



## **The Effect of Arm Muscle Strength, Speed, and Eye-Hand-Foot Coordination on Basketball Dribbling Skills**

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### **Article History**

Received February 2025

Accepted February 2025

Published Vol.14 No.(1) 2025

### **Keywords:**

Arm Muscle Strength;  
Speed; Eye-Hand-Foot  
Coordination; Drib-  
bling Skills Basketball

### **Abstract**

This study aims to determine the effect of arm muscle strength, speed, and eye-hand-foot coordination on basketball dribbling skills in students participating in basketball extracurricular activities. The research sample was 60 students participating in basketball extracurricular activities at one of the state high schools in Jakarta. The research approach used in this study was associative multivariate, with survey methods and test techniques. The analysis technique used the path analysis approach at a significance level of 0.05. The results of the study based on the results of the path analysis test on each hypothesis with the provision of p-value <significance level of 0.05 showed that: there is a direct effect between arm muscle strength on speed, eye-hand-foot coordination, and basketball dribbling skills. There is a direct effect between speed on eye-hand-foot coordination and basketball dribbling skills. There is a direct effect between eye-hand-foot coordination on basketball dribbling skills. There is an indirect effect between arm muscle strength on basketball dribbling skills through eye-hand-foot coordination. There is an indirect effect of speed on basketball dribbling skills through eye-hand-foot coordination. There is an indirect effect of arm muscle strength on basketball dribbling skills through speed. Based on these results, it can be concluded that arm muscle strength, speed, and eye-hand-foot coordination have both direct and indirect effects on the basketball dribbling skills of extracurricular students.

### **How to Cite**

Illanda, V. P., Hernawan., Asmawi, M., & Sujarwo. (2025). The Effect of Arm Muscle Strength, Speed, and Eye-Hand-Foot Coordination on Basketball Dribbling Skills. *Journal of Physical Education, Sport, Health and Recreation*, 14 (1), 107-113.

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## INTRODUCTION

Basketball in Indonesia has experienced significant development in recent decades. As one of the sports that has global appeal, basketball has a place in the hearts of the Indonesian people, especially among the younger generation (Azura et al., 2022). Data from the (Indonesian Basketball League (IBL), 2023) shows that the average number of spectators has increased by 15% per season since 2017. This indicates that the public's enthusiasm for this sport is increasing. However, despite its growth, basketball in Indonesia still faces various obstacles. One of them is limited infrastructure. Based on data from the Ministry of Youth and Sports of the Republic of Indonesia (2022), only 40% of high schools in Indonesia have adequate basketball court facilities. This results in limited access for the younger generation to learn and develop their abilities from an early age. This condition will certainly hinder the development of basketball in Indonesia.

Basketball is one of the sports that has great potential to be developed, especially through extracurricular activities in schools. As one of the most popular sports among the younger generation, basketball offers various benefits, such as developing physical skills, teamwork, and disciplined character. At the school level, basketball extracurricular activities have a strategic role in forming an early foundation for the younger generation to get to know and explore the sport of basketball in a more structured way. Basketball extracurricular activities have various benefits that are not only related to the physical aspects, but also the social and psychological aspects of students. According to research conducted by Smith et al. (2020) sports such as basketball can increase cardiorespiratory capacity, muscle strength, and body coordination. In addition, participation in organized sports activities is also known to reduce the risk of obesity in school-age children. From a social perspective, basketball provides students with the opportunity to develop teamwork and communication skills. In a basketball game, the success of a team depends heavily on the ability of its members to work together, understand each other's roles, and communicate effectively (Johnson & Johnson, 2017). In addition, participation in basketball extracurricular activities can also have a positive impact on students' mental health. As expressed by Brown (2019), team sports can help students reduce stress levels, increase self-confidence, and build better social relationships.

Basketball extracurricular activities play a very important role in improving the quality of students' games. According to a study conducted

by Harris & Cooper (2022), structured training in basketball extracurricular activities can improve students' basic techniques, understanding of game strategies, and decision-making abilities on the field. An organized training program supervised by experienced coaches allows students to develop optimally in both technical and tactical aspects. In addition, students who are active in basketball extracurricular activities show improvements in physical endurance and performance consistency compared to students who do not participate in similar activities.

However, the reality on the ground shows that many students who take part in extracurricular basketball do not yet have optimal dribbling skills. Based on observations, observations, and interviews with the extracurricular basketball coaching team at a public high school in Jakarta, it was found that many students often make mistakes when dribbling a basketball. These mistakes include students who always lower their heads when dribbling the ball so that they cannot see the position of their teammates properly, which results in difficulty finding gaps to pass or find other opportunities to attack. Furthermore, the ball often escapes control and then has difficulty reaching the ball when the ball loses control from the hand. Students also make slow dribbling movements and weak ball bounces which make it difficult to control the ball so that the opponent can easily take the ball. This condition is certainly a gap that should not occur when someone has basketball dribbling skills. According to Pratama et al. (2020), students' low mastery of dribbling techniques is often caused by several factors, such as a lack of understanding of basic techniques, low training intensity, and a lack of varied and interesting training methods. If this problem is not resolved immediately, students participating in extracurricular basketball will have difficulty competing in competitions, both at school and higher levels. Furthermore, the lack of basic skills such as dribbling the ball can hinder the development of overall playing ability, thus impacting individual and team achievement.

Based on the problems that have been raised above, the researcher assumes that the lack of basketball dribbling skills of students participating in extracurricular activities at one of the high schools in Jakarta is not only because students have not mastered the basic techniques of dribbling the ball, but also the role of physical condition components such as arm muscle strength, speed, and hand-eye-foot coordination. Guimarães et al., (2021) said that among the various factors that influence the ability to dribble a basketball, the most important is physical con-

dition. Then Ji et al., (2023) explained that these physical conditions can be in the form of strength and power, coordination, anaerobic endurance, muscle endurance, and speed. This opinion further strengthens the researcher's assumption so that the researcher is interested in studying the effect of arm muscle strength, speed, and hand-eye-foot coordination on the basketball dribbling skills of students participating in extracurricular activities.

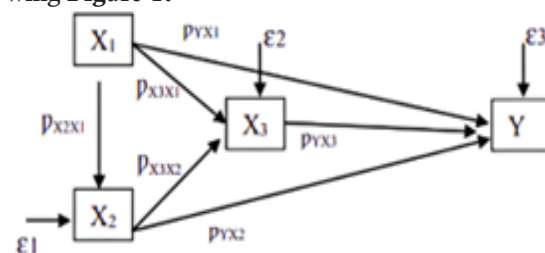
Research conducted by Ilmiyah & Karjadi (2023) examined the "Relationship Between Agility and Speed towards the Results of Extracurricular Basketball Dribbles at SMA N 1 Kedungwuni" showed the results that there is a relationship between agility and dribble results with a significance value of  $0.022 < 0.05$  for female players and  $0.025 < 0.05$  for male players; 2) there is a relationship between speed and dribble results for female players with a significance value of  $0.034 < 0.05$ , and there is no relationship for male players because the significance value is  $0.428 > 0.05$ ; 3) there is a relationship between agility and speed and dribble results with a significance value of  $0.049 < 0.05$  for female players and  $0.038 < 0.05$  for male players.

The purpose of this study was to determine whether there is an influence between arm muscle strength, speed, and hand-eye-foot coordination on the basketball dribbling skills of students participating in extracurricular activities. The results of the study are expected to be a reference for coaches to improve the physical aspects of extracurricular participants in order to create good and accurate basketball dribbling skills.

Thus, this study offers novelty by simultaneously examining the effects of arm muscle strength, speed, and eye-hand-foot coordination on basketball dribbling skills, something that has not been widely discussed in previous studies. Most previous studies have focused more on the relationship between one or two physical factors, such as speed and agility, without considering the role of coordination specifically. In addition, this study provides a new perspective in extracurricular coaching by highlighting how physical aspects can be optimized to improve students' dribbling skills, especially in conditions of limited sports facilities in Indonesian schools. The focus on eye-hand-foot coordination is also an added value, because this aspect is often overlooked in previous studies, even though it has a crucial role in controlling the ball effectively. With an evidence-based approach, this study is expected to fill the gap in previous research and provide recommendations for coaches and schools in designing more effective training programs to improve the quality of basketball games at the school level.

## METHODS

This study uses an associative quantitative research method, with a quantitative approach and survey method techniques and using path analysis techniques. Path analysis is the ability to directly estimate various relationships between variables in a model, including the causes of a variable and the effects of a causal chain (Jin et al., 2024). A path model, or path analysis, is a necessary but not sufficient condition for a variable to be considered a "cause" in the true sense (Krawitz et al., 2022). Riduwan & Engkos in (FADILLA, 2021) stated that the path analysis model is used to analyze the pattern of relationships between variables with the aim of determining the direct or indirect influence of a set of independent variables (exogenous) on the dependent variable (endogenous). The variables studied consist of four variables consisting of three exogenous variables and one endogenous variable. The exogenous variables consist of arm muscle strength (X1), speed (X2), hand-eye coordination (X3) and the endogenous variable is basketball dribbling skills (Y). The pattern of relationships between research variables is shown in the following Figure 1.



**Figure 1.** Constellation of Structural Relationships Between Research Variables

- X1 : Arm muscle strength
- X2 : Speed
- X3 : Hand eye coordination Learning
- Y : Basketball dribbling skills
- Px2x1 : Path Coefficient of Variable X2 With Variable X1
- Px1y : Path Coefficient of Variable X, With Variable Y
- Px2y : Path Coefficient of Variable X2 With Variable Y

The population in this study were basketball extracurricular participants at one of the senior high schools in Jakarta. The sample consisted of 60 active basketball extracurricular participants taken by purposive sampling. This study used a test technique. Measurement of arm muscle strength variables (X1) using the Pull and Push Strength Test, measurement of speed variables (X2) using a 30-meter sprint test, measurement of hand-eye-foot coordination variables

(X3) using a throw-catch-kick test and measurement of basketball dribbling skills variables (Y) using a basketball dribbling skills test.

The data analysis technique was carried out through two stages of analysis, namely descriptive and inferential data analysis. Descriptive analysis was used in terms of data presentation, central measurements, and distribution measurements. Inferential data analysis was carried out to test the hypothesis using path analysis. Path analysis, all hypothesis testing was carried out using  $\alpha = 0.05$ .

## RESULTS AND DISCUSSION

This study consists of four variables, namely hand muscle strength (X1), speed (X2) and hand-eye-foot coordination (X3) and basketball dribbling skills (Y). The results of this study were then processed using Microsoft Excel Computer Program, SPSS 26.0 and Sobel Test Risrel. Conclusions on the proposed hypothesis will be drawn through the path coefficient and significance for each path studied. The structural equation model of this study consists of 3 sub-structures.

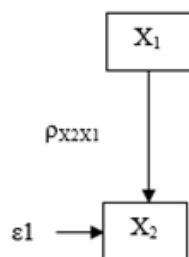


Figure 2. path analysis model 1

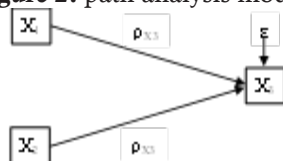


Figure 3. path analysis model 2

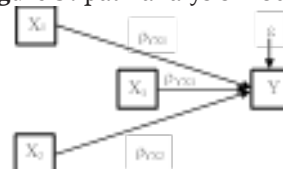


Figure 4. path analysis model 3

Based on data processing, the following data was obtained:

### Sub Structure I

Substructure 1 shows the influence of arm muscle strength on speed. The structural equation

tions of substructure 1 can be seen in **Table 1**.

**Table 1.** Structural equation of substructure 1

Coefficients <sup>a</sup>					
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1 (Constant)	5.592	.290		19.253	.000
X1	-.039	.011	-.440	-3.728	.000

a. Dependent Variable: X2

The structural equation of substructure 1 is:

$$X2 = -0.039X1 + 0.807\varepsilon1$$

The path diagram for substructure 1 does not change.

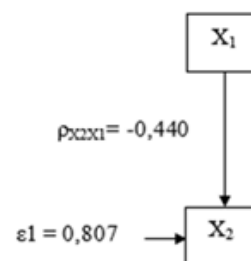


Figure 5. path diagram for substructure 1

Based on the **Table 1** and **Figure 5** above, it is known that the effect of Arm Muscle Strength on Speed is indicated by a beta coefficient of -0.440. The test results with the t test obtained a t value of -3.728 with a significance of 0.000. The significance number is below 0.05, so it can be concluded that there is a linear effect of Arm Muscle Strength on Speed. The amount of Arm Muscle Strength on Speed is 0.193 or 19.3%.

### Sub Structure 2

Substructure 2 shows the combined and partial influence between arm muscle strength and speed on eye-hand-foot Coordination. The structural equation of substructure 2 can be made from the following **Table 2**.

**Table 2.** Structural equation of substructure 2

Coefficients <sup>a</sup>					
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1 (Constant)	38.946	6.756		5.765	.000
X1	.290	.101	.354	2.873	.006
X2	-2.695	1.123	-.295	-2.399	.020

a. Dependent Variable: X3

The structural equation of substructure 2 is

$$X3 = 0.290X1 - 2.695 X2 + 0.696\varepsilon2$$

The path diagram for substructure II does not change.



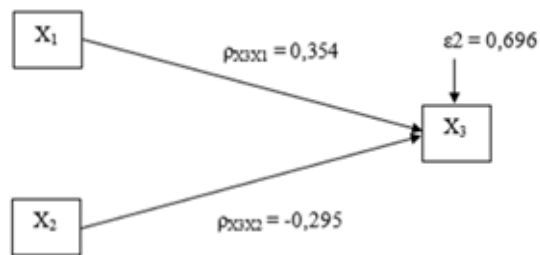


Figure 6. path diagram for substructure 2

The effect of arm muscle strength on hand eye coordination is indicated by a beta coefficient of 0.354. The test results with the t-test obtained a t value of 2.873 with a significance of 0.000. Because the significance number is below 0.05, it can be concluded that there is a linear effect of arm muscle strength on hand eye coordination. The magnitude of the effect of arm muscle strength on hand eye coordination is 0.354 or 35.4%.

The effect of speed on hand eye coordination is indicated by a beta coefficient of -0.295. The test results with the t-test obtained a t value of -2.399 with a significance of 0.000. Because the significance number is below 0.05, it can be concluded that there is a linear effect of speed on hand eye coordination. The magnitude of the effect of speed on hand eye coordination is -0.295 or -29.5%.

### Sub Structure 3

Substructure 3 shows the combined and partial influence between Arm Muscle Strength, Speed and Hand-Eye-Foot Coordination on Basketball Dribbling Skills. The results of the structural equation from substructure 3 can be seen in the following Table 3.

Table 3. Structural equation of substructure 3

Coefficientsa						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	11.865	3.458		3.431	.001
	X1	-.097	.044	-.233	-2.216	.031
	X2	2.046	.480	.440	4.267	.000
	X3	-.131	.054	-.256	-2.424	.019

a. Dependent Variable: X3

a. Dependent Variable: X3

The structural equation of substructure 3 is  $Y = -0.097X_1 + 2.046X_2 - 0.131X_3 + 0.436\epsilon_3$ . The path diagram for substructure III does not change.

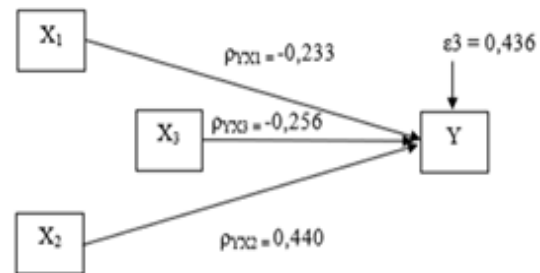


Figure 7. path diagram for substructure 3

The Influence of Arm Muscle Strength on Basketball Dribbling Skills is shown by a beta coefficient of -0.233. The results of the t-test obtained a t value of -2.216 with a significance of 0.031. Because the significance number is below 0.05, it can be concluded that there is a linear influence of Arm Muscle Strength on Basketball Dribbling Skills. The magnitude of the influence of Arm Muscle Strength on Basketball Dribbling Skills is -0.233 or -23.3%.

The Influence of Speed on Basketball Dribbling Skills is shown by a beta coefficient of 0.440. The results of the t-test obtained a t value of 4.267 with a significance of 0.000. Because the significance number is below 0.05, it can be concluded that there is a linear influence of Speed on Basketball Dribbling Skills. The magnitude of the influence of Speed on Basketball Dribbling Skills is 0.440 or 44%.

The Influence of Eye-Hand-Foot Coordination on Basketball Dribbling Skills is shown by a beta coefficient of -0.256. The test results with the t-test obtained a t value of -2.424 with a significance of 0.019. Because the significance number is below 0.05, it can be concluded that there is a linear effect of Eye-Hand-Foot Coordination on Basketball Dribbling Skills. The magnitude of the effect of Eye-Hand-Foot Coordination on Basketball Dribbling Skills is -0.256 or 25.6%.

Based on the results of the hypothesis test that have been carried out in the hypothesis test section, it can be stated that: First, the hypothesis is that there is a significant effect of Arm Muscle Strength on Speed, after testing the hypothesis it is proven that there is a significant effect of Arm Muscle Strength on speed. The structural equation from the results of the path analysis of Arm Muscle Strength on Speed  $X_2 = -0.039X_1 + 0.807\epsilon_1$ . The amount of contribution of the Arm Muscle Strength variable to Speed is 19.3% while the remaining 80.7% is the influence of other variables other than the Arm Muscle Strength variable. The direct contribution of the Arm Muscle Strength variable to Speed is -0.440 or -44%. This finding shows that to increase speed, students can

increase arm muscle strength training. Thus, arm muscle strength plays a crucial role in improving player performance in basketball, especially in terms of shooting speed and accuracy. High arm muscle strength allows players to perform movements faster and more effectively, improving overall performance in the game (Wanena, 2018; Davieri, 2022).

Second, the hypothesis is that there is a significant effect of Arm Muscle Strength and Speed together on Eye Hand Foot Coordination after testing the hypothesis, it is proven that both together and individually, it has a significant effect on Eye Hand Foot Coordination. Structural equation of the path analysis results of Arm Muscle Strength and Speed on Eye Hand Foot Coordination  $X_3 = 0.290X_1 - 2.695X_2 + 0.696X_3$ . The amount of contribution of the Arm Muscle Strength and Speed variables together on Eye Hand Foot Coordination is 30.4% while the remaining 69.6% is the influence of other variables other than the Arm Muscle Strength and Speed variables. The contribution of the Arm Muscle Strength variable to Eye Hand Foot Coordination directly is 0.354 or 35.4%. While the Speed variable has a direct contribution to Eye Hand Foot Coordination of -0.295 or -29.5%. This finding shows that to improve eye hand foot coordination, students can train arm muscle strength and speed where both have a contribution of 42% to improve eye hand foot coordination. Overall, the close and synergistic relationship between arm muscle strength, reaction speed, and eye-hand-foot coordination is essential, especially in the context of improving basic skills in basketball. Training that combines these three aspects can help improve an athlete's overall performance in the sport. (Azhari et al., 2023).

Third, there is a significant influence of Arm Muscle Strength, Speed and Eye Hand Foot Coordination together on Basketball Dribbling Skills. The structural equation of the path analysis results of Arm Muscle Strength, Speed and Eye-Hand-Foot Coordination together towards Basketball Dribbling Skills is  $Y = -0.097X_1 + 2.046X_2 - 0.131X_3 + 0.436X_4$ . The amount of contribution of the Arm Muscle Strength, Speed and Eye-Hand-Foot Coordination variables together towards Basketball Dribbling Skills is 56.4% while the remaining 43.6% is the influence of other variables other than the Arm Muscle Strength, Speed and Eye-Hand-Foot Coordination variables. The contribution of the Arm Muscle Strength variable to Basketball Dribbling Skills directly is -0.233 or 23.3%. The contribution of the Speed variable to Basketball Drib-

bling Skills directly is 0.440 or 44%. While the contribution of the Eye-Hand-Foot Coordination variable to Basketball Dribbling Skills directly is 0.256 or 25.6%. These findings indicate that to improve basketball dribbling skills, students can train arm muscle strength and speed as well as hand-eye-foot coordination. Overall, the ideal conditions for athletes to develop dribbling skills are a combination of arm muscle strength, speed, and hand-eye-foot coordination. Therefore, to improve players' performance in the game, basketball coaches are advised to create training programs that incorporate these three elements (Nurrochmah & Yusuf, 2021).

The indirect effect of Arm Muscle Strength on Basketball Dribbling Skills through Speed obtained a Z value = -2.899 > 0.003, meaning there is a significant effect. The indirect effect of Arm Muscle Strength on Basketball Dribbling Skills through Hand-Eye-Foot Coordination obtained a Z value = -4.204 > 0.000, meaning there is a significant effect. The indirect effect of Speed on Basketball Dribbling Skills through Hand-Eye-Foot Coordination obtained a Z value = 2.515 > 0.011, meaning there is a significant effect. These findings indicate that to improve basketball dribbling skills, it is necessary to pay attention to and improve arm muscle strength training, speed and hand-eye-foot coordination because both directly and indirectly can improve basketball dribbling skills. The strength of the arm muscles, speed, and hand-eye-foot coordination are interrelated factors that are very important in improving dribbling skills in basketball. The cooperation between all these elements creates the balance needed to perform better on the court (Wanena, 2018).

The results of this study are in line with the research conducted by Bahar (2019) on "The Contribution of Speed, Eye-Hand Coordination and Agility to Dribbling Skills in Basketball Athletes in Kerinci Regency". The results showed that there was a positive relationship between speed and dribbling skills with a value of 21.41%, eye-hand coordination with dribbling skills with a value of 17.48%, agility with dribbling skills with a value of 20.36% and speed, eye-hand coordination, and agility to dribbling skills with a value of 18.96%.

## CONCLUSION

Based on the results of the research with Erksogern variables consisting of Arm Muscle Strength, Speed, Eye Hand Foot Coordination, and Erksogern variables are Basketball Dribbling

Skills, it can be concluded that there is a direct influence of Arm Muscle Strength on Speed and Eye Hand Foot Coordination. There is a direct influence of Speed on Eye Hand Foot Coordination and Basketball Dribbling Skills. There is a direct influence of Arm Muscle Strength on Basketball Dribbling Skills. There is a direct influence of Eye Hand Foot Coordination on basketball dribbling skills. There is an indirect influence of Arm Muscle Weakness on Basketball Dribbling Skills through Eye Hand Foot Coordination. There is an indirect influence of Speed on Basketball Dribbling Skills through Eye Hand Foot Coordination. There is an indirect influence of Arm Muscle Weakness on Basketball Dribbling Skills through Speed.

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