



## Shooting Success Level in Basketball Seen from The Formation of The Throwing Angle

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### Abstract

This study focuses on analyzing the relationship between the release angle and the success rate of shooting in the free throw technique in basketball. The study was conducted on members of the Mitra Satu Basketball club using a quantitative descriptive approach. A total of 10 players performed 10 free throw attempts, resulting in a total of 100 shooting data that were analyzed using Kinovea software to measure the release angle, and the chi-square test to determine the relationship between the angle and the success rate of the shot. The results of the analysis showed that there was a significant relationship between the range of the release angle and the success rate of shooting ( $p = 0.009$ ). The angle range of 40–49 degrees produced the highest success rate, which was 48.4%, compared to other angle ranges. This study confirms that the release angle plays an important role in determining shooting accuracy, and certain angles can provide biomechanical advantages for players. Thus, coaches and athletes are advised to focus shooting training on achieving optimal angles and utilizing movement analysis to improve technique consistency. This study also opens up opportunities for further research involving a larger sample size and additional variables, such as throwing distance, which was not examined in this study but could significantly contribute to a deeper understanding of shooting performance in basketball.

### How to Cite

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## INTRODUCTION

The preface contains background research, corroborated with data, information, and re- Basketball is a dynamic and competitive team sport that relies on technique, physical, psychological, speed, and endurance (Prasetyo & Sukarmin, 2017). The aim of this game is to score as many points as possible by putting the ball into the opponent's basket and preventing the ball from entering your own basket (Dias et al., 2016). Cooperation is needed between players who participate in the match to get points, this will be done well when the player has good technique (Yuliandra & Fahrizqi, 2019). Among these techniques, the ability to shoot or shoot the ball into the ring is the most important component in the game of basketball (Darumoyo, 2019).

Factors that influence shooting success are an interesting and relevant area of research in the context of improving athlete performance. One of them is the athlete's understanding of how to shoot correctly, the coach's delivery in providing examples of movements, and the coach's understanding of the biomechanics of shooting movements (Wijaya, 2019). The applied mechanics used to support shooting movements is Newton's third law, where when entering the preparation stage for shooting there is a downward push of the body due to gravity, as well as an upward push of the body to throw the ball (Adina et al., 2018). In shooting This requires the BEEF technique which is an important concept in shooting. BEEF consists of balance, eye (focus on the ring and ball), elbow (elbow position), and follow through (final movement after shooting) (Cahya et al., 2021).

From a sports biomechanics perspective, basketball shooting movements involve complex coordination of various body segments, starting from the feet as support, arm and wrist strength in releasing the ball, to visual focus on the target. One of the techniques in data collection and data processing in biomechanics is using two- or three-dimensional video and cinematography which are analyzed using kinovea software by paying attention to biomechanical principles (Wismanadi, 2019). With this biomechanical analysis, it can help coaches improve athlete movements when shooting and help athletes see directly where their mistakes are (Kusumawati & Muhamad, 2020).

In this study, the level of success referred to is the acquisition or getting results in the sense of having a level in carrying out efforts to produce points in shooting in a basketball game. The level of success in basketball refers to the percentage of

shots that successfully enter the ring from the total shots made by the player. This is usually expressed as a percentage and is an important indicator of a player's shooting efficiency and skills. In this study, the tests and measurements carried out were on the free throw technique (putting the ball into the ring at a relatively close distance). Where this free throw technique requires self-confidence by thinking positively, developing a shooting routine with rhythm, learning to relax, and focusing on the target (Irwati & Himawan, 2020).

The formation of the angle of release is one of the components that determines the accuracy and success of a shot. By categorizing the angle of release into several ranges, this study aims to analyze whether there is a significant difference in the proportion of successful shooting among these angle ranges. This study is based on the assumption that there is a certain angle range that is biomechanically more advantageous for directing the ball into the basket. However, it is important to note that this study is limited to free throws taken from the standard distance of 4.57 meters (15 feet), and does not consider variations in throwing distance. Future research may include different shooting positions and distances to explore how these factors interact with release angles. The findings of this study are expected to provide empirical insights into the importance of release angle in basketball shooting and its implications for training strategies and player performance.

## METHODS

This study aims to analyze the relationship between the throwing angle and the success rate of free throws in members of the Mitra Satu Basketball basketball club. The type of research used is quantitative descriptive analysis using tests and measurements to describe and analyze the relationship between the angle range variable and the success rate of shooting. This study was conducted at the Bappeda Basketball Sport Arena, Banjar City, located at Jl. Raya Batulawang No. 26 Hegarsari, Pataruman District, Banjar City, West Java 43622.

The population in this study were all members of the Mitra Satu Basketball club basketball team totaling 40 people. The sampling technique used purposive sampling technique with the criteria of players who actively participated in training and were willing to be research subjects. Players who met the criteria were 10 people to be research samples. Each player will make 10 free throw attempts, so that there are 100 shooting trial data analyzed.

In this study there are two variables, namely the independent variable and the dependent variable. The independent variable here is the release angle when doing a free throw. This angle will be measured using video analysis with the help of Kinovea software. While the dependent variable is the level of success of the free throw which is cateSport Arenaized into successful balls (entering the ring) and failed (not entering the ring).

Data collection in this study requires several instruments, namely a digital camera used to record video of each free throw attempt from each subject by paying attention to the placement of the camera which must be perpendicular to the shooting motion plane and parallel to the ring to minimize perspective distortion in angle analysis. Next is a laptop used to store video recordings and run Kinovea software. Using Kinovea software to analyze the video used to measure the throwing angle when the ball leaves the player's hand by marking reference points on the relevant video frame. Finally, writing instruments used to record data on the success or failure of each shooting attempt.

The collected data will be analyzed using biomechanical principles with the help of Kinovea software for measuring the throwing angle. Furthermore, to analyze the relationship between the range of throwing angles and the success rate of shooting, the data will be grouped into several relevant angle ranges. After that, it is analyzed through a crosstabulation test and calculating significance with the chi-square test (Fadluloh et al., 2024).

## RESULTS AND DISCUSSION

On the article written from research, then in the early part of the results and a discussion on research be preceded by a description of the According to the results of the evaluation of the success rate of shooting in the Club Mitra Satu basketball team, we can analyze it through the free throw test that has been carried out. Furthermore, the collected data is analyzed with statistical calculations so that its truth can be tested. Based on the results of the evaluation and analysis of data from 10 Club Mitra Satu basketball teams, the quality of the success rate of shooting in the Club Mitra Satu team can be described as follows **Table 1**.

Based on the data in **Table 1**, it can be seen that each player produces a different throwing angle in each trial. Measurements were taken on 100 shots by 10 players. Most of the angles are

in the range of 40°–49°, but there are also lower angles (30°–39°) and higher (50°–69°). This variation provides an initial picture that the players have different techniques or consistency in shooting.

**Table 1.** Results of shooting test angle analysis

Name	Throw Angle									
DA	42.2°	47.7°	33.4°	30.1°	38.2°	37.1°	41.4°	37.9°	40.7°	36.5°
SO	48.6°	49.4°	42.5°	41.9°	46.4°	44.2°	44.6°	40.9°	42.1°	38.1°
NA	41.1°	36.3°	39.2°	43.3°	41.1°	44.9°	44.8°	47.2°	44.2°	44.5°
RD	39.7°	45.5°	40.8°	39.3°	43.1°	40.5°	41.3°	44.5°	41.8°	42.3°
FF	45.5°	45.1°	49.1°	46.1°	44.9°	50.2°	49.7°	52.7°	50.1°	52.3°
PT	41.1°	41.3°	40.8°	42.3°	45.5°	45.9°	41.7°	44.1°	44.5°	48.3°
MI	49.6°	51.1°	46.1°	48.1°	43.8°	43.9°	45.8°	48.6°	48.8°	48.2°
RA	56°	56°	64.1°	61.5°	62.1°	52.7°	57.6°	60.3°	58.2°	57°
GT	50.5°	55°	56.7°	54.1°	56.9°	53.7°	55.6°	54°	56.3°	53.8°
NA	46.1°	46.5°	47.9°	50.3°	48.7°	45.9°	45°	47.1°	47.4°	45.7°

**Table 2.** Shooting success rate

NAME	SHOOTING SUCCESS								
DA	M	T	M	T	T	T	T	T	T
SO	T	T	M	T	M	M	T	M	T
NA	T	T	T	T	T	M	T	T	M
RD	T	T	M	M	M	T	T	T	M
FF	T	M	T	T	T	M	T	T	T
PT	T	M	M	M	T	M	M	M	M
MI	M	T	M	M	T	T	M	T	T
RA	M	T	T	T	T	T	T	T	T
GT	T	T	T	T	T	T	M	T	M
NA	M	M	M	T	T	M	T	M	M

**Table 2** shows the results of each player's shooting success. By using the codes M (Entered) and T (Not Entered), the success rate of each player can be identified from a total of 10 attempts. There is a fairly striking difference in success between individuals, which may be influenced by the angle of the throw, shooting technique, and psychological factors such as concentration and pressure when shooting.

To facilitate analysis, the throwing angles in the study were classified into four cateSport Arenay ranges as follows:

- Angle range 1 = 30-39°
- Angle range 2 = 40-49°
- Angle range 3 = 50-59°
- Angle range 4 = 60-69°

Grouping data into equal interval classes such as 10° is a common practice in descriptive statistics, as it facilitates frequency distribution analysis and data visualization.

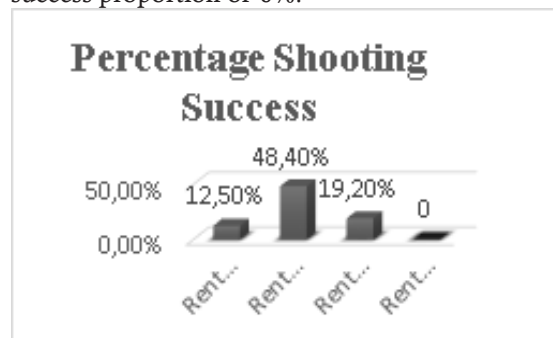
This study aims to analyze whether there is a significant relationship between the angle range and the success rate. Both of these variables are cateSport Arenaiical, so they use the Crossbula-

tion data description test and the Chi-Square Independence test using IBM SPSS Statistics 27 software.

**Table 3.** Crosstabulation Test

		Success Rate		Total
		0	1	
Angle Range	1	7	1	8
	2	32	30	62
	3	21	5	26
	4	4	0	4
Total	64	36	100	

The **Table 3** above is a crosstabulation table between the angle range and the success rate. Interpretation of this data can be done by looking at the distribution pattern of success based on different angle ranges. From this table, the distribution pattern can also be observed. Where in the angle range 1, the majority of observations have a success rate of 0 (failure), out of 8 total shootings only 1 was successful with a success proportion of 12.5%. In the angle range 2, the number of observations with a success rate of 0 and 1 is relatively balanced, out of 62 total shootings there were 30 that were successful with a success proportion of 48.4%. In the angle range 3, the majority are at a success rate of 0 (failure), out of 26 total shootings there were 5 that were successful with a success proportion of 19.2% and the angle range 4 which has a success rate of 0 (failure), out of 4 total shootings none were successful with a success proportion of 0%.



**Figure 1.**

From the success proportion above, it can be seen that angle range 2 has a much higher success proportion (around 48.4%) compared to other angle ranges. Angle ranges 1 and 3 have relatively low success proportions (12.5% and 19.2%). In angle range 4 there was no success at all, so this result may be less representative.

**Table 4.** Chi-Square Test

	Value (X2)	df	Sig. Asymptotic (2-sided)
Pearson Chi-Square	11,470	3	0.009

In the **Table 4** above, it can be interpreted that the Pearson Chi-Square test produces a statistical value of  $X^2 = 11.470$  with a degree of freedom of 3 and the asymptotic significance value (p-value) obtained is 0.009 with  $p < 0.05$ , therefore there is a statistically significant relationship between the angle range and the success rate. This statistical significance implies that variations in the range of throwing angles are related to differences in the success rate of shooting. This means that shooting success or failure does not occur randomly across the observed angle range, but tends to be concentrated in a certain angle range.

Referring to **Table 1**, it can be seen that the angle range 2 shows the highest proportion of successful shooting, which is 48.4% compared to angle range 1 (12.5%), angle range 3 (19.2%), and angle range 4 (0%). This indicates that shooting done with a throwing angle included in the range 2 cateSport Arenay has a greater chance of success in this study.

The findings of this study demonstrate a significant relationship between the range of throwing angles and the success rate of free throw shooting ( $p = 0.009$ ). Specifically, the 40°–49° angle range (angle range 2) recorded the highest success rate at 48.4%, compared to much lower rates in other ranges. This indicates that not all throwing angles offer the same biomechanical advantages for scoring.

From a biomechanical perspective, this is consistent with the principles of projectile motion, where an optimal launch angle helps maximize the entry probability of the ball into the hoop. An angle that is too low may cause a flatter trajectory, increasing the chance of rim interference, while an angle that is too steep can reduce shooting power and directionality (Wismanadi, 2019). These findings align with (Adina et al., 2018), who concluded that throwing mechanics, including release angle and follow-through, are critical to successful shooting.

The dominant success in angle range 2 supports the theory that a parabolic trajectory at around 45 degrees is optimal in maximizing the “entry area” through the hoop. This is supported by (Kusumawati & Muhamad, 2020), who explained that shots within optimal mechanical parameters are more likely to follow a high-arc path, reducing the influence of horizontal error.

Furthermore, this research reinforces the importance of motor consistency and proper technique training. As noted by (Cahya et al., 2021), the BEEF (Balance, Eye, Elbow, Follow-through) principle contributes directly to consistent release mechanics, which is essential for achieving ideal angles. Players who lack stability or focus during



the release tend to produce inconsistent results regardless of their strength or coordination.

Another key insight is the role of visual and motor coordination. According to (Wijaya, 2019), the player's ability to align motor control with visual cues directly impacts angle precision. In this study, players with inconsistent angles also had lower success rates, which may be caused by insufficient shooting rhythm or lack of visual targeting.

Although this study confirms the biomechanical role of angle formation, it also has several limitations. For instance, it was conducted only at a standard free throw distance (4.57 meters) without involving movement-based shots or game-like scenarios. As (Irwati & Himawan, 2020) suggest, psychological aspects such as concentration, match pressure, and routine also significantly affect shooting performance. Since these were not measured, further studies incorporating psychological and kinematic variables are recommended.

In future research, a larger sample and varied shooting distances (e.g., three-point shots, fadeaways) should be included. The addition of 3D motion capture or high-frame-rate video could provide more accurate release parameters such as ball spin, release height, and velocity, further enriching our understanding of biomechanical efficiency.

## CONCLUSION

The conclusion obtained after conducting research and data analysis is that there is a significant relationship between the range of throwing angles and the success rate of shooting. The results of statistical analysis show that the throwing angle in the range of 40-49 degrees (angle range 2) has the highest success rate reaching 48.4%, compared to other angle ranges. Therefore, it can be concluded that the throwing angle plays an important role in determining the accuracy and effectiveness of free throw shots. Throwing angles that are too low (30-39 degrees) or too high (60-69 degrees) tend to produce a lower or even zero proportion of success. Biomechanically, this can be explained because the ball's trajectory is not optimal, either because the elevation angle is not enough to reach the highest point of the parabolic trajectory or because the angle is too steep so that it loses momentum and direction. This study also confirms that biomechanical principles such as balance, elbow position, visual focus, play a very important role in supporting the right throwing angle.

The researcher's suggestion for coaches and athletes is to pay special attention to the formation of the throwing angle in training. Shooting training should be focused on developing the consistency of the throwing angle around 40-49 degrees, because this angle shows the highest tendency in producing successful shots. And this study also shows that the range of angles and shooting success are important factors. By training the formation of the angle, it can also support the success of shooting to the maximum. And no less important, training activities should include psychological approaches such as building self-confidence, managing pressure during matches, and forming a positive competitive mentality, because the mental aspect also contributes to a player's shooting performance.

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