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## Design and Standardization of a Composite Test to Measure Basic Basketball Shooting Types among University Student-Players

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## ORIGINAL STUDY

# Design and Standardization of a Composite Test to Measure Basic Basketball Shooting Types among University Student-Players

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## Abstract

Tests in the sports field constitute an essential tool for achieving optimal results and evaluating player performance, particularly in competitive sports such as basketball. The importance of shooting emerges as it is the only means of direct scoring and the critical statistic that distinguishes victory from defeat. The researchers observed that previous tests of basic shooting types whether administered individually or in combination do not adequately reflect the complexities of actual game situations. Therefore, the problem lies in the need to address this gap by designing a composite test that simulates various playing conditions related to basic shooting skills. The descriptive approach was adopted, and the research community was deliberately selected from student-players at the College of Physical Education and Sports Sciences, University of Baghdad, with a research sample of (88) players. The research resulted in a composite test comprising four basic shooting types (free throw, jump shot inside the arc, jump shot outside the arc, and layup) with a total of 13 attempts and a maximum score of 27 points. The test demonstrated high validity, with 100% expert agreement and a discriminative validity  $t$ -value of 5.11 ( $p < 0.05$ ). Reliability was established using the test-retest method ( $r = 0.91$ ,  $p < 0.05$ ), and objectivity was confirmed with an inter-rater correlation coefficient of 0.96 ( $p < 0.05$ ). The mean performance score was 5.56 points/minute, with scores ranging from 2.14 to 15.56 points/minute, and standards were established, and this achieves one of the sustainable development goals of the United Nations in Iraq which is (Quality Education).

**Keywords:** Design, Standardization, Testing, Basketball shooting

## 1. Introduction

The use of tests in the field of sports is one of the fundamental tools for achieving scientific methods and approaches to obtain the best possible results. It plays a vital role in evaluating player performance, especially in competitive sports like basketball, which is characterized by its speed, excitement, and frequent scoring. The goal of any basketball team is to win the game by scoring the highest number of points during the playing time in the opponent's basket, as this is closely related to determining the outcome (Abd & Shabba, 2021), which highlights the importance of offense and shooting skills.

Research has shown that superior in game shooting accuracy (from both 2- and 3-point shots) increases win probability (Daub et al., 2023). Moreover, the significance of other shooting skills plays a crucial role in the overall success of the team. The offensive shooting skill is the only means that directly contributes to scoring points. According to Okazaki et al. (2015), it is the decisive statistic related to the game that distinguishes between winning and losing (Miki et al., 2024). Therefore, a player needs to master it and increase its effectiveness in terms of accuracy and speed to face various challenges during game time, such as defensive pressure, diverse shooting locations, different distances, as well as score pressure

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and the crowd's influence. In support of this, it is indicated that (Krause & Nelson, 2019) coaches must teach their players to become scorers, not just shooters. Accordingly, establishing an appropriate test to assess shooting performance serves as a key indicator of basketball performance (Zhang et al., 2023) and is essential for understanding the extent of a player's ability to execute this skill.

There are different fundamental types of shooting that can be classified into jump shots from beyond the three-point line, shots taken from inside the three-point line, and free throws (Diaz et al., 2025). These are dictated by the nature of the game, allowing coaches to make better decisions regarding player selection for the team lineup and the needs of offensive tactical situations. Given the increasing importance of shooting skills for coaches and players and their direct impact on game outcomes, coaches and researchers face challenges in accurately and effectively measuring this skill.

Through their research, they have observed a variety of previous tests used to measure basic shooting types, either individually or in combination with other skills like dribbling and passing. This can lead to measurements being taken in specific contexts that do not necessarily reflect the full complexity and challenges faced during actual games. The problem lies in the need to address this gap by developing a composite test that simulates different game conditions related to shooting skills. Such a test would provide a qualitative advancement in evaluating skill levels by better reflecting performance variations and more accurately identifying players' strengths and weaknesses, thus aiding in directing the training process toward improvement. Additionally, it would help reveal individual differences, enable classification, prediction, and selection based on the current condition of the examinees.

The research aims to improve the overall team performance and increase the chances of success in competitions by enhancing ideas and perspectives on what all coaches and players agree upon: that offense provides a psychological boost, increases confidence, and adds enjoyment for the team when points are scored. Confidence leads to success, and success

leads to confidence (Hopla, 2012). Consistently scoring points excites the team and improves its chances of winning basketball games.

The goal of the research is to design and standardize a composite test to measure the basic types of shooting in basketball among student players at the College of Physical Education and Sport Sciences, University of Baghdad, and to establish benchmarks for the composite test results of basic shooting types in basketball for the research sample.

## 2. Method and tools

The descriptive approach was adopted in a survey method, and the research community was chosen deliberately from the student-players at the College of Physical Education and Sports Sciences - University of Baghdad. The sample represented all academic stages, totaling (88) players, with (8) players selected to conduct the pilot study, as shown in Table 1. The data collection tools included (references, observation, testing and measurement, the supporting team Appendix (1), a questionnaire for experts and specialists regarding the test, totaling (5) experts Appendices (2, 3), and a form for recording and analyzing results Appendix (4)). Information was recorded descriptively regarding chronological age, height, weight, and training age, as shown in Table 2.

### 2.1. Composite test for basic shooting types

**Test Name:** Basic Shooting Types in Basketball.

**Purpose of the Test:** To measure the accuracy and time of basic shooting types.

**Tools Used:** 11 markers, 4 official basketballs, a leather measuring tape, electronic stopwatches, results recording and analysis form, and a whistle.

**Test Procedures:** See Fig. 1(A): Marker (1) is on the free-throw line, and markers (2, 7) are placed 30 cm away from the free-throw line on both sides. Markers (3, 5, 8, 10) are positioned 30 cm from the three-point arc, and markers (4, 9) are located 4.45 meters from the central point underneath the hoop on each side. Markers (12, 13) are set 5.45 meters from the central

Table 1. Sample size according to academic stages.

No.	Academic Stages	Total Number	Pilot study	Scientific Basis Sample	Standardization Sample
1.	First	13	2	05	11
2.	Second	17	2	05	15
3.	Third	24	2	10	22
4.	Fourth	34	2	10	32
Total		88	08	30	80

Table 2. Statistical characteristics of the research sample for some variables.

No.	Variables	Mean	Standard Deviation
1.	Age (Years)	22	1.64
2.	Training Age (Years)	3.4	1.18
3.	Height (cm)	182.95	5.82
4.	Weight (kg)	80.56	2.10

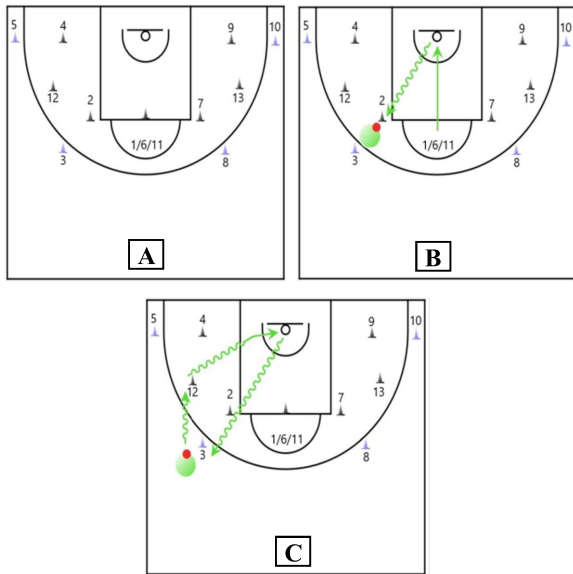


Fig. 1. (A, B, C) Composite Test to Measure Basic Shooting Types in Basketball.

point underneath the hoop on the ground in front of each side.

**Performance Description:** The player begins shooting from behind the free-throw line at the first marker. If the shot is successful or unsuccessful, the player retrieves the ball and moves to the second marker to perform a jump shot from inside the arc. Next, they retrieve the ball and proceed to the third marker to perform a jump shot from outside the arc. After retrieving the ball, the player moves to the fourth marker to perform a jump shot from inside the arc. Then, they retrieve the ball and move to the fifth marker to perform a jump shot from outside the arc. After that, the player retrieves the ball and returns to the first marker to perform a free throw, continuing to work with the markers (7, 8, 9, 10, 11), as shown in Fig. 1(B). The player then returns to marker (3) and proceeds to the twelfth marker to perform a layup shot. In case of a missed shot, the player is allowed to continue and make one jump shot from the closest position. The player then returns to marker (8) and proceeds to the thirteenth marker to perform a final layup shot, as illustrated in Fig. 1(C).

## 2.2. Test conditions

- Speed in performance.
- Execute the sequence of performance correctly.
- After shooting, the player must retrieve the ball and return with a dribble.
- If the layup attempt fails, the player can follow the ball and attempt one jump shot from the nearest location.
- If a violation occurs during the layup attempt, the shot will be canceled.
- When performing a layup from the right side, the player must start with their right foot and use their right hand; when entering from the left side, the player should start with their left foot and use their left hand.
- The test may be repeated once in case of an error in execution.

## 2.3. Test administration

- **Recorder:** Calls out the names first and records all successful and failed shots in order.
- **Referee:** Ensures the correct execution of the basic shooting types.
- **Timer:** Measures the time from the first shot to the thirteenth shot.

## 2.4. Recording

1. The basic shooting types are as follows:
  - A successful free throw is worth **1 point**, with a total of **three attempts**.
  - A successful jump shot from inside the arc is worth **2 points**, with a total of **four attempts**.
  - A successful jump shot from outside the arc is worth **3 points**, with a total of **four attempts**.
  - A successful layup is worth **2 points**, with a total of **two attempts**.
  - A failed layup followed by a successful jump shot is worth **1 point**.
  - The total points for successful shots are **27 points**.
2. The duration of the test is as follows: Calculate the time from the first free throw at marker one to the moment the ball is released during the layup from marker thirteen (if the layup attempt fails, the time ends at the moment the ball is released during the jump shot for continuation). Then, divide this time by 60 seconds to obtain the nearest whole number.
3. Final recording: The total score represents the accuracy of the basic shooting types divided by the total time spent in minutes.

**Pilot Study:** The pilot study was conducted with **8 players** from all stages in the indoor basketball court on Thursday, February 15, 2024, at 10:00 AM. The aim was to identify any obstacles that may arise during the test implementation, ensure players understood the test requirements, determine the time needed to perform the test, identify and correct errors, and evaluate the team's consistency and capabilities (Appendix 1). Based on this, the previous points were adjusted and validated when conducting the test.

**Scientific Basis of the Test:** The test was applied to **30 students** who practice basketball at the College of Physical Education and Sports Sciences - University of Baghdad on March 18, 2024.

- **Validity:** Content validity was used, as the test questionnaire was presented to a group of **5 experts** and specialists in the field of basketball (Appendices 2, 3), and it received **100% approval**. Additionally, one of the components of validity is the ability of the proposed test to distinguish between individuals with high and low scores (Mohamed Nasr [El-Din Radwan, 2006](#)). This was calculated using the t-test for independent samples. The test scores were ranked in descending order from highest to lowest, with **50% of the highest scores** and **50% of the lowest scores** selected when the total number was less than **100** ([Al-Zuhairi & Hamo, 2023](#)). After statistically processing the results, it was found that the test used is valid, as the error level values were smaller than the significance level (0.05) at a degree of freedom (15 + 15 - 2 = 28), as shown in [Table 3](#).
- **Reliability:** The reliability of the test refers to the accuracy of the test in measuring and the consistency of its results when applied multiple times to the same individuals (Mohammed Jasim [Al-Yasiri, 2010](#)) under similar conditions.

To calculate the reliability coefficient, the test-retest method was used with the same group of individuals, with a time interval of **7 days**. The simple correlation coefficient was then applied, and it was found that the test possesses a degree of reliability since the error level value is smaller than the significance level (0.05) at a degree of freedom (30 - 2 = 28), as shown in [Table 4](#).

**Objectivity:** Objectivity refers to the extent to which the evaluator or examiner is free from subjective factors such as bias (Layla Sayed [Farhat, 2007](#)). It was calculated by correlating the scores of two judges (Judge 1: Prof. Dr. Luay Sami Rifat, and Judge 2: Assist. Prof. Dr. Laith Mohammed Abdul Razzaq, University of Baghdad - College of Physical Education and Sports Sciences). The simple correlation coefficient was then used, and it was found that the test possesses a degree of objectivity since the error level value is smaller than the error level (0.05) at a degree of freedom (18), as shown in [Table 5](#).

**Normal Distribution:** To verify the scientific validity of the test, the normal distribution of the results of the scientific basis sample was adopted. The skewness coefficient was used as an indicator to demonstrate this. It indicated that the test achieves a normal curve since the results were not significantly skewed but were closer to a normal distribution, as shown in [Table 6](#).

**Statistical Methods Used in the Research:** Percentage, Mean, Standard Deviation, Simple Correlation Coefficient, Median, Skewness Coefficient, t-test for Independent Samples, and Standard Score Adjusted by the Sequence Method.

**Presentation and Analysis of Results and Discussion:** After conducting the composite test to measure the accuracy of basic shooting types, the raw scores were obtained for the results of the sample, which consisted of student players from all academic levels.

Table 3. Discriminative validity of the results of the composite test for basic shooting types in basketball.

Variable	Unit of Measurement	Upper Group		Lower Group		t-value	Sig.*	Significance
		Mean	Standard Deviation	Mean	Standard Deviation			
Composite Test	Points/Minute	9.19	3.06	4.00	0.96	5.11	0.00	Statistically Significant

\*The error level is considered statistically significant when it is < (0.05) at a degree of freedom of (28).

Table 4. Reliability of the results of the composite test for basic shooting types in basketball.

Variable	Unit of Measurement	Correlation		
		Coefficient (r)	Value	Sig.*
Composite Test	Points/Minute	0.91		0.00

\*The error level is considered statistically significant when it is < (0.05) at a degree of freedom of (28).

Table 5. Objectivity of the results of the composite test for basic shooting types in basketball.

Variable	Unit of Measurement	Correlation Coefficient (r) Value	Sig.*	Significance
Composite Test	Points/Minute	0.96	0.00	Statistically Significant

\*The error level is considered statistically significant when it is < (0.05) at a degree of freedom of (28).

Table 6. Description of the results of the composite test for basic shooting types in basketball.

Variable	Unit of Measurement	Mean	Median	Standard Deviation	Skewness Coefficient*
Composite Test	Points/Minute	6.60	5.25	3.45	0.96

\*Skewness is considered normal (homogeneous) when its value is within ± 1.

Table 7. The fixed value and the achieved highest and lowest scores for the composite test results of basic basketball shooting types.

Variable	Unit of Measurement	Sample Size	Mean	Standard Deviation	Fixed Value	Achieved Highest Score	Achieved Lowest Score
Composite Test	Points/Minute	80	5.56	3.23	0.323	15.56	2.14

These scores serve as the source for the standards (Mohammed Abdelsalam Ghoneim, 2004). A good test includes standard values corresponding to the raw scores, extracted by converting the raw scores into standard scores. One of the methods used is the adjusted standard score calculated sequentially based on the arithmetic mean and the fixed value, as shown in Table 7. Standards represent the performance of a specific population in a given test (Ali Samoum Al-Fartousi et al., 2015). Test standardization, along with having fixed standards as quoted by Al-Yasiri (2010), is considered one of the essential and complementary elements of the evaluation process to achieve objective results (Yousif et al., 2022). The standards that were reached are norm-referenced, as they are being introduced for the first time in the Iraqi context. A test

with norm-referenced standards is among the most widely used types in sports, and Table 8 includes the standards derived from the test results.

The achieved arithmetic mean (5.56), based on the total points divided by the total time in minutes, reflects a performance level that requires improvement, whether in terms of accuracy or time. The significant gap between the highest score achieved in the test (15.56) and the lowest score (2.14) indicates a clear disparity in the players' ability to perform under time pressure. This disparity can be explained by two main factors:

The first factor is the individual ability to shoot under pressure. This requires selecting drills that simulate game conditions, which contribute to the success rate of attempts and encourage the player to

Table 8. Raw and sequentially adjusted standard scores for the composite test results of basic basketball shooting types.

Scores		Scores		Scores		Scores	
Sequential	Raw	Sequential	Raw	Sequential	Raw	Sequential	Raw
100	21.710	83	16.219	66	10.728	49	5.237
99	21.387	82	15.896	65	10.405	48	4.914
98	21.064	81	15.573	64	10.082	47	4.591
97	20.741	80	15.250	63	9.759	46	4.268
96	20.418	79	14.927	62	9.436	45	3.945
95	20.095	78	14.604	61	9.113	44	3.622
94	19.772	77	14.281	60	8.790	43	3.299
93	19.449	76	13.958	59	8.467	42	2.976
92	19.126	75	13.635	58	8.144	41	2.653
91	18.803	74	13.312	57	7.821	40	2.330
90	18.480	73	12.989	56	7.498	39	2.007
89	18.157	72	12.666	55	7.175	38	1.684
88	17.834	71	12.343	54	6.852	37	1.361
87	17.511	70	12.020	53	6.529	36	1.038
86	17.188	69	11.697	52	6.206	35	0.715
85	16.865	68	11.374	51	5.883	34	0.392
84	16.542	67	11.051	50	5.560	33	0.069

adopt new behaviors, making them more prepared to give more effective responses (Amaro et al., 2024). Moreover, the stability and success of movement in different positions are important requirements for basketball coaches, aiming to translate motor skills into practical performance that aligns with game play, with accuracy and energy efficiency. Additionally, the integration of mental and mechanical aspects of shooting enhances shooting success (Wissel, 2018). In addition, players with high mental toughness demonstrate greater confidence in decision-making during shooting, which is reflected in higher shooting success rates (Ibrahim Bahram Khorshid Mohammed Ali, 2025).

The second factor is the nature of the composite test, which reflects a variety of challenges (basic shooting skills and time pressure). As is well known, free throws, jump shots from inside or outside the arc, and layups heavily depend on focus, accuracy, strength, balance, timing, and motor coordination. Accordingly, the development of diverse shooting skills plays a critical role in narrowing performance disparities among players, functions as a fundamental determinant in elevating the overall team level, and serves as a strategic cornerstone in the team's offensive approach (Boonsom & Bungmark, 2024).

### 3. Conclusions and recommendations

#### 3.1. Conclusions

- The composite test for measuring basic shooting types in basketball among student players at the College of Physical Education and Sports Sciences, University of Baghdad, has been established.
- The composite test for measuring basic shooting types in basketball was applied for the first time in the Iraqi context.
- The composite test revealed multiple challenges that included a variety of basic shooting skills, in addition to the factor of time pressure.
- There is a variation in the performance levels of players under time pressure.
- The standards for the results of the composite test for basic shooting types in basketball have been established, qualifying them to be norm-referenced.

#### 3.2. Recommendations

- Adopting the composite test for basic basketball shooting types as an assessment tool by coaches during the continuous evaluation process.
- Incorporating specialized training to develop performance under time pressure.

- Utilizing the standards related to the research as norm-referenced benchmarks, as they will later serve as a criterion for selection and comparison.
- Conducting similar research and studies on other offensive or defensive basic skills in basketball.

### Conflicts of interest

None

### Ethical-Clearance

This manuscript approved by Prof. Dr. Faris Sami Yousif Shabba on (04/02/2024).

### Author's contributions

All contributions of this study were done by the researchers Prof. Dr. Faris Sami Yousif Shabba who get the main idea and work on writing and concluding also with number of experts, Dani Thamer Sami Yousif, Prof. Dr. Faris Sami Yousif Malik (statistical analysis and final revision).

**Facilitate the task:** This study was supported by College of Physical Education and Sports Sciences/ University of Baghdad.

Roles of each researcher in the research:

1. First researcher: Prof. Dr. Faris Sami Yousif Shabba was responsible for conceptualization, design, and interpretation of results.
2. Second author: Dani Thamer Sami Yousif was responsible for literature review and data collection.
3. Third author: Professor Dr. Faris Sami Yousif Malik was responsible for draft writing and final revision of the manuscript.

### Funding statement

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### Data availability

The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

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## Appendices

### A. Appendix (1): Supporting team

No.	Name and Academic Title	Specialty	Place of Work
1	Prof. Dr. Luay Sami Rifat	Sports Training - Basketball	College of Physical Education and Sports Sciences - University of Baghdad
2	Assoc. Prof. Dr. Shirzad Mohammed Jaro	Sports Training - Basketball	College of Physical Education and Sports Sciences - University of Baghdad
3	Assoc. Prof. Dr. Laith Mohammed Abdul Razzaq	Testing and Measurement - Basketball	College of Physical Education and Sports Sciences - University of Baghdad
4	Dr. Harith Mubasher Mohammed	Sports Training - Basketball	College of Physical Education and Sports Sciences - University of Baghdad

### B. Appendix (2): Questionnaire of experts and specialists' opinions on the test

**University of Baghdad - College of Physical Education and Sports Sciences Dear Respected Experts and Specialists:**

The researchers aim to conduct their study titled (**Design and Standardization of a Composite Test to Measure Basic Shooting Types in Basketball**), which addresses the fundamental types of shooting (free throw shooting, jump shooting, and layup shooting). Through this study, I seek to develop a test that measures the accuracy of these shooting types. Therefore, due to your expertise in this field, please provide your valuable opinion on the validity of the test, along with any comments you deem appropriate that would serve the purpose of this test.

With thanks and appreciation

Name of the Expert and Specialist:

Academic Title and Date:

Specialty:

Signature:

Place of Work:

Date:

Suitable ( )

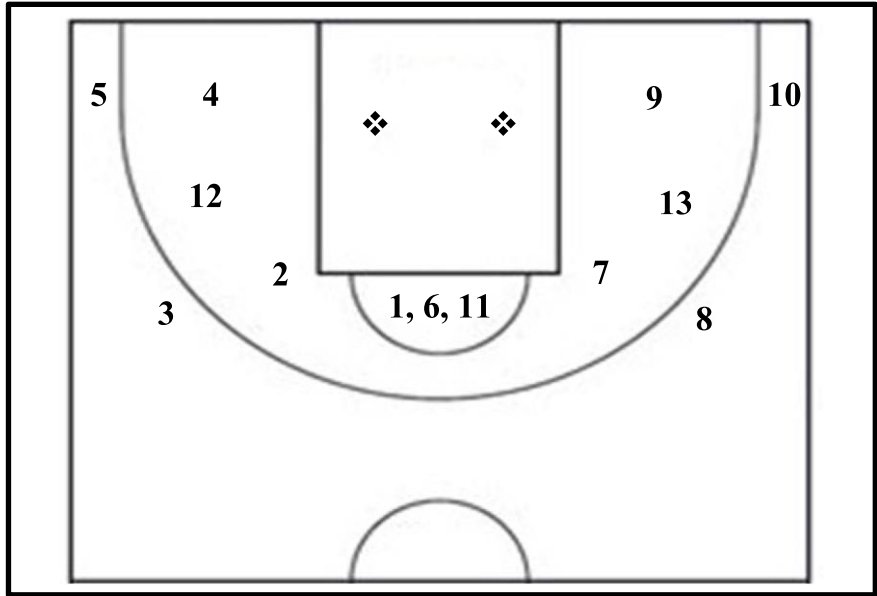
Not Suitable ( )

Comments:

### C. Appendix (3): Experts and specialists in the field of basketball

No.	Name and Academic Title	Specialty	Place of Work
1	Prof. Dr. Mohanad Abdul Sattar Abdul Hadi	Sports Training - Basketball	College of Physical Education and Sports Sciences - University of Baghdad
2	Prof. Dr. Wissan Hanoun Ali	Exercise Physiology - Basketball	College of Physical Education and Sports Sciences - University of Baghdad
3	Assoc. Prof. Dr. Shirzad Mohammed Jaro	Sports Training - Basketball	College of Physical Education and Sports Sciences - University of Baghdad
4	Assoc. Prof. Dr. Laith Mohammed Abdul Razzaq	Testing and Measurement - Basketball	College of Physical Education and Sports Sciences - University of Baghdad
5	Dr. Harith Mubasher Mohammed	Sports Training - Basketball	College of Physical Education and Sports Sciences - University of Baghdad

**D. Appendix (4): Form for recording and analyzing the results of the composite test for basic shooting types in basketball**



<p style="text-align: center;"><b>Total Successful Shots</b></p> <p>1. (1, 6, 11 = )</p> <p>2. (2, 4, 7, 9 = )</p> <p>3. (3, 5, 8, 10 = )</p> <p>4. (12, 13 = )</p> <p>❖ Point for Offensive Rebound in case of a failed layup attempt ( )</p>	<p style="text-align: center;"><b>Total Points Scored</b></p> <p style="text-align: center;">( )</p>
<p style="text-align: center;"><b>Time Taken for the Test</b></p> <p style="text-align: center;">( )</p>	

- Dividing the time result by 60 seconds.
- Total points divided by time in minutes.

# تصميم وتقنين اختبار مركب لقياس أنواع التصويب الأساسية بكرة السلة لدى لاعبي الجامعات الطلبة

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## المستخلص

يعد استخدام الاختبارات في المجال الرياضي أداة أساسية لتحقيق الأساليب العلمية للحصول على أفضل النتائج الممكنة، وتلعب الاختبارات دوراً حيوياً في تقييم أداء اللاعبين، ولا سيما في الرياضات التنافسية مثل كرة السلة التي تتميز بالسرعة والإثارة وتسجيل النقاط. إن الهدف الرئيس لأي فريق هو الفوز من خلال تسجيل أكبر عدد ممكن من النقاط، مما يبرز أهمية التصويب، ويعد التصويب الوسيلة الوحيدة لتسجيل النقاط بشكل مباشر، وهو الإحصائية الحاسمة التي تميز بين الفوز والخسارة. لاحظ الباحثون أن الاختبارات السابقة لقياس أنواع التصويب الأساسية سواء طبقت منفردة أو مركبة مع مهارات أخرى غالباً ما تقيس هذه المهارات في سياقات محددة لا تعكس تعقيدات المباراة الفعلية بشكل كافٍ. لذا تكمن المشكلة في الحاجة إلى سد هذا النقص من خلال تطوير اختبار مركب يحاكي ظروف اللعب المختلفة المرتبطة بمهارات التصويب الأساسية. اعتمد المنهج الوصفي، واختير مجتمع البحث بالطريقة العمدية من الطلاب اللاعبين في كلية التربية البدنية وعلوم الرياضة - جامعة بغداد، إذ بلغت عينة البحث (88) لاعباً. أسفر البحث عن اختبار مركب يضم أربعة أنواع أساسية من التصويب (الرمية الحرة، التصويب من داخل القوس، التصويب من خارج القوس، والتصويب من تحت السلة) بإجمالي 13 محاولة وبعدها أقصى 27 نقطة. أظهر الاختبار صدقاً عالياً، إذ بلغت نسبة اتفاق الخبراء 100%، وبلغت قيمة  $t$  للصدق التمييزي  $5.11$  ( $p < 0.05$ )، وتم التحقق من الثبات بطريقة الاختبار وإعادة الاختبار ( $r = 0.91$ ,  $p < 0.05$ )، كما تم التأكد من الموضوعية بمعامل ارتباط بين المقيمين بلغ  $0.96$  ( $p < 0.05$ )، وبلغ المتوسط الحسابي للأداء  $5.56$  نقطة/دقيقة، وتراوح الدرجات بين  $2.14$  و  $15.56$  نقطة/دقيقة، وتم التوصل للمعايير.

**الكلمات المفتاحية:** التصميم، التقنين، الاختبار، التصويب بكرة السلة.