



The relationship between decision-making time and accuracy of jump shooting among students at the college of physical education and Sports Sciences in handball

Mustafa Ahmed Obaid ¹

¹ University of Baghdad, College of Physical Education and Sport Sciences.

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Abstract

The study aimed to analyze the nature of the relationship between decision-making time and the accuracy of shooting by jumping among handball players who are students of the fourth stage at the College of Physical Education and Sport Sciences to reveal the extent to which cognitive-motor ability contributes to improving offensive skill performance. The study adopted a descriptive approach using the method of relational relationships, and 20 players who were selected deliberately participated. The study used a reaction time system to measure decision time, as well as test the accuracy of shooting from jumping from three specific points within the attack area. The results showed that the Arithmetic mean decision time was 0.828 seconds, while the Arithmetic mean successful shooting attempts from the jump shooting were 69.24 out of 10. Statistical processing also revealed a statistically significant negative correlation between the two variables of $r = -0.84$, indicating that the lower the decision time, the higher the shooting accuracy from jumping. These results indicate that the higher the player's possessed speed in analyzing the situation and making decisions, this was directly reflected in a more accurate ability to direct the ball while jumping, which is consistent with the principles of sensorimotor perception and the theory of information processing in sports performance. The study recommends the need to integrate special training to reduce decision-making time into training programs for attackers, such as changing attitudes, visual and auditory response exercises, as well as the use of electronic measuring devices to enhance skill development. He also recommends future studies that address other psychomotor variables such as selective attention and motor prediction speed to develop the performance of offensive positions in handball.

Keywords: Handball, Decision Time, Shooting Accuracy, Jumping in Handball.

¹ University of Baghdad, College of Physical Education and Sport Sciences.
mostafa.a@cope.uobaghdad.edu.iq .



Introduction

Handball is one of the fast team games characterized by the complexity of offensive and defensive situations, the constant need to make accurate decisions under the pressure of time and space. The effectiveness of an offensive performance in handball depends on the ability to read the situation, choose the appropriate response and then execute it kinetically within milliseconds. This dynamic nature makes cognitive abilities especially decision time a central element in explaining the differences between outstanding players and less experienced players especially in offensive situations that require the speed of forecasting and determining game variables such as the positions of defender's goal angles and timing of jumping and shooting. The shooting skill from the jump is the cornerstone in the construction of the modern attack in handball since it represents the most widely used and effective offensive means of scoring. This skill is based on the fusion of physical elements (explosive power, elevation, and arm speed) with technical elements (launch angle, ball control, and timing of leaving the ground) as well as cognitive elements, most notably the ability to make a quick decision at the critical moment before shooting. Since shooting from the jump is the most popular and successful attacking strategy for scoring, it forms the basis of contemporary handball attacks. This ability is based on a combination of technical (angle of release, ball control, timing of leaving the ground), physical (explosive power, elevation, arm speed), and cognitive (most notably, the capacity to make fast decisions at the crucial moment before shooting) factors. A player's shooting is not only a mechanical movement but a series of sequential decisions, such as choosing the shooting point, determining the moment when he should leave the ground, and predicting the direction of the goalkeeper's and defense's movement. Skill accuracy can no longer be studied in isolation from cognitive processes, as modern models of motor learning suggest an organic relationship between cognitive decisions and motor outcomes. Decision time is the time between the player's reception of the stimulus (such as the appearance of a gap in the defense or the movement of the goalkeeper) and the moment when the executive action begins. The faster a player filters out unimportant information and pick out crucial information, the more capable they are of choosing an effective offensive response. According to the Perception-Action Theory, the quality of a decision is inseparable from the quality of execution, because both belong to a single system that interacts with the environment moment by moment. The importance of this cognitive variable is even more pronounced among attacking center players, who bear the bulk of the responsibility for finishing attacks and face closed and complex playing situations that require a quick reading of defenders' positions and identifying the ideal moment to jump over the defender's shoulder and aim at the far or near corner. In every shot attempt, the attacking player goes through a series of rapid mental processes, starting with selective attention to stimuli, followed by motor perception, decision-making, and finally the execution of



the shot. This series is often less than a second, so a slight delay in decision time can mean a definite scoring opportunity. The second variable in the research, which is the accuracy of shooting from the jump, is one of the most used indicators in evaluating an offensive player's efficiency. Precision is the result of the interaction of several systems: the neuromuscular system, the cognitive system, the visual system, and the motor rhythm. Therefore, a decrease in shooting accuracy does not necessarily indicate a weakness in technique but may indicate a delay in situational perception, a miscalculation of variables such as distance or angle of throwing, or slow decision-making during defensive pressure. In the university environment and among students of the College of Physical Education and Sport Sciences, this problem is clearly prominent: most students possess basic skills in handball, but they often suffer from a weakness in "situational cognitive processes" that are not sufficiently focused in traditional training. This makes the study of the relationship between decision-making time and the accuracy of shooting from the jump of great scientific and practical importance, especially in the development of training curricula aimed at integrating cognitive training with skill training. By reviewing the recent sports literature, it is clear that many studies have unanimously agreed on the crucial role of speed decision-making in the success of offensive skills in team games such as football, handball, and basketball. However, studies linking this variable specifically to the shooting skill of attacking center players are still few, which is a knowledge gap worth studying. This confirms the need to conduct field research that clarifies the nature of this relationship among the students of the College of Physical Education and Sport Sciences to form scientific data on which to build in the development of training and teaching methods.

Problem of Study

Through the researcher's field experience in teaching handball and his observation of the level of performance of the students of the College of Physical Education and Sport Sciences in the skill of shooting from jumping, it was found that there is a clear disparity in the accuracy of execution among the players of despite the similarity of their basic physical and skill levels. This disparity raised a practical and scientific question about the cognitive/cognitive factors affecting skill performance, especially the time of decision-making, which is considered one of the decisive mental abilities in team games with changing and fast situations (Lenzen, Theunissen, & Cloes, 2009). Studies show that the quality of decisions in play situations is based on the player's ability to pick up and act on visual and motor stimuli over short periods of time, and that differences between the distinct and non-distinct are seen in both decision-making speed and motor response accuracy (Mann et al., 2007). Systematic reviews and studies specialized in handball have also shown that the study of perception-action coupling is essential to understand shooting behaviors



and the effectiveness of finishing attacks, and that current research rarely directly links decision time to the accuracy of shooting from jumping offensive position players (Bonnet et al., 2020). On the other hand, analyses of the biomechanical dimension of jump shooting show that kinetic variables (e.g., hand speed, jump height, and shooting angle) affect shooting accuracy, but final performance is the product of a complex interaction between biomechanical structures and perceptual decisions made under the pressure of time and space (Belčić et al., 2023). Furthermore, Quiet Eye research suggests that shooters and shooting experts have visual focus and cognitive initiative-taking patterns that increase execution accuracy and reduce response time in defensive pressure situations (Vickers, 2019). Based on these theoretical and applied data, and with the lack of field studies that have dealt with the direct relationship between decision-making time and the accuracy of shooting from jumping among attacking center players in a university student environment, a knowledge gap is clear that requires field research. Therefore, the research problem is determined in the following question: Is there a statistically significant correlation between the time of decision-making and the accuracy of shooting performance from the jump among the players in handball who are students of the College of Physical Education and Sport Sciences?

purpose of the study

- Measuring the decision-making time of the players in handball who are students of the College of Physical Education and Sport Sciences.
- Measuring the accuracy of shooting from jumping in the research sample.
- Determine the nature of the relationship between decision time and the accuracy of shooting from the jump.
- Explain how speed of decision affects the executive level of the attack. Provide training recommendations to improve offensive performance.

Study Hypotheses

There is a statistically significant correlation between decision-making time and the accuracy of shooting performance from jumping among the attacking center players in handball who are students of the College of Physical Education and Sport Sciences.

Methodology



The researcher adopted the descriptive approach of relational relations to suit the nature of the problem, as this method aims to reveal the nature of the relationship between variables as they appear in reality without interfering with their modification, and it is one of the most used approaches in research that studies cognitive motor phenomena in students and players (Creswell & Creswell, 2017; Thomas et al., 2015).

Participants

The research sample consisted of 20 students from the fourth stage at the College of Physical Education and Sport Sciences/University of Baghdad for the academic year 2024-2025, and they were selected by the deliberate sample method, as they represent the most appropriate educational category to test the relationship between decision-making time and shooting accuracy from jumping in the players in handball. The student is enrolled in the fourth stage and has completed practical and theoretical handball courses during the years of study, free of muscular or joint injuries that affect jumping or shooting. The sample was selected according to specific criteria to ensure accurate representation of the indigenous community and to maintain consistency and objectivity in measuring the variables under study. These criteria included the student being enrolled in the fourth stage having completed practical and theoretical handball courses during the study years and being free of muscle or joint injuries affecting jumping or shooting. These criteria are aimed at ensuring a sufficient level of motor cognitive and sensory skills necessary to accurately and reliably conduct target tests and are also consistent with literature recommendations confirming the need to standardize the level of experience when testing cognitive skill variables in team games (bonnet et al., 2020; Mann et al., 2007). The initial sample underwent a purification process to verify the integrity of the data and exclude situations that may affect the reliability of the results. The purification process included the exclusion of some students for reasons of commitment or ability to take tests such as non-compliance with attendance during lectures the presence of temporary shoulder or knee injuries that impede jumping or arm movement and non-compliance with instructions during measurement procedures which affect the accuracy of the data. After the purification process the final sample was fixed on 20 students, a size suitable for statistical analysis procedures related to correlation relationships and consistent with what the scientific research literature in physical education indicated about the adequacy of small and medium samples in studies of motor and cognitive skills (Creswell and Creswell, 2017; Thomas et al., 2015). The unification of the educational and training environment of fourth-stage students reduced the impact of uncontrolled environmental factors which enhances the accuracy of the results and makes it possible to generalize them to similar categories of students of the faculties of physical education and sports science (Belčić et al., 2023).



The study tests

In this study the researcher relied on a set of scientific tools and tests aimed at measuring the two main variables of the study namely the decision-making time and the accuracy of aiming from the jump of handball players. These tools were selected based on methodological grounds consistent with the recommendations of modern literature in the field of motor perception and aimed at group games (Mann et al., 2007; bonnet et al., 2020; Belčić et al., 2023).

The researcher of this section relied on an accurate description of the procedures ensuring the re-implementation of the study in similar environments achieving the conditions of constancy and truthfulness in skill and cognitive tests in the sports field.

First: decision time Test (decision time Test)

Test description

To measure the decision-making time the researcher used an electronic program for viewing visual-motor stimuli based on a simple reaction time and selection model which is used in perceptual-motor studies to assess the speed of response and decision-making under various conditions of visual stimulation. A set of symbols or colors was displayed on the computer screen the student was asked to make the right decision based on the predetermined stimulus press the corresponding response Button and record the time between the appearance of the alarm and the response. This procedure is similar to that proposed by Vickers (2019) Williams and Ford (2008) in studies of mathematical cognition.

Testing Supplies & Instruments

- A laptop with Reaction Time software installed.
- Highly sensitive response pad.
- A quiet lab environment inside the skills lab or one of the closed rooms.
- Data Registration Forms.

Testing Procedures

- The student sits in front of a screen at a distance of 60 to 70 cm.



- The stimulus to respond to is explained (e.g., the appearance of a red color among multiple colors).
- The program features 20 attempts per student.
- The program records the time in milliseconds for each attempt.
- The arithmetic average of the decision-making time for each student is calculated.

Scientific basis of the test

This method is based on the perception-action coupling models used to measure the speed of decision-making in team games.

Several studies have confirmed that decision tests based on visual responses are a reliable indicator of decision speed in high-tempo games such as handball.

Second: Test the accuracy of shooting from jumping.

Test Description

To measure the accuracy of shooting from jumping, the researcher used a field test based on international models for the study of shooting in handball, specifically the Jump Shot Accuracy Protocol test used in several recent studies, including a study (Belčić et al., 2023). The test involves the player shooting the ball while jumping from a distance of 7 meters towards a goal divided into numerical squares to determine accuracy.

Testing Supplies & Instruments

- A standard handball goal. Divide the goal into 9 squares using colored ribbons. 20
- Standard handball.
- Camera or shooting accuracy tracker (optional to enhance analysis).
- Measuring ruler, floor bar, and jump area fasteners.

Testing Procedures

The student stands behind the 9-meter line and starts rushing with offensive steps that resemble a real attack.

Performs a standard offensive jump towards the shooting point.

The student performs 10 attempts to aim at the goal.

The location of the falling ball is recorded inside the squares.

The accuracy is calculated according to the following table:

- Lateral upper squares injury: 3 points
- Middle squares injury: 2 points
- Lower squares injury: 1 point

The total points are calculated as the value of accuracy for each player.

Statistical Methods

- Arithmetic average.
- Standard deviation.
- Pearson simple correlation coefficient.
- Significance analysis of the results (significance $\alpha \leq 0.05$).

Result

Table 1. shows the arithmetic averages, standard deviations, and correlation coefficient between decision time and jump shooting accuracy

Variable	M	SD	r	(p-value)
Decision Time	0.828	0.106	-0.84	
Accuracy of shooting from jumping	69.24	5.12		<0.001

Table (1) shows the descriptive statistics and the analysis of the correlation between the study variables, namely: Decision Making Time and shooting accuracy from jumping among players in handball students of the College of Physical Education and Sport Sciences. The results of the analysis showed that the average decision time was 0.828 seconds with a standard deviation

of 0.106, which indicates that there is a slight difference in the speed of the players when making decisions during attack situations. As for the accuracy of shooting from the jump it averaged (69.24 %) with a standard deviation (5.12) reflecting relatively stable performance among players. As some of them tend to achieve higher accuracy of shooting than others during the jump. As for the correlation relationships between the variables. the results showed a strong negative correlation and a statistically significant function between the time of decision-making and the accuracy of shooting from jumping ($R = -0.84, p < 0.001$), which means that players with a shorter decision-making time managed to achieve higher accuracy of shooting from jumping ($R = -0.84, p < 0.001$), which means that players with a shorter decision-making time were able to achieve higher shooting accuracy from jumping. Regarding correlation relationships between variables: The results showed a strong negative and statistically significant correlation between decision time and jump shooting accuracy ($r = -0.84, p < 0.001$), which means that players with shorter decision times were able to achieve higher shooting accuracy than jumping. This suggests that decision-making speed is a significant factor in improving shooting performance, as the player who is quicker to make decisions can aim the ball with higher accuracy towards the target during attack. These results support previous hypotheses in the field of sports psychology, which suggest that reducing the cognitive processing time of field situations increases the effectiveness and accuracy of skill performance in dynamic and open sports such as handball, especially in attacking situations from jumping that require high coordination between motor perception and quick decision-making.

Discussion

The results of this study showed that there was a strong and statistically significant negative correlation between decision-making time and shooting accuracy from jumping among the players in handball who were students of the College of Physical Education and Sport Sciences, where the correlation coefficient was ($r = 0.84, p < 0.001$). This result indicates that the less time a player has to make decisions, i.e., the faster he is able to process information and make his decisions, the more accurate he will be in shooting while jumping. These indicate The relationship focuses on the pivotal role that cognitive competence and mental processing play in the performance of fine motor skills in dynamic play situations, including proper jump timing, body balance through the air, directing the ball toward the goal, and interaction with multiple field variables such as the position of the defender and teammates. The average decision time in the sample (0.828 seconds) and Arithmetic mean shooting accuracy (69.24%) reflect individual differences between players in cognitive and motor abilities, confirming that some players possess high cognitive speed associated with greater executive accuracy. These results are consistent with what (singer, 2001) indicated, that the speed of decision-making under temporal and spatial stress is a crucial skill in interactive sports because athletes with a high ability to quickly process situations are more



efficient in adapting to fast-playing situations and achieving accurate skill performance (Singer, 2001). Many studies have also confirmed that players with an advanced ability to anticipate opponents' movements and make a quick decision show more accurate and effective performance. From an educational and applied point of view these results can be explained by the characteristics of the study sample since undergraduates often have a good knowledge base but their practical competitive experience may be limited which leads to unevenness in cognitive and motor competence. Previous studies have shown that students who have not undergone intensive training in interactive game situations are slower in decision-making and less accurate in performance reflecting the role of continuous and intensive training in the development of cognitive abilities associated with motor skills. Thus it seems that the decision-making time is not a secondary variable but a major determinant of performance because the players who recorded more time in decision-making were themselves the least accurate which indicates the importance of rapid information processing selective attention and motor readiness in the performance of the skill (Williams, 2008). The practical implications of these results are also evident in sports training as they indicate the need to integrate cognitive and cognitive training programs within motor skills classes, which enhance the speed of decision-making and the anticipation of motor reactions. It is advisable to design exercises that simulate realistic playing situations including jumping and aiming under the pressure of defenders or in a changing environment to improve the interaction of perception decision-making, and motor execution at the same time. Recent studies show that joint exercises combining cognitive and skill aspects contribute to improved performance within matches more than exercises focused on physical skill alone (Zhu, 2024) and neurological studies confirm that more experienced players show faster and more efficient neurological responses when making a decision which translates into higher accuracy in the implementation of skills under the pressure of the match (Xiong, 2024). Therefore the results of this study suggest that improving decision-making time through cognitive exercises and realistic interactive exercises can lead to increased aiming accuracy from jumping, as well as enhance the ability of players to adapt to fast and complex game situations. In theory the study adds evidence that skill performance in team sports is based on an integrated interaction of mental abilities, tactical knowledge and physical skills, which opens the way for the development of comprehensive training programs that take into account the mental physiological and motor aspects of players enhancing the effectiveness of performance within matches.

Conclusions

The study showed a statistically significant and strong negative correlation between the decision-making time and the accuracy of shooting from the jump in handball players showing that the speed of decision-making is a decisive factor in improving the accuracy of skill



performance. The results revealed that faster decision-making players achieved higher aiming accuracy, while longer decision-making time was associated with lower accuracy confirming the important role of cognitive processing and selective attention in complex motor skills. The study indicates that there are individual differences between the players in cognitive and motor abilities, since the difference in the speed of decision-making is directly reflected in the efficiency of the implementation of shooting skills from jumping. The results confirm the importance of integrating cognitive and skill aspects in the development of sports performance in open-ended team sports such as handball, enhancing the ability of players to adapt to changing and complex playing situations.

Recommendations

Integration of cognitive and skill training: it is advisable to include exercises to develop processing speed and decision-making within the skill training programs of handball players to promote harmony between perception and motor execution.

Design exercises to simulate realistic play: training situations should be diversified to include elements of temporal and spatial pressure, such as the presence of defenders or sudden changes in the position of the ball, to enhance the ability of players to make quick and accurate decisions in actual matches.

Periodic assessment of decision time and accuracy of aiming: it is recommended to periodically use tests of decision time and shooting skills to monitor progress and identify players who need additional cognitive or skill support.

Develop comprehensive training programs: programs should be designed that link the cognitive aspect, tactical experience, and physical skills to improve performance on the field in an integrated manner.

Individual training according to cognitive abilities: it is recommended to identify individual differences in decision-making speed between players and design training activities tailored to support players with lower cognitive speed, to enhance the chances of achieving optimal performance for all team members.

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