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Shooting Skills As Part Of The Psychomotor Learning Of Students

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Abstract

Petanque is a precision sport that has gained popularity, especially among adolescent to adult athletes. One of the most challenging skills to master in petanque is the shooting technique, which requires optimal hand-eye coordination, concentration, and anthropometric factors such as arm length. This study aims to examine the influence of arm length, hand-eye coordination, and concentration on the shooting ability of petanque athletes in West Sumatra. This quantitative study employed a path analysis approach. The research was conducted in February 2025 at the Sports Field of the Faculty of Sports Science, Padang State University. The population consisted of all 40 petanque athletes from West Sumatra, selected using a total sampling technique. Data collection instruments included an arm length test, a tennis ball throw-and-catch test (hand-eye coordination), the Grid Concentration Test, and a petanque shooting test. Data were analyzed using structural equation modeling at a significance level of $\alpha = 0.05$. The findings revealed that: (1) arm length had a direct and significant effect of 6.30% on shooting ability; (2) hand-eye coordination had a direct and significant effect of 20.9%; (3) concentration had a direct and significant effect of 8.53%; (4) arm length had an indirect effect of 12.18% through concentration; (5) hand-eye coordination had an indirect effect of 31.14% through concentration; and (6) collectively, arm length, hand-eye coordination, and concentration had a significant combined effect of 44.89% on the shooting ability of West Sumatran petanque athletes.

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INTRODUCTION

In Petanque is a precision sport that requires technical skills, high concentration, and good body coordination (Effendi et al., 2024) . In petanque, one of the main skills that athletes must master is *shooting* , which is throwing metal balls (boules) to hit or get rid of the opponent's boules accurately (Lubis et al., 2023) . Success in shooting is greatly influenced by various factors, both from the physiological and psychological aspects of the athlete (Nurhasan et al., 2024) . Therefore, it is important to examine the variables that can contribute to improving shooting skills in this sport.

One physiological aspect that deserves attention is the athlete's arm length (Pelana et al., 2021) . Arm length is believed to be directly related to the range of motion and swing power when throwing a boule (Pelana et al., 2019) . Athletes with proportional arm length tend to have more stable movement control and the ability to create a more effective throwing trajectory (Agustina et al., 2025) . Research in various sports shows that arm length can affect technical performance, including in sports that require throwing accuracy such as petanque.

In addition to physiological aspects, eye-hand coordination ability also greatly determines the quality of shooting (Purnomo & others, 2020) . This coordination reflects the ability of the nervous system to align hand movements according to what the eye sees (Gallicchio et al., 2024) 2. In petanque, athletes must be able to estimate the distance, direction, and speed of the boule quickly and accurately (Nurhasan et al., 2024) . Imbalance or weakness in eye-hand coordination can cause the throw to miss the target, thereby reducing effectiveness in the game (Pratama et al., 2024) .

Psychological factors such as concentration also play an important role in shooting success (Prayoga et al., 2024) . Athletes are required to stay focused in the face of competitive pressure and be able to ignore distractions from the surrounding environment (Goel & Handa, 2020) . Concentration allows athletes to maintain rhythm and accuracy in throwing techniques. Weaknesses in concentration often result in technical errors, decreased accuracy, and inappropriate strategies in the game (Agustina et al., 2025) .

Based on the background, this study aims to analyze the effect of arm length, eye-hand coordination, and concentration on the shooting ability of petanque athletes in West Sumatra. By knowing the contribution of each factor, it is expected that the results of this study can be a basis for coaches and athletes in compiling more effective and targeted training programs to improve performance in matches.

METHODS

Methods This research is a quantitative approach, survey method with measurement and test techniques, while the analysis technique uses a path analysis approach . The relationship used is causal, consisting of Arm length (X1), Eye-hand coordination (X2), and Concentration (X3) as independent variables and *shooting ability* (Y) as the dependent variable.

A total of 40 petanque athletes as samples in this study were taken by *total sampling* . The sample of this study is categorized as adolescent to adult or senior athletes, the sample is male (n = 20) and female (n = 20). They have stated that they are able to comply with the rules during the study and participate voluntarily through a written agreement.

Shooting ability is measured using the *shooting game station test* . This test aims to measure the athlete's *shooting ability* . The results recorded are points 1 ball throw, according to the points on the *shooting game station obstacle* . (Figure 1)

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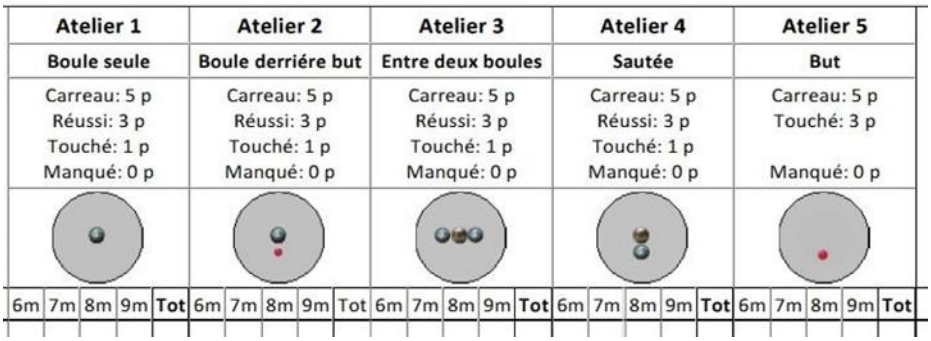

Figure 1. Points on *the shooting game station obstacles*

Atelier is a discipline or station. Carreu is the shooting ball is in the target, the target ball goes out and gets 5 points. Reussi is the shooting ball and the target ball goes out and gets 3 points. Touché is the shooting ball only touches the target ball and gets 1 point. Manque is not hitting the target and does not get any points. The following is the classification of *the shooting game station test. (Table 1)*

Table 1. Classification of test shooting game stations

Category	Category
Very well	Mean + 1.5 SD More
Good	Mean + 0.5 SD to Mean + 1.5 SD
Enough	Mean - 0.5 SD sd Mean + 0.5 SD
Not enough	Mean - 1.5 SD sd Mean - 0.5 SD
Not at all	Mean - 1.5 SD less

Note: “Score” Unit Result

Hand Eye Coordination

The test instrument used to measure eye-hand coordination uses a tennis ball throw-catch test and a circular field with a diameter of 30 cm. The aim is to measure eye-hand coordination. (Figure 2)

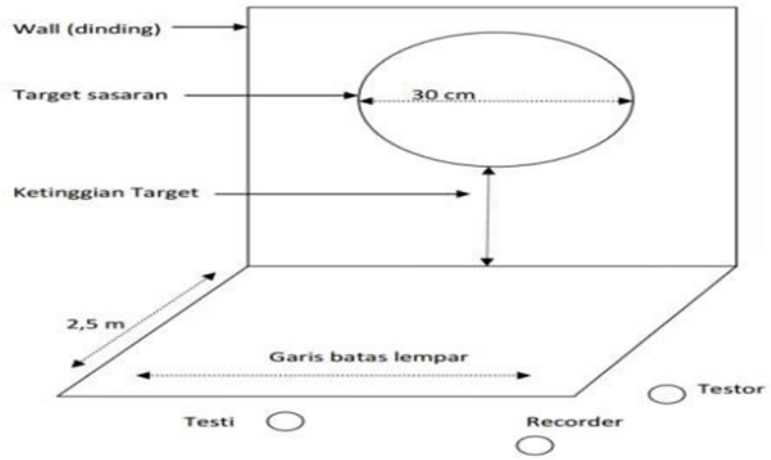

Figure 2. Hand Eye Coordination Test

The score is calculated based on the number of balls that can be thrown with the right hand then caught by the left hand or vice versa, according to the participant's habits for 30 seconds as many as possible. The following is the classification of hand-eye coordination tests. (Table 2)

Table 2. Classification of Eye Hand Coordination Tests

Category	Son	Daughter

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Very good	>35	>30
Good	30 – 35	25 – 30
Currently	25 – 29	20 – 24
Not enough	20 – 24	15 – 19
Very less	<20	<15

Note: "Score" Unit Result

Concentration

The instrument used to obtain athlete concentration data is done using the *Grid Concentration Test concentration test* . *The Grid Concentration Test* is a form of measuring instrument to determine the level of concentration using numbers. This test has a validity of 0.87 and a reliability of 0.96. This test has a number 100 with 2 digits consisting of numbers 00 to 99 which are placed randomly in 10 rows x 10 columns. The sample is given a time of 1 minute or 60 seconds, the sample value is how many numbers can be connected sequentially within a predetermined time. The following is the *Grid Concentration Test classification* . (Table 3)

Grid Concentration Test Classification

No	Criteria	Information
1	21 and above	Very good
2	16 – 20	Good
3	11 – 15	Currently
4	6 – 10	Not enough
5	5 and below	Very less

Note: "Score" Unit Result

Sleeve Length

Collecting arm length data is done using *an anthropometer* or meter test tool that aims to measure arm length. The validity used is *content validity* , by calibrating the measuring instrument to the Meteorology agency. Assessment of arm length measurements uses units of measurement in centimeters (cm).

Statistical Analysis

This study uses descriptive analysis to describe the variable scores, central measures and dispersion (variance, standard deviation) through frequency distribution and histograms. Inferential analysis is carried out using path analysis to test the direct and indirect effects between variables. Hypothesis testing includes the normality test of the estimated error with the Liliefors test, linearity and significance tests with ANOVA, and the homogeneity test of variance using the Bartlett test.

RESULT AND DISCUSSION

Results Data description aims to describe the characteristics of testing and measuring each variable. So that the level/classification of the sample is known. Table 4 shows the average and standard deviation of the *shooting ability score* of 18.6 ± 7.24 for athletes. Hand-eye coordination in male athletes is 28.7 ± 5.67 . Concentration in athletes is 14.73 ± 3.52 . Furthermore, the length of the arm in athletes is 21.68 ± 1.21 .

Table 5 shows that based on the results of the normality test of the estimation error, the data obtained for the arm length variable with a value of Asymp. Sig = 0.146 ≥ Pvalue = 0.05. hand eye coordination variable with a value Asymp. Sig = 0.200 ≥ Pvalue = 0.05, concentration variable with

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value Asymp. Sig = 0.162 ≥ Pvalue = 0.05, and the *shooting ability variable* with a value of Asymp. Sig = 0.161 ≥ Pvalue = 0.05.

Table 6 shows the results of the linearity test calculations for the research design group for Arm Length, Eye Hand Coordination, and Concentration. It was found that the probability value was > 0.05.

Figure 3 shows the results of hypothesis testing using the path analysis approach. It can be seen that arm length (X_1) has a direct effect on shooting ability (Y) with a path coefficient of 0.251. In addition, arm length also affects hand-eye coordination (X_2) and concentration (X_3), which ultimately contribute to shooting ability. Hand-eye coordination (X_2) shows the strongest effect on shooting ability with a coefficient of 0.457. Meanwhile, concentration (X_3) also makes a positive contribution with a coefficient of 0.292. The residual value for each endogenous variable is quite high ($\varepsilon_1 = 0.78$; $\varepsilon_2 = 0.89$; $\varepsilon_3 = 0.94$), indicating that there are other influences outside the model that need to be explored in further research.

Table 4. Summary of Research Variable Data Statistics

Variables	Arm length	Hand eye coordination		Concentration	Petanque *shooting* results
		Son	Daughter		
Mean	21.68	28.7	23	14.73	18.6
SD	1.21	5.67	5.66	3.52	7.24
Mmax	25	37	35	26	32
Mmin	18.5	19	16	10	8

Table 5. Summary of Normality Test with Kolmogorov-Smirnov Test

Variables	Asymp.Sig	*p-Value*	Conclusion
Sleeve length	0.146	0.05	Normal
Hand eye coordination	0.200		
Concentration	0.162		
Shooting ability	0.161		

Table 6. Summary of Linearity Test Results of Data from Research Design

No	Connection	Probability (sig)	Sig α	Information
1	Y and X_1	0.063	0.05	Linear
2	Y and X_2	0.522	0.05	Linear
3	Y and X_3	0.622	0.05	Linear
4	X_3 and X_1	0.607	0.05	Linear
5	X_3 and X_2	0.285	0.05	Linear
6	X_2 and X_1	0.706	0.05	Linear

Discussion

The findings show that arm length has a significant direct effect on the shooting ability of petanque athletes by 6.30% ($P_{\gamma 1} = 0.251$). This shows that the more optimal the proportion of the athlete's arm length, the more likely the athlete is to be able to shoot more accurately and efficiently. A more proportional arm length allows for a better range of motion and provides a mechanical advantage in producing the right throwing force (Pelana et al., 2021) .

Eye-hand coordination is the variable that has the greatest influence on shooting ability, which is 20.9% ($P_{\gamma 2} = 0.457$). This result indicates that the athlete's ability to align visual perception with hand movements is crucial in determining throwing accuracy. Petanque is a sport

that relies heavily on precision, and without good coordination between vision and motor action, shooting ability will be greatly impaired (Henkaryansyah et al., 2024) .

Concentration directly contributes 8.53% to shooting ability ($P_{\gamma 3} = 0.292$). In petanque, concentration is an important aspect because athletes are required to focus in a short time, organize throwing strategies, and avoid distractions from the surrounding environment (Pratama et al., 2024) . When concentration is disturbed, the tendency to make technical errors and decrease throwing accuracy becomes higher (Nasution et al., 2023) .

In addition to the direct effect, this study also found an indirect effect of arm length (12.18%) and hand-eye coordination (31.14%) on shooting ability through the concentration variable. This shows that these two physiological variables not only play a physical role, but can also affect the athlete's mental readiness in maintaining focus when shooting. Athletes with good hand-eye coordination and arm length are better able to manage concentration because they feel confident in their technique, so the cognitive load is reduced (Helmi et al., 2024) .

The path analysis model in this study shows that arm length, hand-eye coordination, and concentration simultaneously contribute 44.89% to the shooting ability of petanque athletes. This means that there are still 55.11% of other variables that have not been described in the model, such as experience factors, emotional stability, or basic techniques that may affect shooting results. Therefore, coaches and trainers need to consider a holistic training approach that includes biomechanical, sensorimotor, and psychological aspects.

Based on the data obtained in the field, the optimal shooting ability of petanque athletes is influenced by several factors including hand-eye coordination, concentration and arm length. However, there are several limitations that need to be validated in further research. The samples used are still random, ranging from teenagers to adults so that more focused, broader and more diverse samples are needed. The factors used are still limited, namely hand-eye coordination, concentration and arm length. Therefore, it is necessary to add other factors that affect the shooting ability of petanque athletes. Of the three factors, hand-eye coordination is the dominant factor that affects the shooting ability of petanque athletes, without ignoring other factors (concentration and arm length). This means that athletes who have good hand-eye coordination, good concentration and optimal arm length have an impact on the shooting ability of petanque athletes.

CONCLUSIONS

Based on the findings and path analysis conducted, we can conclude that there is a significant influence both directly and indirectly from arm length, hand-eye coordination, and concentration on the shooting ability of West Sumatran petanque athletes. Directly, arm length contributes 6.30%, hand-eye coordination 20.9%, and concentration 8.53% to shooting ability. In addition, there is an indirect influence through the mediating variable concentration, which is 12.18% for arm length and 31.14% for hand-eye coordination. Simultaneously, these three variables contribute 44.89% to the shooting ability of athletes. These results indicate that efforts to improve shooting performance in petanque must involve integrated physical and psychological development, with a special focus on improving hand-eye coordination and strengthening athlete concentration.

CONFLICTS OF INTEREST STATEMENT

Regarding this study, the author declares that there is no conflict of interest.

AUTHOR CONTRIBUTIONS

Study concept and design: Dini Restuti. Acquisition of data: Nurul Ihsan. Analysis and interpretation of data: Bafirman Bafirman. Drafting the manuscript: Aldo Naza Putra. Critical revision of the manuscript for important intellectual content: Wilda welis. Statistical analysis: Dini Restuti.

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