated value is a percentage error, it indicates that differences between pre-test and post-test are statistically significant. As for front ground stroke: it was found that mean of differences between pre-test and post-test was (0.95), and standard deviation of differences (0.43) calculated t-value was 4.63, with a margin of error of (0.000) at a significance level of 0.05. Since calculated value is based on margin of error, this indicates that differences between pre-test and post-test were statistically significant. Regarding backhand groundstroke, mean value of differences between pre-test and post-test was 1.43. standard deviation of differences was (0.46), while calculated value of (t) was (2.76), and error ratio was (0.003) at a significance level of (0.05). Since calculated value of error ratio indicated that differences between pre-test and post-test were statistically significant.

Table 7. Mean and standard deviation for control and experimental groups, and t- value for basic tennis ball skills

Variables	Experimental group		Control group		(t) Value	Sig. level	Sig. type
	M.	St.d	M.	St.d			
Serve	5.72	0.27	5.32	0.34	2.16	0.000	Sig.
Forehand	2.77	0.22	2.66	0.29	1.67	0.000	Sig.
Backhand	1.91	0.14	1.81	0.22	1.24	0.000	Sig.

Preceding tables show that results of pre-test, post-test, and post-test measurements showed significant differences in favor of post-tests. Significant differences were also found in post-tests between experimental and control groups, with experimental group scoring higher. The researcher attributes this improvement to effectiveness of learning units implemented according to Bybee 5Es model, which is an active learning strategy aimed at improving players' understanding and organizing information in a way that helps them absorb knowledge more effectively.

Each of these steps contributes to enhancing learning process in an integrated and sequential manner, thus increasing effectiveness of self-learning. In first step, "Mood" players are motivated to create their psychological and mental environment to focus on the material. Then comes "Understanding" step, which allows players to analyze information and connect it to prior knowledge, making it easier for them to build a strong knowledge base and a deeper understanding of the topics. As for "Recall" step, it is one of key elements that motivates players to actively remember information, thus enhancing consolidation of knowledge in long-term memory.

"Discovery" step focuses on identifying gaps or errors in understanding, allowing players to review their performance and correct their course if necessary. "Elaboration" step then follows, encouraging players to expand on information and connect it to their personal experiences or prior knowledge, making it more comprehensible and applicable. Finally, "Practical review" step completes process, where players revisit all previous steps, verifying accuracy of their information and their level of understanding. This enhances players' self-confidence and encourages them to rely on self-directed learning strategies.

Kubaisi (2010) explained that Bybee 5Es model is essential when considering educational system, as it contributes to effective interaction among elements of educational process and enables learner to view subject matter comprehensively, thus improving multiple levels of thinking.

Theoretical interpretation of results

The researcher attributes results to capabilities of Bybee 5Es model to develop and organizing self-learning, in addition to improving players' comprehension of knowledge and developing critical thinking skills. In addition, harnessing all available conditions during application of teaching units helped in providing necessary tools and means to achieve the best results by enhancing students' ability to rely on themselves to understand and apply their duties, which is consistent with what Karima Fayyad (2004) indicated regarding necessity of providing a suitable climate and necessary means to accomplish academic tasks.

Regarding role of exercises in enhancing learning: One of strengths of teaching units used is gradual progression of learning according to steps of technical performance for each activity, exercises were characterized by sufficient comprehensiveness in terms of physical and skill preparation, which is appropriate to level and abilities of sample. This is consistent with what Harah (1990) stated, that effective motor practice is one of the most important variables in motor learning.

Interpretation of effect of educational tools: Use of necessary educational devices and tools led to an improvement in performance level of experimental group. Diaa Al-Khayat and Nawfal Al-Hayali (2014) indicate that availability of tools and assistive devices is one of basic factors that accelerate learning process. Lamia Al-Diwan (2016) also confirmed that using specific tools for practice leads to clarifying form of performance and facilitating learning process for student and understanding lesson. The researcher agrees with Ya'rub Khayoun that reason for significant results is that physical and skill exercises used in educational units are related to observation method presenting a model.

Conclusions

Effect of Bybee 5Es model to develop athletic skills, results showed that use of educational units had a significant positive impact on developing the skills of serving, forehand and backhand strokes in tennis compared to traditional methods. Bybee 5ES model contributed to promote a deep understanding and accurate and sound application of skills. Continued improvement after implementing the training units: study revealed that improvement in serving, forehand, and backhand strokes was not only immediate but continued after training unit period ended. This indicates that strategy helped solidify players' skills. An effective model for teaching other skills, as results may illustrate Bybee 5Es model, It can be an effective model for teaching other sports skills in volleyball or similar sports, given its ability to combine mental and physical aspects in education.

Recommendations

The researcher recommends adopting Bybee 5Es model as part of tennis learning programs, especially when teaching basic skills. Expanding application of the model to other sports, applying Bybee 5Es model to learn diverse athletic skills and in other individual and team sports, and testing their effectiveness in improving athletic skills in multiple fields. Conducting training courses for trainers on importance of Bybee 5Es model.

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