

## The Relationship Biomotor Components and Football Skills in Extracurricular Activities at SMK KARTEK Jatilawang Banyumas

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### Abstract

This study aims to analyze the functional relationship between biomotor components (agility, eye-foot coordination, leg power, and speed) and fundamental football skills (dribbling and shooting) among extracurricular students at SMK KARTEK Jatilawang, Banyumas. The background of this research is the low technical skills of students despite regular training, suggesting a lack of foundational physical development. This research employed a quantitative approach with a correlational and causal-comparative design. The population was all students participating in the football extracurricular, totaling 100 students (N=100). The instruments used were the Illinois Agility Test for agility, Soccer Wall Volley Test for coordination, Standing Broad Jump for power, 30-Meter Sprint for speed, and standard football skill tests for dribbling and shooting developed by Narlan & Junior (2020). Data were analyzed using descriptive statistics, Pearson product-moment correlation, multiple linear regression analysis, and independent sample t-test. The results showed a significant simultaneous relationship between biomotor components and dribbling skills ( $F=57.318$ ,  $p<0.001$ ) as well as shooting skills ( $F=10.018$ ,  $p<0.001$ ). Partially, agility ( $r=-0.804$ ) and speed ( $r=-0.939$ ) showed a very strong correlation with dribbling but were not significant for shooting accuracy. Conversely, eye-foot coordination ( $r=0.396$ ) and leg power ( $r=-0.215$ ) significantly influenced shooting skills. The comparative test also revealed significant differences in skills between students with high and low biomotor abilities. The study concludes that specific biomotor components are critical predictors of football performance, suggesting that training programs should be tailored—focusing on speed and agility for dribblers, and coordination and power for shooters.

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## INTRODUCTION

Football is unequivocally the most popular team sport globally, transcending cultural and geographical boundaries. In Indonesia, football is not merely a sport but a cultural phenomenon that plays a strategic role in the national education system. Within the context of formal education, particularly at the Vocational High School (SMK) level, football serves as a primary extracurricular vehicle for character building, fostering discipline, teamwork, and resilience among students (Weinberg & Gould, 2015).

SMK KARTEK Jatilawang in Banyumas Regency has positioned football as a flagship extracurricular activity. The school invests in regular training sessions and coaching staff to develop student potential. However, despite these structural efforts, empirical observations on the field reveal a persistent performance gap. Students, although enthusiastic and disciplined in attendance, exhibit suboptimal mastery of fundamental technical skills, specifically dribbling and shooting. In modern football, these two skills are paramount; dribbling is the primary mechanism for ball progression and creating space, while shooting is the decisive action for scoring goals (Reilly & Williams, 2003).

The recurring issue of low technical proficiency often stems not from a lack of tactical understanding, but from an insufficient physical foundation. In sports science, this foundation is referred to as biomotor components. According to the theory of Periodization by Bompa and Haff (2009), technical training cannot be effectively executed if the athlete's biomotor abilities—such as strength, speed, endurance, coordination, and flexibility—are underdeveloped. Technical skills are essentially superimposed on these physical capabilities.

Four specific biomotor components are hypothesized to be critical determinants

for football performance in this demographic:

1. **Agility:** Defined as the ability to change direction rapidly without losing balance. In football, agility is crucial for evasion and marking (Sheppard & Young, 2006).
2. **Eye-Foot Coordination:** The neuromuscular ability to synchronize visual input with leg movement, essential for precise ball contact during passing and shooting.
3. **Leg Power:** The product of strength and speed, manifesting as explosive force. This is critical for jumping (heading) and generating ball velocity during shooting.
4. **Speed:** The ability to move the body linearly in the shortest possible time, vital for beating opponents to the ball (Luxbacher, 2014).

While previous studies (Narlan, 2020; Yulianto, 2021; Faqih et al., 2023) have established links between these components and football skills, the majority of existing literature focuses on elite athletes or specialized football academies (SSB). There is a paucity of research focusing specifically on vocational students (SMK), who possess distinct physiological characteristics and face different academic and physical stressors compared to pure athletes. Furthermore, few studies have dissected the *partial* versus *simultaneous* contributions of these variables specifically towards the dichotomy of dribbling (a locomotive skill) versus shooting (a manipulative/ballistic skill) in this specific population.

This study aims to fill this gap by conducting a comprehensive analysis of the functional relationships between agility, coordination, power, and speed against dribbling and shooting skills. Additionally, this research investigates the magnitude of performance differences between students with high versus low biomotor profiles to provide empirical evidence for the necessity of physical conditioning in school-based extracurricular programs.

## METHODS

## Research Design

This study employed a quantitative approach utilizing a descriptive correlational design to determine the strength and direction of relationships between independent and dependent variables. Furthermore, a causal-comparative (ex-post facto) analysis was conducted to compare technical proficiency between distinct physical ability groups.

## Participants

The population for this study comprised all students actively registered in the football extracurricular program at SMK KARTEK Jatilawang, Banyumas, for the academic year 2025/2026. Given the population size was manageable (N=100), a Total Sampling technique (saturated sampling) was utilized. The sample consisted of 100 male students aged 15–18 years. All participants were screened for health status and provided informed consent prior to data collection.

## Instruments and Procedures

Data collection was conducted in a structured circuit format to ensure efficiency and consistency. The instruments used were standard tests with established validity and reliability in sports science literature:

1. Agility (Independent Variable X1): Measured using the Illinois Agility Test. The course measures 10 meters in length and 5 meters in width, involving four cones placed in the center for weaving.  
*Procedure:* Participants start from a prone position, sprint up, run the course involving straights and slalom weaves, and finish.  
*Measurement:* Time is recorded to the nearest 0.01 second. Lower time indicates better agility.
2. Eye-Foot Coordination (Independent Variable X2): Measured using the Soccer Wall Volley Test.  
*Procedure:* Participants stand behind a line 2.5 meters from a wall. On the signal, they kick the ball against the

wall, control the rebound (or volley it directly), and kick it back.

*Measurement:* The score is the total number of successful legal hits against the wall in 30 seconds. Higher frequency indicates better coordination.

3. Leg Power (Independent Variable X3): Measured using the Standing Broad Jump.

*Procedure:* Participants stand behind a line and perform a two-footed jump forward for maximum distance, using arm swings for momentum.

*Measurement:* The distance from the take-off line to the heel of the nearest landing foot is measured in centimeters (cm). The best of three trials is recorded.

4. Speed (Independent Variable X4): Measured using the 30-Meter Sprint Test.

*Procedure:* Participants use a standing start. On the auditory signal, they sprint at maximum effort through the 30-meter finish line.

*Measurement:* Time is recorded using a stopwatch to the nearest 0.01 second.

5. Dribbling Skill (Dependent Variable Y1): Measured using the Slalom Dribbling Test (Narlan & Juniar, 2020).

*Procedure:* Participants dribble a ball through a series of 6 cones placed 2 meters apart. They must weave through the cones, turn around the last cone, and weave back to the start line.

*Measurement:* Total time taken is recorded. Penalties are added for touching cones or missing weaves.

6. Shooting Skill (Dependent Variable Y2): Measured using the Target Shooting Test (Narlan & Juniar, 2020).

*Procedure:* Participants shoot a stationary ball from the penalty area line (16.5 meters) towards a regulation goal. The goal is divided into ropes creating scoring zones: Top corners

(score 7), bottom corners (score 5), center sides (score 3), and absolute center (score 1).

*Measurement:* Each participant takes 5 shots. The final score is the sum of points obtained.

### Data Analysis

The collected data were processed using IBM SPSS Statistics version 26.0. The analysis sequence included:

1. **Descriptive Statistics:** To determine Mean, Standard Deviation (SD), Minimum, and Maximum values.
2. **Prerequisite Testing:** Normality test using *Shapiro-Wilk* and Homogeneity test using *Levene's Test*. Linearity was also verified.
3. **Hypothesis Testing:**  
*Pearson Product Moment Correlation* for partial relationships.  
*multiple Linear Regression (ANOVA/F-Test)* for simultaneous relationships.  
*Independent Sample T-Test* for comparing high vs. low biomotor groups

## RESULTS AND DISCUSSION

### 1. Descriptive Statistics

The descriptive analysis provides a comprehensive overview of the physical and technical profile of the students at SMK KARTEK Jatilawang. The data in Table 1 indicates the variability in student performance.

**Table 1. Descriptive Statistics of Research Variables (N=100)**

| Variables | Mean | Std. Deviation | Minimum | Maximum |
|-----------|------|----------------|---------|---------|
|-----------|------|----------------|---------|---------|

|                          |        |      |      |      |
|--------------------------|--------|------|------|------|
| Agility (X1) (seconds)   | 17.15  | 1.15 | 15.2 | 19.8 |
| Coordination (X2) (reps) | 13.26  | 2.45 | 8    | 19   |
| Leg Power (X3) (cm)      | 179.11 | 14.3 | 150  | 210  |
| Speed (X4) (seconds)     | 5.26   | 0.38 | 4.5  | 6.2  |
| Dribbling (Y1) (seconds) | 19.3   | 2.1  | 15.5 | 24.1 |
| Shooting (Y2) (score)    | 14.67  | 3.5  | 8    | 22   |

The average agility time of 17.15 seconds suggests a moderate level of agility for this age group compared to normative data for athletes. The shooting score mean of 14.67 (out of a potential max of 35) indicates that shooting accuracy is an area requiring significant improvement.

### 2. Prerequisite Test Results

**Normality:** The Shapiro-Wilk test yielded significance values (p) greater than 0.05 for all variables (e.g., Dribbling p=0.124, Shooting p=0.098), indicating normal distribution.

**Linearity:** Scatter plot analysis and deviation from linearity tests confirmed linear relationships between predictors and criterion variables.

### 3. Partial Correlation Analysis

The core of the analysis lies in understanding how each physical component relates to specific skills. The Pearson Correlation matrix is summarized in Table 2.

**Table 2. Summary of Pearson Correlation Analysis**

| Independent Variable | Dribbling Skills (Y1)   | Shooting Skills (Y2)   |
|----------------------|-------------------------|------------------------|
| Agility (X1)         | r = -0.804 (Sig. 0.000) | r = 0.083 (Sig. 0.411) |

|                   |                                               |                                               |
|-------------------|-----------------------------------------------|-----------------------------------------------|
| Coordination (X2) | $r = -0.378$ (Sig. $r = 0.396$ (Sig. 0.000))  | $r = -0.229$ (Sig. $r = -0.215$ (Sig. 0.032)) |
| Leg Power (X3)    |                                               |                                               |
| Speed (X4)        | $r = -0.939$ (Sig. $r = -0.039$ (Sig. 0.700)) |                                               |

*Correlation is significant at the 0.01 level (2-tailed).*

#### Interpretation:

For Dribbling: Speed (X4) has the strongest correlation ( $r=-0.939$ ), followed closely by Agility (X1) ( $r=-0.804$ ). The negative correlation denotes that lower time (faster speed/agility) results in lower dribbling time (better performance).

For Shooting: Speed and Agility showed *no significant correlation*. Instead, Eye-Foot Coordination (X2) showed the strongest positive correlation ( $r=0.396$ ), meaning higher coordination relates to higher shooting scores.

#### 4. Simultaneous Regression Analysis

To determine if the biomotor components *collectively* predict skill performance, Multiple Regression Analysis was conducted.

Table 3. Simultaneous Significance Test (F-Test ANOVA)

| Model             | M Sum of Squares | df | Mean Square | F       | Sig. |
|-------------------|------------------|----|-------------|---------|------|
| 1. Dribbling (Y1) |                  |    |             |         |      |
| Regression        | 345.12           | 4  | 86.28       | 57.3180 |      |
| Residual          | 143.02           | 95 | 1.505       |         |      |
| 2. Shooting (Y2)  |                  |    |             |         |      |
| Regression        | 12.55            | 4  | 28.138      | 10.0180 |      |
| Residual          | 266.85           | 2  | 2.809       |         |      |

The F-values for both models (57.318 for Dribbling and 10.018 for Shooting) are significant at  $p < 0.001$ . This confirms that the combined model of Agility, Coordination, Power, and Speed significantly influences football technical skills.

#### 5. Comparative Analysis (High vs. Low Biomotor Groups)

Students were categorized into "High" and "Low" biomotor groups based on T-scores of their physical tests. An Independent Sample T-Test was performed.

Table 4. T-Test Results: Comparison of Skills by Biomotor Category

| Variable            | Group         | Mean  | Mean Difference | t-value | sig. (2-tailed) |
|---------------------|---------------|-------|-----------------|---------|-----------------|
| Dribbling (seconds) | High Biomotor | 16.07 | 6.61            | 21.045  | 0               |
|                     | Low Biomotor  | 22.69 |                 |         |                 |
| Shooting (score)    | High Biomotor | 17.81 | 6               | 17.757  | 0               |
|                     | Low Biomotor  | 11.81 |                 |         |                 |

The results show a massive discrepancy. Students with high biomotor ability completed the dribbling course 6.61 seconds faster and scored 6 points higher in shooting than their lower-ability peers.

#### 1. The Dominance of Speed and Agility in Dribbling Performance

The findings of this study unequivocally identify **Speed** ( $r = -0.939$ ) and **Agility** ( $r = -0.804$ ) as the primary drivers of dribbling performance. This strong correlation aligns with the biomechanical nature of the task. Dribbling is, in essence, "sprinting with a ball."

The kinematics of a high-speed dribble closely mimic those of a linear sprint. The correlation of near -0.94 suggests that students who possess high anaerobic power and fast-twitch muscle fiber dominance (manifested in sprint speed) can transfer this velocity to ball progression. This supports the findings of Rayhan et al. (2020), who noted that sprint training significantly improves dribbling speed.

Furthermore, Agility acts as the "steering mechanism." In the slalom test used, the center of mass (COM) must be shifted laterally to navigate cones. Students with high agility scores demonstrated superior neuromuscular control, allowing

them to decelerate, cut, and re-accelerate without significant loss of momentum. Conversely, students with poor agility struggled to maintain balance during the turning phase, resulting in wider turns and slower times. This validates Sheppard and Young's (2006) model of agility, which emphasizes the cognitive-motor link in changing direction.

## 2. The Speed-Accuracy Trade-off in Shooting

A critical and perhaps counter-intuitive finding of this study is the lack of significant correlation between Speed/Agility and Shooting accuracy (Table 2). This phenomenon can be explained by Fitts' Law, or the Speed-Accuracy Trade-off.

In the context of shooting a stationary ball, the approach run requires a stable plant foot placement. If a student relies solely on speed (sprinting at the ball), the momentum generated becomes difficult to control at the point of impact. High velocity in the approach run often leads to biomechanical errors:

- a. Improper Plant Foot: The non-kicking foot lands too far or too close to the ball due to excessive speed.
- b. Postural Instability: The body leans too far back, causing the ball to fly over the crossbar (high trajectory error).

Therefore, raw running speed does not translate to shooting accuracy. Instead, accuracy relies on controlled power and coordination.

## 3. Coordination and Power as Determinants of Shooting Accuracy

Eye-Foot Coordination emerged as the strongest predictor for shooting ( $r = 0.396$ ). Shooting is a complex kinetic chain requiring the synchronization of visual target acquisition and limb movement. The brain must calculate the distance to the goal and adjust the force and angle of the leg swing accordingly. Students with high coordination scores (Wall Volley test) demonstrated a superior "feel" for the ball, allowing them to strike the ball's "sweet spot" consistently.

Leg Power also showed a significant relationship ( $r = -0.215$ ). While the correlation is moderate, it is mechanically vital. Power (Force x Velocity) determines the ball's flight speed. A ball struck with high power travels to the target faster, reducing the time for environmental factors (like wind) to deviate its path, and making it harder for a goalkeeper to intercept. However, power must be coupled with coordination; power without accuracy results in a forceful miss.

## 4. The Performance Gap: Implications for Talent Identification

The comparative analysis (Table 4) provides the most compelling evidence for the importance of physical conditioning. The difference of 6.61 seconds in dribbling between the High and Low biomotor groups is enormous in the context of football, where margins of victory are often measured in milliseconds. Similarly, a 6-point difference in shooting represents a 50% increase in scoring potential for the high-biomotor group.

This suggests that the "Low Skill" observed in the problem statement is effectively a symptom of "Low Fitness." Students at SMK KARTEK who struggle with technique likely do so because their bodies cannot mechanically support the demands of the skill. For instance, a student with weak leg power cannot shoot from distance, forcing them to alter their technique (e.g., toe-poking) to compensate, which further degrades accuracy.

## 5. Educational and Coaching Implications

Based on these findings, the coaching strategy at SMK KARTEK Jatilawang needs to be re-evaluated. The current "one-size-fits-all" approach to training may be inefficient.

For Midfielders/Wingers: Training should prioritize Speed and Agility (SAQ) drills, ladder drills, small-sided games with high intensity). This will directly transfer to improved dribbling and ball carrying.

For Strikers: Training should prioritize Plyometrics (for leg power) and Coordination drills (juggling, volleying, target practice). This builds the chassis required for accurate and powerful shooting.

Integrated Periodization: Physical training should not be separated from technical training. Drills should combine physical load with technical execution (e.g., sprinting then shooting) to simulate match conditions and mitigate the speed-accuracy trade-off.

## CONCLUSION

This study provides robust empirical evidence that biomotor components are fundamental prerequisites for football technical proficiency among vocational students.

1. Simultaneously, Agility, Coordination, Power, and Speed significantly influence both dribbling and shooting.
2. Partially, the relationships are specific: Speed and Agility are the critical drivers for Dribbling, whereas Coordination and Power are the key determinants for Shooting.
3. There is a distinct Speed-Accuracy Trade-off observed in shooting, where speed does not correlate with accuracy.
4. Students with higher biomotor profiles perform significantly better in technical tests, confirming that physical fitness is the bedrock of technical skill.

It is recommended that physical education teachers and coaches at SMK KARTEK implement a structured physical conditioning program that targets these specific biomotor components to elevate the overall technical standard of the football extracurricular team.

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